Unravelling the role of innovation intermediaries in smallholder agricultural development: Case studies from Kenya

Catherine Wakesho Kilelu

Thesis committee

Promotor
Prof. Dr C. Leeuwis
Professor of Knowledge, Technology and Innovation
Wageningen University

Co-promotor
Dr L.W.A. Klerkx
Associate professor, Knowledge, Technology and Innovation Group
Wageningen University

Other members
Prof. Dr S.W.F. Omta, Wageningen University
Prof. Dr E.H.M. Moors, Utrecht University
Prof. Dr M. Mulder, Wageningen University
Dr S.J. Oosting, Wageningen University

This research was conducted under the auspices of Wageningen School of Social Sciences (WASS)

Unravelling the role of innovation intermediaries in smallholder agricultural development: Case studies from Kenya

Catherine Wakesho Kilelu

Thesis
submitted in fulfilment of the requirements for the degree of doctor
at Wageningen University
by the authority of the Rector Magnificus
Prof. Dr M.J. Kropff,
in the presence of the
Thesis Committee appointed by the Academic Board
to be defended in public
on Tuesday 19th November 2013
at 1.30 p.m. in the Aula.

Kilelu, Catherine W
Unravelling the role of innovation intermediaries in smallholder agricultural development: Case studies from Kenya.
186 pages

PhD thesis, Wageningen University, Wageningen, NL (2013)
With references, with summaries in Dutch and English

ISBN 978-94-6173-767-0

Acknowledgements

"It always seems impossible until it's done." — Nelson Mandela

As I complete my PhD studies, I can't help but reflect about my life's path and thank God for coming this far. I would not have arrived here at the end of this PhD journey without the encouragement and support of many people and institutions. I would like to take this opportunity to offer them my sincere gratitude.

First, I would like to thank the Wageningen Graduate School of Social Sciences (WASS) for awarding me the Open Scholarship that made it possible to pursue PhD studies. I came to Wageningen through a serendipitous meeting with Sue Canney in Nairobi, who put me in touch with Professor. Akke van der Zijp. I am grateful that it is through these connections that I was then introduced to Cees Leeuwis, who together with Laurens Klerkx enthusiastically agreed to be my (co) promotors. Cees and Laurens, thank you for your guidance, unfading support and encouragement from the onset to the end. Cees, you amazed me at how you made time for all your students despite your very busy schedule particularly during the recent re-organization of the Knowledge, Technology and Innovation (KTI) chair group. You patiently read through countless drafts of all the chapters and with your thoughtful probing, nudged me to untangle myself from the various conceptual and methodological webs as I told the empirical story, always reminding me to keep it simple. Thank you for also making time for various social activities and the invitations to your home.

Laurens, thank you for always asking the tough questions couched in your distinct sense of humour. The pointed and critical comments pushed me to think more systematically about how to frame the scientific contribution of my work. I am also grateful to you for pointing me to an expansive range of literature that was invaluable in anchoring my work. Your guidance assisted me to organize my ideas and to reflect deeper in analyses as you tirelessly coached me in the process of writing scientific publications. Your mentorship and support particularly during the last mile of this process when I was feeling overwhelmed contributed immensely to getting me to the finish line. Thank you also for

inviting me to your home where I got to know your family. Lastly, I take pride in being your first PhD graduate and wish you all the best for the many more to come.

My gratitude also goes to many colleagues at the KTI group who provided a collegial environment and always had words of encouragement along the way. These include Anne-Marie van Passen, Barbara van Mierlo, Noelle Arts, Rico Lie, Todd Crane, Sietze Vellema, Dominic Glover, Connie Almekinders, and Kees Jansen. I particularly benefitted from the company of many PhD and Postdoc colleagues in the group who provided both intellectual camaraderie and a social network that made the journey less arduous and lonesome. I would especially like to thank Diana Cordoba, Paola Chaves, Betty Adjei, Huan Yang, Silvia Perez-Perdomo, Augustin Kouevi, Hanneke Nijland, Frans Hermans, Marc Schut, Jasper de Vries, Edwin Oberjé, Lonneke van Leeuwen, Bob Mulder, Duguma Debele, Bela Teeken, Alfred Mokuwa and Marieke Douma. Frans thanks again for your help with the Dutch translation of the thesis summary. It was also a pleasure and privilege to meet Professor. Anne van den Ban, founder of the extension chair group at Wageningen University. I want to thank him for enthusiastically sharing his interesting life stories and his many books, and for also taking time to arrange various farm visits that gave me a feel for Dutch agriculture.

I also express my sincerest gratitude to the friendly and helpful ladies at the KTI secretariat that ensured all my logistical and administrative matters were well taken care of during my stay with the group. The team includes Vera Mentzel, Myriam Cevat, Sylvia Holvast, Annette Dijkstra, Inge Ruisch, Bea Prijn. Vera, thank you especially for going above and beyond your call of duty in assisting me to settle down from the first day I arrived to the last day of my stay, including my brief housing crises. I would also like to mention Catherine O'dea at this point and thank her for editorial support with some of the chapters in the thesis. Thanks also to Luc Dinnissen for assisting me with the cover design.

I am also glad to have walked this journey with other PhD colleagues including: Charity Osei-Amponsah, Kwadwo Amankwa, Euloge Codjo, William Quarmine, Akpo Essegbemon, Rolland Yemadje, Nathalie Kpera and Amadou Sidibe, Lilian Ayete-Ayampong, Rijn van Fedes, Christina Mandara and Zachary Masanyiwa.

During fieldwork, I received enormous support from many institutions and individuals. I would like to thank ILRI for hosting me as the graduate fellow. I specifically thank Dr. Seife Ayele and Dr. Isabelle Baltenweck for providing intellectual and logistical support. I am also grateful to Caroline Bosire and Turi Ouma for their assistance during the research. I would also like to express my gratitude to the East Africa Dairy Development (EADD) programme Kenya office team for enabling me access to the different study sites. I would like to especially Alice who was my main point of contact and who assisted me with organizing the many field visits. I would also like to thank my research assistants, Kenneth Kipchumba in Tanykina and Gideon Koima in Metkei for their enthusiastic support. I am also very grateful to Farm Concern International for the support they provided me that enabled me to conduct research on one of their project. I particularly would like to thank Gerard Watoro who gave me enormous support during the field work in Kieni. I am also hugely indebted to the many farmers who made time to participate in numerous meetings, answering endless questions and for sharing invaluable information about their farming endeavours and their lives.

During my stay in Wageningen, I found friendship in different circles that made my experience wholesome. My heartfelt thanks go to the Kenyan community in Wageningen who over the years provided a "home away from home" in various ways. *Asanteni sana*! I would also like mention Jessica Ndubi who was a good friend and colleague at KTI, and with whom I regularly shared meals and spent many hours discussing the PhD work. Many thanks to Faith Mutavi for assisting me with formatting the thesis which gave me time to focus on the finer details of finalizing the manuscript. Noura Harrath, Eva-van Iwaarden, and Susan Moenga, you were good company. Esther Gitonga you were my reliable loctician. I also enjoyed many evenings with members of the university's table tennis and women's football clubs recharging through sports. My appreciation goes to Vera and Titus De Meester, and Elles Drost, who provided me with a home during my stay in Wageningen. Thanks also to the International Christian Fellowship where I found a spiritual home.

I cannot forget to thank many former colleagues and friends at IDRC who contributed to fuelling my interest in research for development. I would like to mention those that

especially provided me with different opportunities that eventually led me to this PhD path. These include Ana Boischio, Andres Sanchez, Kristina Taboulchanas, Renaud De Plaen, Sophie Oroscz, Lamia el Fattal, Kathleen Flynn-Dapaah., Simon Carter and Jean Lebel.

I am grateful for the love, support and prayers from my entire family and many friends. Special thanks to my parents, Florence Mwashila and Michael Mwashila Kilelu for laying the important foundation that have shaped me. Mum, you particularly deserve a special mention for your steadfast love, unending sacrifices and continuous prayers that have carried me and brought me to where I am today. I am also grateful to my sister, Margaret, brothers Vincent and Udie. A special thanks to my friends Teo, Prabha, Genevieve, Helene and Laverne for their continuous encouragement to soldier on and finish.

Last but not least, to Sarah Macharia. Thank you for accompanying me in this journey with unwavering love, support, patience and unwearied fortitude. In addition, you painstakingly edited the various chapters and offered critical comments which have contributed immensely to improving the quality of this work. I look forward to a new and exciting journey together.

Table of contents

List of figures and tables

Figures

Tables

CHAPTER 1

General Introduction

1.1 Introduction: Setting the scene

This thesis contributes to debates on ways in which innovation could be enhanced in order to advance sustainable smallholder agricultural development, particularly in sub-Saharan Africa (SSA). It investigates the dynamics of innovation processes, zooming in on the role of innovation intermediaries in supporting these processes and their outcomes, using case studies from the Kenyan agricultural sector. Although there is recognition in the literature that agricultural innovation is a process that results from the interaction of multiple actors and factors (Biggs, 1990 ; Knickel et al., 2009 ; Leeuwis & van den Ban, 2004), there are still gaps in understanding how these processes are coordinated and shaped particularly in the context of the recent rapidly evolving agri-food sector in SSA (McCullough et al., 2008 ; Ochieng, 2007 ; World Bank, 2006). These gaps result from a lack of systematic analysis of the recent changing landscape of innovation intermediaries who facilitate and shape agricultural innovation processes (Leeuwis & Aarts, 2011). In an effort to reduce these gaps, this thesis 1) explores and documents the changing landscape of innovation intermediaries in the context of support for smallholder agricultural development in the Kenyan agricultural context, and 2) investigates how different innovation intermediaries contribute to innovation processes and teases out some of the tensions and gaps that emerge from these processes. The scientific relevance of the thesis is that it provides evidence of the emergence of innovation intermediaries in smallholder contexts and unravels their role in dynamic innovation processes.

This first chapter provides a general introduction and background to the thesis. It elaborates on the problem and research, highlighting the main conceptual issues that set the stage for the thesis. These inform the empirical chapters, which are embedded in specific scientific debates. Subsequently, the general research objectives and questions are presented, followed by the research approach and finally the thesis outline.

1.2 Problem statement: The need to support agricultural innovation in smallholder agriculture in SSA

The need to stimulate innovation for smallholder agricultural development in SSA is receiving renewed attention on the development agenda, because the sector remains

central to achieving economic growth, sustainable development, and improved livelihoods (InterAcademy Council, 2004 ; World Bank, 2007). This renewed interest in innovation is unfolding in a rapidly evolving context in which many actors and factors are driving smallholder agricultural development. Firstly, there are persistent challenges relating to food and nutrition insecurity linked to smallholder production challenges, which are compounded by increased food prices (Hounkonnou et al., 2012 ; InterAcademy Council, 2004 ; Jayne et al., 2010 ; World Bank, 2007). Secondly, drivers such as climate change, increasing competition between food and biofuel production, agro-ecosystem degradation, and other sustainability concerns are projected to negatively and disproportionately impact on smallholders and their rural communities (Ewing & Msangi, 2009 ; Schut et al., 2011). Thirdly, there are increasing opportunities and challenges for integrating smallholder producers into expanding and dynamic domestic and global agricultural markets characterised by supermarket chains, large-scale processors, and wholesalers (McCullough et al., 2008 ; Ochieng, 2007 ; Reardon et al., 2003 ; Vorley et al., 2007 ; Wiggins et al., 2010 ; World Bank, 2006). These opportunities are linked to changing and sometimes contested technological landscapes (e.g. biotechnology, ICT), coupled with changing knowledge and innovation support structures involving diverse public and private actors engaged in the sector (Christoplos, 2010 ; Clark, 2002 ; Juma, 2011 ; Poulton et al., 2010 ; Sulaiman et al., 2012 ; Sumberg & Reece, 2004).

Enhancing innovation in order to address these challenges and opportunities requires the involvement of an ever expanding diversity of actors engaged in and around the agricultural sector in recent years. These actors include different categories of farmers, farmer organisations, public and private research organisations, extension and other innovation support service providers, agri-input suppliers, different output market actors, non-governmental organisations (NGOs), and regulatory agencies, to name but a few. As Leeuwis and van den Ban (2004) note, because innovation is not an isolated process, it requires coordinated effort and action in a network of interdependent actors. But as a recent World Bank (2006) study on enhancing innovation in the smallholder agricultural context noted above, that even when there were strong market incentives to innovate, it was not sufficient to induce new patterns of collaboration among the diverse actors as is necessary for innovation. This lack of interactions and collaboration is particularly

apparent in the SSA smallholder agricultural context because of various system failures (see e.g. Hounkonnou et al., 2012 ; Poulton et al., 2010 ; Röling et al., 2012), which, similar to those Klein-Woolthuis et al. (2005), can broadly be characterised as infrastructural, institutional, interactional, and capabilities failure.

Effectuating linkages and forging collaboration among the expanding range of actors remains a weakness in the effort to accelerate agricultural development in SSA. This weakness has resulted in limited access to new knowledge and agricultural inputs, weak articulation of demand for research and extension support, weak or non-existent technological learning capacity at the farmer/entrepreneur level and at the sector level, weak integration of social and environmental concerns into sector planning and development, weak connections to sources of financing for innovation, and weak connections to markets (Juma, 2011 ; Kelly et al., 2003 ; Poulton et al., 2010 ; World Bank, 2007). In this context, achieving the vision of an innovative agricultural sector in SSA countries such as Kenya will require deliberate efforts to stimulate synergy and networking between various actors engaged in agriculture development.

There has thus been increasing interest in understanding how innovation processes are orchestrated in developing countries, such as Kenya, and particularly in the role of innovation intermediaries who are noted to be important in facilitating linkages in agricultural innovation processes (Klerkx et al., 2009). Howells (2006, p. 720) defines an innovation intermediary as "an organization or body that acts an agent or broker in any aspect of the innovation process between two or more parties. Such intermediary activities include: helping to provide information about potential collaborators; brokering a transaction between two or more parties; acting as a mediator, or go-between, bodies or organisations that are already collaborating; and helping find advice, funding and support for the innovation outcomes of such collaborations". The critical role of intermediary actors in supporting innovation processes is receiving attention in the innovation studies literature (Howells, 2006 ; Smits & Kuhlmann, 2004 ; Winch & Courtney, 2007). While most of the scholarly work on intermediaries has focused on industrial sectors, a number of studies have investigated the intermediary domain in the agricultural sector in developed countries (Klerkx & Leeuwis, 2008a ; Klerkx & Leeuwis, 2009a ; van Lente et al., 2003). Although some exploratory work has been done in the smallholder agricultural

development context (Klerkx et al., 2009), questions remain about: who innovation intermediaries are, how they emerge, what their role is in supporting agricultural innovation processes, and whether and how they contribute to innovation outcomes.

1.3 Locating innovation intermediaries in agricultural innovation system dynamics in SSA

In an effort to understand how smallholders can build their innovation capacities, recent studies have applied agricultural innovation systems (AIS) approaches (Ayele et al., 2012 ; Clark et al., 2003 ; Gildemacher, 2012 ; Hellin, 2012 ; Larsen et al., 2009 ; Spielman et al., 2011 ; World Bank, 2006). According to the World Bank (2006: vi), an innovation system can be defined as "a network of organisations, enterprises, and individuals focused on bringing new products, new processes, and new forms of organisation into economic use, together with the institutions and policies that affect their behaviour and performance. The AIS perspective is a reflection of the evolution in systems thinking in agricultural innovation over the years (Biggs, 1990). It has built on the analytical shift from a conventional linear model of knowledge and technology transfer (from researchers to extension agents to farmers) embodied within national agricultural research systems. The critique of the inadequacy of linear approaches paved the way for other approaches such as the Farming Systems research and Agricultural Knowledge and Information Systems (AKIS) and then the AIS that embraced more centrally the market and non-market institutional and policy context in understanding the complex interactions of actors and factors that contribute to innovation processes. Several authors have provided extensive reviews of this evolution (see Assefa et al., 2009 ; Klerkx et al., 2012 ; Spielman, 2005 ; World Bank, 2006).

The interest in innovation intermediaries in the agricultural sector in SSA is occurring in the context of such a shift towards innovation systems approaches, which have directed attention away from the previously dominant linear model that viewed innovation mainly as technology supply. Innovation systems approaches view innovation as a co-evolutionary process in which multiple stakeholders interact in dynamic ways to address socio-technical problems caused by many factors in the agricultural sector (Biggs, 2007 ; Knickel et al., 2009 ; Leeuwis & van den Ban, 2004 ; World Bank, 2006). From this

perspective, the importance of innovation intermediaries that connect the different actors in order to align the different socio-technical factors in innovation processes in developing countries is becoming apparent (Devaux et al., 2010 ; Ekboir & Vera-Cruz, 2012 ; Klerkx et al., 2009 ; Szogs, 2008). As Howells (2006) emphasises however, in order to deepen the understanding of the role of innovation intermediaries, better conceptualisation of these processes is necessary.

As noted in section 1.1, the recent focus on innovation intermediaries in the agricultural sector has emerged from the developed countries context (see Batterink et al., 2010 ; Klerkx & Leeuwis, 2008b ; Klerkx & Leeuwis, 2009a ; van Lente et al., 2003). The analytical focus of these studies has been on the structure and functions of innovation intermediaries, and this has added to the understanding of the complex role that intermediaries play in agricultural innovation. Innovation intermediaries execute a broad range of functions in the context of dynamic innovation processes, where, in addition to creating linkages among diverse actors, they also undertake an "animateur" role where they create system dynamism (Howells, 2006). However, as many authors have argued, the emergence, characteristics, and positioning of innovation intermediaries is contextually embedded. In the Dutch context for instance, innovation intermediaries have emerged from an innovation system trajectory of privatisation of research and extension establishments, accompanied by the introduction by new funding modalities. In this context, Klerkx and Leeuwis (2009) identify new and independent organisations whose sole function is innovation intermediation, instead of it being a "side-function" of an existing organization.

In the smallholder context of countries such as Kenya, the debate about innovation intermediation is framed within the perspective of evolving agricultural extension and advisory services to support emerging agricultural innovation systems. Many scholars argue that, in line with the shift towards more demand-driven and pluralistic advisory systems, the role of advisory actors has expanded beyond technology transfer. It now includes organising rural producers, forging links with markets, and brokering multi-actor networks and partnerships in the AIS (Birner et al., 2009 ; Christoplos, 2010 ; Davis, 2008 ; Rivera & Sulaiman, 2009). This is connected to the problem of effective coordination, which many studies have shown to be a major challenge hampering smallholder farmers'

access to a range of innovation support services and inputs, and participation in remunerative output markets .The authors argue that addressing this challenge requires various types of intermediation mechanisms (Chowa et al., 2013 ; Kydd & Dorward, 2004 ; Markelova et al., 2009 ; Poulton et al., 2010). The innovation intermediary concept encompasses this vision for a broader and systemic role in supporting innovation processes that is not just about providing extension or advisory services. The recurrent challenge highlighted in the literature about weak interactions among actors in agricultural innovation systems points to the need for systematic analyses of the role of intermediary actors in addressing these challenges and their contribution to innovation processes. This requires not only distinguishing between different types of intermediaries but also looking at the different levels of their operation within agricultural innovation networks, that goes beyond the traditional bilateral support mechanisms to a more systemic support of innovation processes (Klerkx et al., 2009 ; Kristjanson et al., 2009 ; Leeuwis & van den Ban, 2004 ; van Lente et al., 2003).

Despite, increased reference to innovation intermediaries implicitly and explicitly in smallholder-dominated agricultural innovation in developing countries, there has been little systematic analysis to characterise these actors. Klerkx et al. (2009) provide an initial overview of the innovation intermediary landscape in the developing and emerging countries context. Based on a review of the literature, they deduce that in the context of agricultural innovation in developing countries, there are already many parties fulfilling the innovation intermediation role. The review identifies several types of organisations including NGOs, research organisations, specialised third party organisations, and government agencies. This overview then points to the need for more analysis to understand their emergence, functioning and position in the agricultural innovation context dominated by smallholder farmers. Furthermore, at the general level scholars such as Sapsed et al. (2007), point out that there is need for more process studies of innovation intermediaries in order to provide further insight into their everyday working and the extent to which they effectively support innovation processes. This includes how they support the co-evolution of innovation by improving the fit between different kinds of technological, social, organisational, and institutional innovations, and how they facilitate the accompanying learning processes. In light of these calls for further research, this thesis

seeks to deepen the understanding of innovation intermediation in the Kenyan agricultural context.

1.4 Study context: Supporting smallholder innovation in Kenya

In Kenya, the agricultural sector continues to occupy a key strategic position in realising food and nutrition security, economic growth and poverty reduction goals. The agricultural sector accounts for about 24% of Kenya's GDP and directly and indirectly contributes to the livelihoods of 80% of the population, the majority of whom are smallholder producers. Despite agriculture's important position, the sector has had mixed successes over the years, and its full potential has not been realised for a myriad of reasons. These reasons are related to various macro-economic factors linked to micro-level socio-technical challenges facing farmers that have resulted in agricultural development proceeding slowly. At the core are challenges relating to supply-driven research and extension systems, lack of access to quality farm inputs and other auxiliary services (e.g. credit), and limited agri-business orientation and market access that interact with factors such as complex land access and tenure issues (Kibaara et al., 2008 ; Republic of Kenya, 2005 ; 2009 ; Southall, 2005).

For such a critical sector to increase productivity, be commercially competitive, and remain sustainable, the Kenyan government has crafted policies and is supporting various programmes with the goal of bolstering agricultural innovation capacity. Recently, the government set out a number of key guiding policies, including the Economic Recovery Strategy (ERS), the Strategy for Revitalising Agriculture (SRA), and the Vision 2030 that aim to stimulate the transformation of smallholder subsistence production into an innovative, entrepreneurial, commercially-oriented, and modern agricultural sector (Republic of Kenya, 2009). To address these challenges, the government and various donor agencies have funded various multi-actor initiatives to enhance innovation in the sector. These initiatives are characterised by stimulating interactions of public, private, and civil society actors in order to bolster smallholder pro-innovation processes in various agricultural sub-sectors (Odame et al., 2009; Poulton & Kanyinga, 2013; USAID-KDSCP, 2008).

In the above context, scholarly attention has been paid to understanding the different mechanisms for enhancing smallholder innovation capacity and related market participation in Kenya (Keskin et al., 2008 ; Neven & Reardon, 2004 ; Nyambo et al., 2009 ; Odame & Muange, 2011 ; Odame et al., 2009 ; Steglich et al., 2012). These studies have shown that technological and institutional innovations are central to stimulating robust agricultural development in various sub-sectors. The studies highlight the important role of networks and the need to build linkages among the diverse actors to enhance innovation. Generally, the findings point to weak interactions and fragmented links between different actors at different system levels that continue to constrain innovation capacity and hence affect broad agriculture development. Odame et al. (2009), for example, note that in some cases the non-existent interactions between universities and agricultural research institutes and agribusiness firms hinder smallholders' innovation capacity. This observation is also made by Keskin et al. (2008) study of the livestock sector. Although these studies reveal how the emergence of new actors and new institutional arrangements such as multi-actor networks and partnerships are contributing to supporting smallholder innovation, they remain largely silent on how these processes are orchestrated and facilitated. Therefore, there is a dearth of empirical studies focused on intermediaries and their role in dynamic innovation processes in smallholder agricultural development in Kenya.

1.5 Research objectives and questions

The overall objective of this thesis is to explore and increase the understanding of the role of innovation intermediaries in the dynamics of a changing agricultural innovation system in Kenya. The specific objectives are:

1. To investigate and characterise the changing landscape of innovation intermediaries in evolving smallholder agricultural development in Kenya; and
2. To unravel and assess the contribution of different innovation intermediary arrangements in supporting dynamic innovation processes.

From these objectives, the following overarching research questions are derived that guided the different studies reported in chapters 2 to 5:

1. Who are the innovation intermediaries in the agricultural sector in Kenya, and what functions do they fulfil?
2. How do innovation intermediaries support innovation processes and what is their contribution to the outcomes of these processes?

In line with these broad questions, each chapter has its own set of more specific guiding questions, zooming in on aspects such as co-evolution, coordination, and learning.

1.6 Research design, case study selection and methods

This section describes the overall research design of the thesis, elaborating on data collection and analysis. Each of the empirical chapters provides specific details on the research methods relevant to it. To enable investigation of the structure of innovation intermediaries and their role in innovation processes, an overall case study research design was opted for. The case study method was chosen because it is better suited to providing in-depth insights into complex social phenomena or social processes, permitting a holistic capturing of the experiences of those involved and making possible a meaningful characterisation of these processes (Denzin, 1970 ; Stake, 1978 ; Yin, 2003). The case study design is appropriate for our study given its focus on answering how and why questions, in describing the evolving intermediary landscape, and subsequently deepening the understanding of how intermediaries help shape innovation processes and the extent to which they are effective.

The study was conducted in two stages. The first stage was guided by the first research objective and applied a multiple case study approach to map different organisations identified as undertaking intermediary functions. This stage followed a modified inductive strategy (Blaikie, 2000) so that, *a priori*, the study began with conceptualisation of the intermediaries from literature, this was then used to develop a characterisation of organisations that could be considered intermediaries. From the exploratory study, the second stage was a single case study of two intervention programmes, providing an in-depth analysis of the role of intermediaries in innovation processes.

1.6.1 *Selection of case studies*

Case study selection was also a two-step process. For the initial exploratory study, the multiple case studies mapped the changing intermediary actors' landscape in the Kenya agricultural context. This mapping used a snowball sampling approach (Creswell, 2002) to identify the types of organisations fulfilling an intermediary role. This sampling approach was adopted in response to absence of a list of intermediary organisations, this absence is probably due to what Howells (2006) notes as a lack of a clear definition and consensus of what innovation intermediaries are. After the mapping, the study zoomed in on the single cases to understand the role of intermediaries in innovation processes. The two case studies were purposively selected from two sub-sectors - dairy and horticulture (focused on domestic marketing) that have been considered innovative in trying to enhance innovation capacity in smallholder agricultural development in Kenya (Ngigi, 2005 ; Odame et al., 2009). The selected cases were the East Africa Dairy Development (EADD) programme and the Farm Concern International (FCI) project on smallholder commercialisation of bulb onions. The two case studies were representative of recent developments in interventions on smallholder commercialisation that apply various multi-stakeholder models such as innovation platforms and hubs. Thus, they were considered potentially illuminating (Eisenhardt, 1989 ; Flyvbjerg, 2006 ; Yin, 2003). The fact that the initiatives were on-going provide the opportunity to follow the processes in real time. For each of the single case studies, the unit of an analysis was the innovation intermediary facilitating the intervention. These programmes worked in multiple sites, thus, within the larger programme/project, a selected number of sites, considered embedded sub-units, were studied (Gerring, 2004 ; Yin, 2003).

For the EADD case, the research was conducted in two sites selected from 13 project sites operational at the start of the research. Each site had established a smallholder dairy farmers' business association (DFBA) operating a chilling plant. These two sites were Tanykina Dairy Company Ltd in Nandi County and Metkei Multipurpose Dairy Ltd in Kerio County. They are located in the Rift Valley region, which are high potential dairy production areas. These two sites were selected to ensure a wide representation of the processes that were supported in the project. For the FCI case, four project sites were selected for in-depth data collection. The study was conducted in Kieni East and West

districts, Nyeri County which are dryer zones in Kenya's central highlands region of Kenya and considered agro-ecologically ideal for growing onions.

1.6.2 *Data collection approaches and data analysis*

Data were collected from June 2010 to December 2011. Several methods were used to collect primary data for the study, including semi-structured interviews, focus group discussions, conversational interviews, and participant observation. In addition, short questionnaires were used to collect some basic quantitative data (on production parameters, e.g. onion yields, milk production, prices). These primary data sources were complemented with secondary data, including various documents such as project proposals, reports, evaluation reports, organisational records (e.g. compiled data), and government policy documents. All focus group discussions and semi-structured interviews) were recorded, and the transcripts were analysed through coding guided by sensitising concepts derived from the theoretical frameworks underlying the different studies. The details of analyses are provided in the individual chapters.

1.7 Reflections on the quality of the study design

According to (Yin, 2003:p. 33-38), the four quality tests of case study research include construct validity, internal validity, external validity, and reliability . This section reflects on how quality was ensured in this thesis, including in the design, data collection, and analysis stages.

Construct validity

Construct validity refers to ensuring that there are measures that enable research to produce an accurate presentation of the object of study (Silverman, 2009 ; Yin, 2003). Construct validity can be ensured by triangulation, using multiple sources of data, establishing a chain of evidence, and having interpretation validated by a key informant (Yin, 2003). To ensure construct validity in this thesis, data were collected from multiple sources and used multiple analytical procedures to triangulate the results. To ensure a chain of evidence, concepts were operationalized so that the data collected matched the research questions. In addition, the data were carefully recorded and stored to ensure traceability of sources. On the validation aspect, at the end of the fieldwork period, brief

reports were prepared on the findings of each of the in-depth case studies and shared with key informants for feedback. In addition, drafts of scientific articles based on the case studies were sent to the respective informants for comments.

Internal validity

This test deals with handling shortcomings relating to the broad problem of making inferences. This validity test is most applicable for experimental or quasi-experimental studies that make causal inferences, but it also affects case studies that make inferences based on interviews and documentary evidence (Yin, 2003). To enhance the internal validity of this thesis, pattern matching was used during analysis, where expected patterns for defined processes were matched to the observations in the data (chapters 3 to 5).

External validity

This test deals with the generalizability of findings, particularly from a single case study. Although this has been a major criticism of case studies, proponents have noted that case studies are intended for analytical rather than statistical generalisation (Eisenhardt, 1989 ; Yin, 2003). The chapters in this thesis address conceptual research questions, which according to Yin (2003) provide the opportunity for analytical generalisation.

Reliability

According to Yin (2003), the reliability test deals with the extent to which results can be replicated if the same procedures are followed. In this instance, although the details of data collection were carefully recorded, the dynamic context in which the data were collected would make it difficult to replicate the study.

1.8 Organisation of the thesis

In this section, the scope of the specific thesis chapters is briefly introduced. Figure 1.1 provides an overview. Chapter 2 is an exploratory study that provides evidence of the diverse organisations and actors that fulfil the intermediary role in the Kenyan agricultural sector. These include a mix of new actors that have emerged recently and existing actors that are taking on a myriad of functions to support diverse smallholders. From the findings, a typology is derived showing the varied nature of innovation intermediaries that support different innovation needs of heterogeneous smallholders and that are adapted to the specific context of the Kenyan agricultural sector.

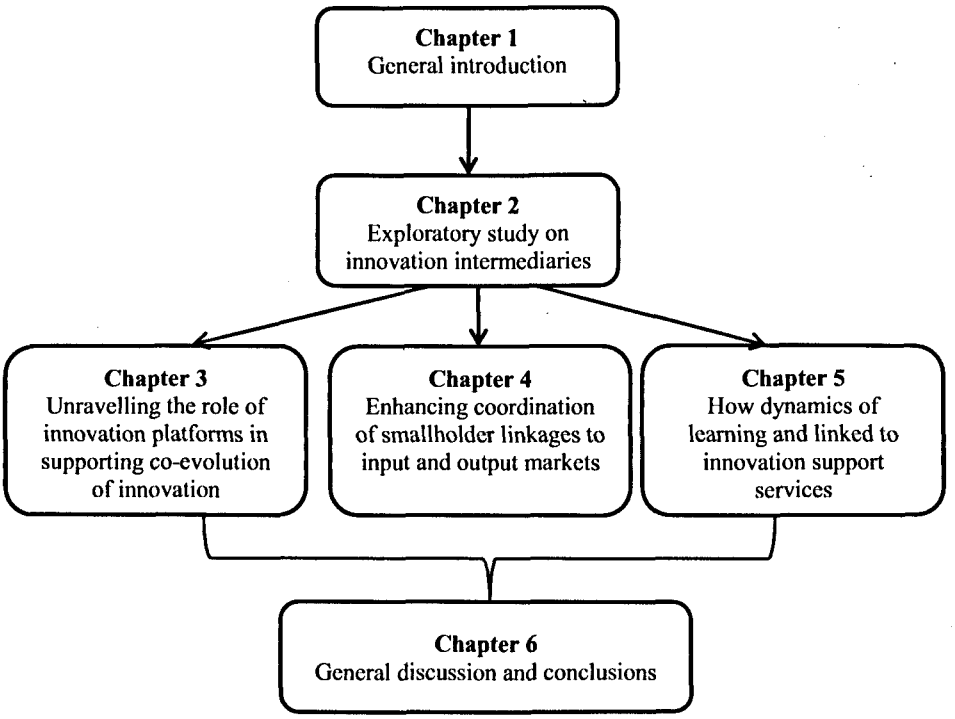

Figure 1.1: Overview of the thesis

The subsequent chapters (3, 4 and 5) build from the exploratory study and analyse how innovation intermediaries support dynamic innovation processes and contribute to outcomes. Chapter 3 investigates how the EADD consortium stimulated co-evolution of innovation by facilitating a multi-actor innovation platform. The innovation platform concept is applied to understand the EADD's intermediary role in orchestrating linkages and interactions to address technical, social, and institutional issues in the process. The findings indicate that co-evolution of innovation is a highly dynamic process with various interactional tensions and unexpected effects, and that the distributed nature of intermediation is important in resolving some of these tensions emerging at different actor interfaces. The findings also show that the intermediaries, through the innovation platform, are not always able to adapt adequately to emerging issues because of limitations of incorporating systematic learning and feedback in the process. Chapter 4 unravels the processes of coordination to enhance smallholder farmers' linkages to innovation support services and inputs, and to output market actors, through the hub concept. The hub is an intermediary institution through which the DFBAs foster

coordination to enhance relationship amongst farmers (horizontal coordination), between farmers and output market actors (vertical coordination), and between farmers and input and service providers (complementary coordination), with the aim of resolving relationship issues that constrain smallholders' position in the dairy value chain.

Chapter 5 deepens insights on learning relating to smallholder agricultural innovation and commercialisation in light of demand-oriented approaches to supporting innovation processes. While learning is noted as a central element in supporting smallholder innovation, it has not been analysed in connection with the micro-level interplay of matching demand with supply of innovation support services that assist learning processes. The chapter is based on a case study on smallholder commercialisation of bulb onions in Kenya. It presents an analysis of how farmers' demands continually emerge in innovation processes, triggered by new problems, uncertainties, and challenges or new opportunities, which need to be matched to appropriate innovation support. In this case study, the matching is supported by the project, acting as an innovation intermediary, which mobilises a network of public and private services and input providers who bring in complementary knowledge, skills, and resources necessary for the innovation processes. However, the findings indicate that the project is not effective in being responsive and adaptive to many of the emerging demands. These findings indicate that there are shortcomings in the project's monitoring and feedback approach, which focuses mainly on pre-set project outcomes. Finally, in Chapter 6 provides a synthesis of the findings and a reflection on the implications of the study or theory, policy and practice.

CHAPTER 2

Beyond knowledge brokering: an exploratory study on innovation intermediaries in an evolving smallholder agricultural system in Kenya[1]

[1] Published as: Kilelu, C. W., Klerkx, L., Leeuwis, C. & Hall, A. (2011) Beyond knowledge brokering: an exploratory study on innovation intermediaries in an evolving smallholder agricultural system in Kenya. Knowledge Management for Development Journal 7(1): 84-108.

Abstract

The recognition that innovation occurs in networks of heterogeneous actors and requires broad systemic support beyond knowledge brokering has resulted in a changing landscape in the intermediary domain in the increasingly market-driven agricultural sector in developing countries. This paper presents findings of an explorative case study that looked at 22 organisations identified as fulfilling an intermediary role in the Kenyan agricultural sector. The results show that these organisations fulfil functions that are not limited to distribution of knowledge and putting it into use but also include fostering integration and interaction among the diverse actors engaged in innovation networks and working on technological, organizational, and institutional innovation. Further, the study has identified various organizational arrangements of innovation intermediaries, with some organisations fulfilling a specialized innovation brokering role and other intermediaries taking on brokering as a side activity, while substantively contributing to the innovation process. On the basis of these findings, we identify a typology of four innovation intermediation arrangements including technology broker, systemic broker, enterprise development support, and input access support. The results indicate that innovation brokering is a pervasive task in supporting innovation and will require policy support to embed it in innovation support arrangements, but without prescribing a one-size-fits-all approach.

2.1 Introduction

The agricultural sector in Kenya, as in many developing countries, is evolving, driven largely by a policy and practice push to transform smallholder producers into entrepreneurs. These should pursue market opportunities in agricultural value chains, while continuing to address food insecurity challenges. The opportunities noted include diversification of crops and products, and value addition driven by changing markets for both staple and high value crops (Kibaara et al., 2008 ; Republic of Kenya, 2009). This emphasis on a market orientation has pointed to the need to evolve demand-driven agriculture innovation support arrangements to enable smallholders build the necessary capacities for innovation and participation in agricultural value chains.

Within these value chains, smallholder producers interact with diverse stakeholders in that is increasingly referred to as an agricultural innovation system (Spielman, 2005 ; World Bank, 2006). An innovation system is defined as a network of organisations, enterprises, and individuals focused on bringing new products, new processes, and new forms of organization into economic use, together with the institutions and policies that affect their behaviour and performance' (World Bank, 2006, p.5). Others have variously referred to these networks as innovation coalitions, platforms, or public–private partnerships (Engel, 1995'; Hall et al., 2001 ; Hartwich & Tola, 2007 ; Röling, 2009) Enabling innovation within these networks requires establishing necessary relationships and interactions among heterogeneous actors. However, scholars have noted that mobilizing such networks – which are critical for knowledge exchange and other vital support (e.g. accessing financing, market development) to enable innovation – remains a challenge in most contexts (Klerkx et al., 2009 ; World Bank, 2006). Innovation systems in developing countries have especially been noted to be rather weak, with interactions between the various actors characterised as rather sporadic and fragmented. Often, the necessary linkages are absent or dysfunctional, resulting in what has been referred to as system and market failure (Klein-Woolthuis et al., 2005 ; Szogs, 2008 ; World Bank, 2006). In Kenya, several scholars have pointed to such gaps (Keskin et al., 2008 ; Odame et al., 2009) To address such system fragmentation, studies have pointed to the role of intermediary organisations in creating the necessary linkages and interactions in order to build dynamic networks within and between innovation projects (Klerkx et al., 2009).

Traditionally, extension services were considered the main intermediary actor in supporting agricultural innovation. These primarily focused on knowledge and technology transfer or brokering from researchers to farmers. The effectiveness of this approach has been questioned for its linear understanding of innovation processes. But as innovation systems thinking emphasises, generation and exchange of (technical) knowledge are not the only prerequisites for innovation. A focus on supporting smallholder agricultural enterprises has particularly pointed to the need for non-technical support services such as marketing support, financing, collective organizing, and business management. The recognition that innovation requires such broader systemic support beyond dissemination of scientific knowledge and information, and also strengthening interactions between diverse actors, has resulted in a changing landscape in the agricultural intermediary domain (Klerkx & Leeuwis, 2008b ; Sulaiman & Hall, 2002).

In Kenya, the changing intermediary domain is reflected in the emergence of new actors and the re-positioning of existing ones. These include state, private sector, and nongovernmental agencies fulfilling new roles within an agricultural support system driven by the demands and needs of entrepreneurs (Muyanga & Jayne, 2008 ; Nyambo et al., 2009 ; Republic of Kenya, 2009). However, little empirical research in Kenya has looked systematically at the evolving intermediary domain, with the aim of understanding the broad functions and roles of intermediaries in supporting innovation and their resultant contributions. It is this dearth of empirical analysis that led us to the research questions – What does the innovation intermediary landscape in the evolving Kenyan agricultural innovation system look like? How and why do the intermediaries contribute to innovation support, beyond knowledge brokering? Furthermore, these questions connect to a call in the literature for structural empirical analysis of intermediaries, which especially in the case of agricultural innovation systems in developing countries has received little systematic attention (Klerkx et al., 2009).

This paper presents findings from an explorative case study on this changing innovation support landscape in Kenya. The next section builds a conceptual framework to analyse structures and functions of intermediaries and their contributions to supporting agricultural innovation processes. Section 2.3 summarizes the case study and the methods, followed by the results in Section 2 4. The contributions of the paper to understanding the

diversity of intermediary structures and the broad innovation support functions they fulfil are discussed in section 2.5. The paper concludes by pointing out implications of the findings for policy and further research.

2.2 The changing intermediary domain in agriculture: going beyond knowledge brokering to supporting innovation processes

Most of the literature on intermediaries in innovation has emerged out of studies in the industrial sector (and increasingly in the health field) that have analysed their role in linking producers and users of scientific knowledge and related technologies in the innovation process (Hargadon, 2002 ; Smedlund, 2006 ; Stewart & Hyysalo, 2008 ; Suvinen et al., 2010). Within this literature, there are different views on intermediaries. One perspective equates intermediaries to knowledge brokers, in the sense of being translators and disseminators of research, much like the classical definition of agricultural extension. However, other scholars distinguish the knowledge broker as one who facilitates access to knowledge, rather than being the expert who is substantively involved in the translation and transmission of this knowledge (Laszlo & Laszlo, 2002 ; Meyer, 2010).

Others have argued that knowledge brokering in principle is not a linear 'science push' process, particularly in increasingly demand-driven approaches to innovation. In the agricultural sector, such knowledge brokering has occurred in the context of emerging knowledge markets in privatized research and extension systems. In this context, the demand side denotes agricultural entrepreneurs, whereas the supply side features R&D and knowledge service providers (Clark, 2002 ; Klerkx & Leeuwis, 2008b ; Leeuwis & van den Ban, 2004). These scholars view knowledge brokering as having the more sophisticated role of matching the demand for and supply of knowledge, entailing articulation of sector innovation visions that then influence research agendas or, at the level of the individual entrepreneur, articulation of demands for farm-specific innovation support services. Further, knowledge brokers have also been understood as intermediaries that occupy 'boundary positions', sitting on the periphery of different worlds and creating an interface between the various actors in innovation networks. The focus of most

boundary work literature has been on the interaction between the science, policy, and practice worlds (Kristjanson et al., 2009 ; McNie, 2007 ; Michaels, 2009).

Clearly, in agricultural innovation there is need for knowledge brokering, particularly in a context where sources of knowledge are multiple and highly dispersed (Engel, 1995 ; Röling, 2009). However, a sole emphasis on brokering scientific knowledge and technology alone does not take cognizance of the complexity of drivers of agriculture innovation, particularly in developing countries. As Röling (2009) has pointed out, innovation is the emergent property of interaction, and thus the promotion and support of innovation becomes a matter of more broadly facilitating interactions. This corresponds with current thinking that supporting innovation goes beyond increasing the supply of new scientific knowledge and technologies, but rather emerges out of the interplay between scientific, technological, socio-economic, institutional, and organizational arrangements (Smits, 2002). This understanding of the collaborative nature of innovation has shifted the focus on innovation support beyond knowledge brokering to innovation intermediation. Innovation intermediation encompasses broader innovation support and management functions that aim to reinforce relational embeddedness within innovation networks and enhance innovation capabilities. Intermediaries therefore act as 'bridging organisations' that facilitate access to knowledge, skills, services, and goods from a wide range of organisations.

In the context of agricultural innovation in developing countries, innovation intermediaries have been noted to perform a range of tasks including facilitation of needs identification and agenda-setting processes; organizing producers and the rural poor; building coalitions of different stakeholders; promoting platforms for information and knowledge sharing; experimenting with and learning from new approaches; facilitating organizational and institutional innovation; sourcing funding for projects; and enhancing business skills, negotiation, and management of innovation processes (Klerkx et al., 2009 ; Knickel et al., 2009 ; Sulaiman et al., 2010). The important and catalytic role of innovation intermediaries in optimizing innovation system interaction (Howells, 2006) forms a strong argument for their inclusion in the growing body of research on agricultural innovation systems.

2.2.1 *Distinguishing innovation intermediaries: specialized broker or a complementary role?*

The literature on innovation intermediaries has been quite fragmented, resulting in what Howells (2006) notes as a dispersed field of study that is not well grounded theoretically. Because of a lack of conceptual grounding, definitions of intermediaries have not been crystallized, and various concepts are used interchangeably, making it hard to distinguish intermediary types. The term innovation intermediary has been described using various terms including broker, boundary spanner, and third party. According to Howells (2006, p.720), the term innovation intermediary is an umbrella term that denotes 'an organization or body that acts as an agent or broker in any aspect of the innovation process between two or more parties'. These organisations undertake a range of activities that include: scouting potential collaborators, brokering a transaction, mediating, helping find advice, funding, and supporting collaboration. Other scholars, however, distinguish between actors who take on intermediary roles as an add-on to other activities, such as R&D or technical advisors/experts thus contributing substantive knowledge to the innovation process, and specialized innovation brokers that mainly facilitate multi-actor interactions in innovation (Klerkx & Leeuwis, 2008b ; Winch & Courtney, 2007). These specialized organisations emerge specifically to undertake a liaison or broker role as their core business and do not contribute substantively but merely facilitate linkages van Lente et al. (2003) also distinguish systemic intermediaries as a specific type that works mainly at the system or network level to facilitate high-level actor interactions. However, as Howells (2006) points out, many organisations combine this role with directly providing technical services (e.g. as research or technical consultants), indicating that 'pure' innovation brokers are not common.

These distinctions appear to be specific to innovation system contexts. For example, in the Dutch agricultural sector, specialized innovation brokers have emerged and established their position in the context of a fully privatized knowledge infrastructure (Klerkx & Leeuwis, 2008b ; Klerkx & Leeuwis, 2009a ; van Lente et al., 2003). In many developing countries, however, the context is such that innovation brokering is done as a side activity by organisations such are research institutes, consultants, input suppliers, and special programmes (Klerkx et al., 2009). There is much debate about what the most appropriate

innovation brokering arrangement would be in the developing countries context, without necessarily proposing a blueprint. Some scholars argue for the need to retool and expand the role of extension services to take on broad intermediary functions that include knowledge brokering and facilitation of multi-actor interactions (Gebremedhin et al., 2006 ; Rivera & Sulaiman, 2009), others argue for the potential for specialized agencies to take on a systemic intermediary role (Klerkx et al., 2009).

2.2.2 *Functional characterization of innovation intermediaries*

In the literature, innovation intermediaries are characterised by a myriad of functions that they undertake in supporting agricultural innovation. Following a comprehensive review of various authors who have looked at the roles and functions of intermediaries and brokers in supporting and managing innovation processes (Howells, 2006 ; Klerkx & Leeuwis, 2008b ; Kristjanson et al., 2009 ; Smits & Kuhlmann, 2004 ; van Lente et al., 2003), we noted six broad functions that include:

i. Demand articulation/stimulation
ii. Network building
iii. Knowledge brokering
iv. Innovation process monitoring
v. Capacity building
vi. Institutional support

These broad functions include what Leeuwis and van den Ban (2004) refer to as communicative functions that are cognizant of multiple actors and relations that need to be negotiated and of the accompanying social learning in innovation processes. These diverse functions and accompanying tasks point to the complex and multi-layered nature of innovation processes. The functions are visualized in Figure 2.1, which characterizes the schematic representation that guides our analysis.

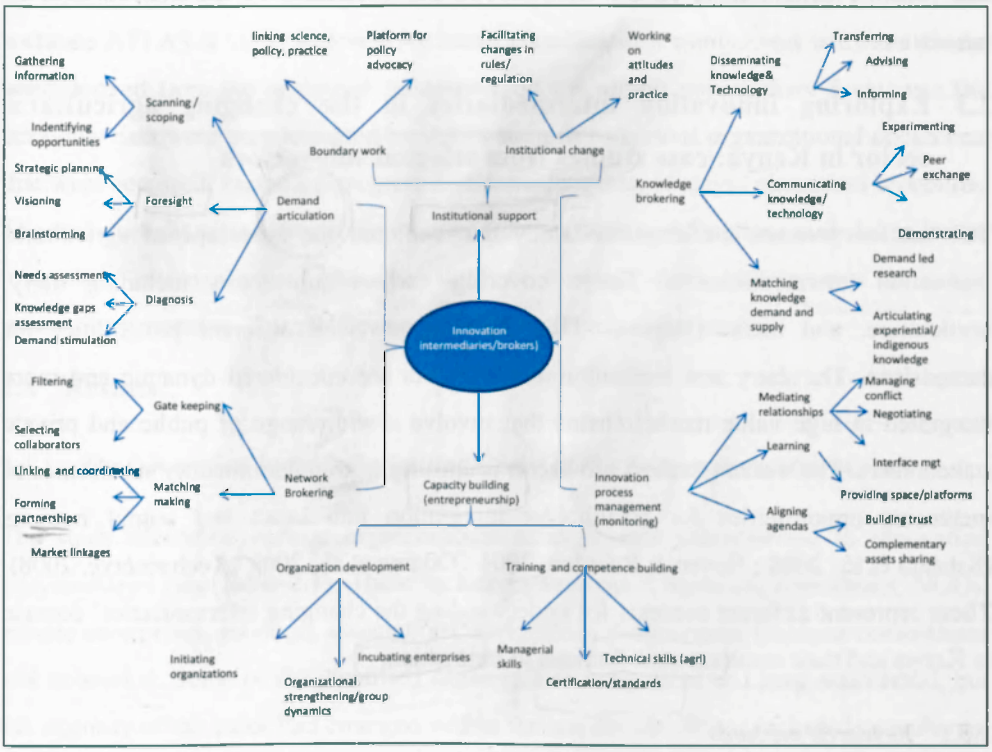

Figure 2.1: Range of innovation intermediaries functions

Source: (Howells, 2006 ; Klerkx & Leeuwis, 2008b ; Klerkx & Leeuwis, 2009a ; Kristjanson et al., 2009 ; Smits & Kuhlmann, 2004 ; van Lente et al., 2003)

It is also important to note that innovation intermediaries provide support at different levels in the so-called innovation systems including the macro (national level), meso (complete sectors), and micro (firm/farm level). Furthermore, as Howells (2006, p.724) has noted: 'intermediaries are increasingly involved in more complex relationships, such as "many-to-one-to-one", "one-to-one-to-many", "many-to-one-to-many", or even "many-to-many-to-many" collaborations, forming both vertical and horizontal relationships in increasingly distributed innovation networks'. This conceptual background provides the starting point for understanding the diversity of actors that form the intermediary domain in a nascent agricultural innovation system in the Kenyan context. For the purpose of this study, we operationally define an innovation intermediary as an organization formally engaged in coordinating and facilitating innovation processes between two or more parties

and possibly providing a variety of other functions relating to different aspects of innovation.

2.3 Exploring innovation intermediaries in the changing agricultural sector in Kenya: case studies from selected sub-sectors

This section presents the empirical study that explored the landscape of agricultural innovation intermediaries in Kenya covering various sub-sectors including dairy, horticulture, and maize (staples). This diversity provided different possibilities for comparison. The dairy and horticultural sub-sectors are considered dynamic and more integrated in high value market chains that involve a wide range of public and private stakeholders. The maize (staples) sub-sector is shifting from predominantly subsistence to increasing opportunities for smallholder integration into input and output markets (Kibaara et al., 2008 ; Neven & Reardon, 2004 ; Odame et al., 2009 ; Technoserve, 2008). These represent different contexts for understanding the changing intermediaries' domain in Kenya and their resultant contributions to innovation.

2.3.1 *Research methods*

The study used an exploratory case study design to identify and characterize innovation intermediaries in selected sub-sectors. A case study design was chosen because of the study's emphasis on detailed contextual analysis in a limited number of events (Yin, 2003). Using a snowball sampling approach (Creswell, 2002), 22 organisations providing identifiable innovation intermediary services and working in any one of the three sub-sectors were approached for the study. This sampling approach was utilized due to the lack of an identifiable list of intermediary organisations for reasons similar to what Howells (2006) has noted, including the lack of an accepted definition of and consensus on what an innovation intermediary is and the multiplicity of organisations taking on intermediary roles in innovation processes.

The data were collected between May and December 2010 through in-depth interviews with key informants within the identified organisations. A checklist was developed to guide the interviews, focusing on the organization type, activities, funding, and functions of the organization. To ensure reliability of data collection and analysis, all the interviews

were taped and fully transcribed. These were then coded using the qualitative data software ATLAS ti v.6.1, followed by broad classifications using Excel software. Codes were derived from the analytical framework on innovation intermediary functions. The interview data were supplemented by information from various organizational documents that were accessed, including progress and annual reports, strategic plans, and brochures. The study sought to understand the nature of the activities and functions undertaken by the innovation intermediaries, and thus did not evaluate their effectiveness in actual innovation processes. This can be considered a limitation of the study.

2.4 Results

2.4.1 *The innovation intermediaries' landscape in the Kenyan agricultural sector*

The study identified various organizational arrangements characterised as innovation intermediaries (see Table 2.1). These included government agencies, consultants, NGOs, private enterprises, producer associations, and special programmes (such as consortiums and networks). Some of the identified organisations were older and long established, but the majority of the cases had emerged within the last decade. These included consultants, NGOs, and the special programmes.

Table 2.1 also reveals a varied mix of funding modalities for the intermediaries. The most common source of financing was through external funding, including bilateral development programmes, private charitable foundations, and government development grants. This funding was accessible to intermediaries working across all three sub-sectors. This implies that public funding is the main market facilitator for innovation intermediaries because of the public good nature of their support. However, other financing vehicles noted in the horticulture sub-sector included fees for service, some form of shareholding by private consultants (Today Agriculture), and membership fees at FPEAK. Private companies also supported some intermediaries, e.g. ISAAA working on agri-biotechnology, and REAL-IPM, a for-profit enterprise, accessed a matching grant through a competitive innovation fund set up by various international development agencies.

The findings show that most of the innovation intermediaries consider their role mainly as facilitators, but they also provide substantive knowledge intensive services in supporting innovation both technically (e.g. extension services) and in relation to non-technical aspects (e.g. business skills training). However, some of the organisations, including KDSCP, Agriprofocus, ISAAA, and AATF, can be categorized as specialized innovation brokers as they mainly focused on catalysing and facilitating interactions in support of different levels of innovation (see Table 2.1). Furthermore, the results indicate that some established organisations which initially provided more traditional extension support to smallholders have shifted their mandates and scope and have taken on a more facilitative role, e.g. Technoserve and FPEAK. As one respondent noted:

> *"We started to help the African farmers improve technologically in what they are doing. We were more focused on the production end. In the early 2000, we shifted to being more value chain focused; we focused more on the market-driven sales, in just being market facilitators."*

Similarly, NALEP, a government extension programme, is reflective of this shift from providing extension and advisory services to being a more facilitative systemic intermediary. NALEP facilitates district stakeholder forums that provide platforms which are intended to mobilize and foster collaboration among various actors working in specific regions to support rural farming households exploit livelihood opportunities.

The results also show that some of the intermediaries work mainly in the agricultural sector (e.g. dairy farming, horticulture, staples-maize), and others work cross-sectorally. For example, consultants such as Spantrack, Setpro, Precise Management, and the NGO-SITE also work in non-agricultural sectors, mainly on SME development. Consequently, they place a strong emphasis on strengthening agricultural entrepreneurs' business skills. Similarly, other intermediaries working in the dairy and horticulture sub-sectors emphasise a private sector market-driven and entrepreneurship model for supporting innovation. This involves building the technical and non-technical capacities of farmer enterprises and related support enterprises – referred to as business development services (BDS) – working within the sub-sectors.

Table 2.1: Characterising innovation intermediaries' functions in supporting agricultural development in Kenya

Name of organization	Type of organization and year established	Sector	Funding	Types of activities in agricultural sector	Broad functions and level of functioning**
1. KDSCP (Kenya Dairy Sector Competiveness Program-managed by Land O Lakes)	International NGO-2007	Dairy	Donor	Organizing the multi-actor National Dairy Taskforce as a platform for articulating issues that impede sector competitiveness. Stimulating and supporting (funding) capacity building of different sector actors (BDS providers, training institutes, Kenya Dairy Board) Facilitating policy and regulatory change Engaging the private sector actors in exploring product development Program coordination (lead agency)	**1, 2, 4,5, 6** Sub-sectoral (systemic) level
2. MESPT (Micro Enterprise Support Project Trust)	Trust-2008	Cross-sectoral	Donor and Kenya government	Conducting needs assessment for improving smallholder dairy production and marketing Facilitating capacity building for BDS supporting dairy cooperatives as microenterprise	**1, 2, 4, 5** Collective enterprises
3. EADD (East Africa Dairy Development Programme)	Consortium (NGOs and Research institutes)-2007	Dairy	Donor	Conducting needs assessment and identifying challenges affecting smallholder dairy production and marketing Facilitating formation of dairy business companies and associations and enhancing their management through capacity building Stimulating and supporting (funding) capacity building of different sector actors (BDS providers e.g. A.I., feeds, transporters, finance) Facilitating access to knowledge/technology Linking with dairy processors, Program coordination (lead agency)	**1,2,3,4,5** Collective enterprises
4. Setpro consultants	Consultants-2000	Cross-sectoral	Donor funding (Third party)	Contracted as lead facilitating agency for KDSCP Needs assessment and facilitating strategic planning support for dairy milk cooperatives in specific regions Linking and stimulating demand for BDS (A.I., animal health, training and advisory) by cooperatives Facilitating training of farmers on technical and business skills; access to knowledge/technology Forging and managing linkages between cooperatives and financial institutions, training institutions, input suppliers	**1,2,3,4,5** Collective enterprises
5. Precise management	Consultant-2005	Cross-sectoral	Donor funding (Third party)	As above	**1,2,3,4,5** Collective enterprises

Name of organization	Type of organization and year established	Sector	Funding	Types of activities in agricultural sector	Broad functions and level of functioning**
6. Spantrack Consulting	Consultants-1996	Cross sectoral	Donor funding (Third party)	As above	**1,2,3,4,5** Collective enterprise
7. World Wide Sires (East Africa)	Limited company-1990	Dairy	Donor funding (Third party)	As above Providing genetics and breeding services to farmers	**1,2,3,4,5** Collective enterprises
8. SDCP(Smallholder Dairy Commercialization Program)	Ministry of Livestock Program-2007	Dairy	Government/ Donor grant	Facilitating market-oriented dairy enterprise development through private service providers to train on organization and enterprise skills Providing direct technical support to smallholder dairy producers Supporting market chain development Supporting policy implementation Program coordination (lead agency)	**1,4,5,6** Farmer common interest groups
9. SITE	Local NGO-1995	Cross-sectoral	Donor	Facilitating training of dairy traders and linking them to technical information Supporting formation of dairy traders' association and providing entrepreneurial support Creating links between dairy traders, cooperatives, and regulatory agencies	**1, 2, 3,5** Dairy service providers
10. FCI (Farm Concern International)	Local NGO-2003	Agribusiness-Horticulture and Staples	Donor	Needs assessment and market research to identify enterprise opportunities Facilitating access/dissemination of available technology (crop varieties) from research stations and private sector actors and peer exchanges Organizing smallholder producers into commercial villages (as production and marketing structures) Facilitating training on technical (production and postharvest) and non-technical (business skills) Supporting access to financing including microfinance and saving schemes Facilitating value networks of different actors with emphasis on public–private partnerships	**1,2,3,4,5** Farmer collective enterprise
11. KHDP (Kenya Horticulture Development Program-managed by Fintrac)	Consultants-2005	Horticulture	Donor	Needs assessment and opportunity identification Providing agronomic marketing, postharvest handling, and processing support for smallholders (both in-house capacity and in partnership with others) Facilitating support for sanitary and phyto-sanitary compliance through training Building partnerships Program management	**1,2,3,4,5,6** Farmer collective enterprises

Name of organization	Type of organization and year established	Sector	Funding	Types of activities in agricultural sector	Broad functions and level of functioning**
12. Technoserve	International NGO-1973	Agribusiness-Horticulture and Dairy	Donor	Enterprise development through agri-industry analysis and strategic planning Facilitating smallholder producer enterprise development by linking to business experts for training Facilitating linkage formation among different actors in value chain with emphasis on markets actors	**1,2,3,4,5** Farmer collective enterprises
13. SHOMAP (Smallholder Horticulture Marketing Program)	Ministry of Agriculture Program-2007	Horticulture	Government/ Donor grant	Supporting production of selected horticulture products with market potential through common interest groups Facilitating infrastructure development (access roads, collection centres and markets) to enhance market access of selected enterprises Program coordination (lead agency)	**1,2,3,4,5** Farmer collective enterprises
14. NALEP (National Agriculture and Livestock Extension Program)	Ministry of Agriculture Program-2000	Agribusiness and extension	Government/ Donor grant	Facilitating needs assessment and identification of livelihood opportunities Facilitating multi-stakeholder forums at regional (district) levels to set agendas for action including in R&D Providing technical support to public extension services including training Facilitating implementation of relevant government policies Program coordination (lead agency)	**1,2,3,4,5, 6** Stakeholder forums-network level
15. FPEAK (Fresh Produce Exporters Association Kenya)	Producer Association-1975	Horticulture	Membership fees Donor	Facilitating technical training in production (on quality - safety and code of practice) Auditing for compliance on good agricultural practice standards Marketing Information and facilitation Lobbying and advocacy on sector policy and regulation issues Focal coordination for export horticulture	**1,2,3,4,5**, 6 Individual and farmer collective enterprises
16. Agri-ProFocus	NGO Network-2009	Agribusiness	Donor	Facilitating a learning platform among agencies and individuals supporting agricultural enterprise development Policy advocacy Aims to link agribusinesses and research in order to match demand and supply of knowledge Stimulating and facilitating decentralized (localized) market in capacity building services through a capacity development fund	**1,2,3,** Network
17. Today Agriculture	Consultants-2004	Horticulture (mainly export)	Consulting fees Shares	Organizing farmers for production Providing technical advice on production(on quality - safety and code of practice) Auditing on quality standards Technology transfer support	**1,2, 3,5**

Name of organization	Type of organization and year established	Sector	Funding	Types of activities in agricultural sector	Broad functions and level of functioning**
18. ISAAA (International Services for Acquisition of Agri-biotech Applications)	International NGO-1996	Crop biotechnology	Donor Private companies	Facilitating access to crop biotechnology by identifying, supporting acquisition, application and dissemination of crop biotechnology through linking local agricultural research institutes and sources of the biotechnology (proprietary) Gathering, processing, and sharing biotechnology knowledge Policy brokering supporting agri-biotechnology	**1,2,3,4,6** Stakeholder forums-network level
19. AATF (African Agriculture Technology Foundation)	Regional NGO-2002	Crop and livestock proprietary biotechnology	Donor	Facilitating the identification, access, development, delivery, and utilization of proprietary agricultural technologies Negotiating IPR to enable access to and adaptation and use of the technology Capacity building for African institutions on biotechnology research Policy and regulatory advocacy	**1,2,3,4, 5, 6** Stakeholder forums-network level
20. FIPS (Farmer Inputs Support Services)	Local not-for-profit company-2003	Staples (maize, sorghum, etc.)	Donors	Stimulating farmer demand for inputs (small pack fertilizer and seeds) Promoting development of village-based agricultural advisors and input suppliers Facilitating increased farmer access to and proper use of agricultural inputs through public–private partnerships (e.g. research centres, fertilizer and seed companies) Stimulating market for inputs through increased demand and matching with supply by local stockists	**1,2,3,4,5** Individual farmers
21. REAL-IPM	Private company-2003	Floriculture and Maize	Matching grant from donors	Stimulating farmer demand for inputs (small pack fertilizer and seeds) Product development – combined with seed and fertilizers (for priming) and bio-pesticides Training on integrated pest management Policy advocacy on bio-pesticides	**1,2,3,4,5** Individuals farmers
22. AGMARK	Local NGO-2004	Agri-input supply	Donor	Facilitating access to agricultural inputs through support for rural agri-dealer network development Stimulating commercialization of new varieties of seeds (inputs) by creating demand for the same Facilitating training of agri-dealers on business management and technical and agronomic matters Output market identification and facilitation (limited) Policy advocacy on input subsidies	**1,2,3,4,5** Agri-dealers-micro level

1=Demand articulation; 2= Network building; 3=Knowledge brokering; 4= Innovation process management; 5=Capacity building 6= Institutional support

* *Most prominent functions of the organization noted in bold

2.4.2 *The role of innovation intermediaries in agricultural innovation in Kenya*

Below we discuss the roles identified within the intermediary landscape in Kenya using the framework of the six broad functions and related tasks identified in Figure 2.1. These include: (1) demand articulation or stimulation, (2) networking brokering, (3) knowledge brokering, (4) capacity building, (5) innovation process monitoring, and (6) institutional support.

Demand articulation or stimulation

The findings in Table 2.1 show that intermediaries undertook various activities to support demand articulation for incremental innovation support (e.g. access to existing technologies/inputs and knowledge). Demands were expressed through needs assessments and strategic planning exercises in some cases. In such cases, demand articulation focused on analysing the problems and challenges that the smallholder producers face in applying existing knowledge or technologies in production, or bottlenecks around access to output markets or finance, etc., in order for them to grow their enterprises. In explaining their support in demand articulation, one respondent noted:

> *"So the issue first is to go through with them, like an assessment, self-assessment of a sort, and then they'd discover the gaps within. Then for some of those gaps, you automatically know what they are lacking and who has it. When you point it out to them, they say "yes, that is what we need". They'd really see what is hindering them."*

From the findings, we noted that demand articulation also entailed a more pro-active role of intermediaries in stimulating demand for technologies, knowledge, and accompanying services necessary to enable innovation. For example, AATF and ISAAA played a catalytic role in stimulating demand for new agri-biotechnology through scoping for information, technology intelligence gathering, and raising awareness about these new technologies. Similarly, intermediaries such as FIPS, REAL-IPM, and AGMARK played an important role in stimulating demand for technologies that are already available (fertilizers and improved seeds) but whose uptake has been low, particularly among poor farmers in some regions. This demand stimulation is then complemented by stimulating the supply and availability of these technologies and inputs at the local level. Also,

demand stimulation is related to the on-going policy-supported discourse of engaging in farming as a business. The role of the intermediaries in this case is to identify enterprise opportunities for smallholders and follow up by stimulating demand for technical and business support, as noted in the quotes below:

> *"You start showing them how they can do serious business . . . help them to realize the benefit of having a business plan, a strategic plan, and ensure that this business plan and strategic plans are being implemented"*

Examples of such intermediaries included FCI, Technoserve, EADD, and the various consultants working mainly in the horticulture and dairy sub-sectors.

Some of the intermediaries work at a higher system level (sectoral), facilitating more strategic demand articulation. KDSCP, for example, works with heterogeneous actors in the dairy sub-sector to articulate the challenges and opportunities along the dairy value chain and has identified areas of interventions so as to enhance sector competitiveness, including knowledge, organizational forms, and institutional gaps such as policy and regulation. Agriprofocus also facilitates needs assessment and demand articulation for agribusiness development support for members (mainly in horticulture and dairy), including demand articulation for knowledge and technology and the identification of institutional problems (e.g. inadequate policy).

Network building

The results (Table 2.1) indicate that intermediaries have been instrumental in orchestrating and brokering networks of heterogeneous actors. The network constellations that the different intermediaries facilitated vary considerably however, particularly within subsectors. Due to the nature of the value chain, innovation intermediaries working in the dairy sub-sector facilitated more complex forward (output) and backward (input) linkages between dairy cooperatives or farmer-owned companies with various actors. These included a range of BDS such as breeding, genetics and animal health services, feed manufacturers, transporters, financial services, processors, and various government agencies and research organisations. In the horticulture sub-sector, intermediaries – e.g. FCI, Technoserve, Today Agriculture, KIIDP – supported farmer producer groups to forge links with input suppliers, microfinance, extension services (public and private),

public research institutes, quality assurance services (e.g. certification), and various output markets including local traders, institutions, supermarkets, and exporters. A commonality between the intermediaries in these two sub-sectors is their emphasis on private-sector models focused on stimulating commercially oriented BDS.

The intermediaries working in the maize (staples) sub-sector, i.e. FIPS, REAL-IPM, AGMARK, focused mainly on supporting backward linkages for input access. Therefore, they mobilized less diverse networks, comprising mainly fertilizer and seed companies, research institutes, local agri-dealers/input stockists, and extension agents. Because their support focused on enhancing production mainly for subsistence, the output market was peripheral to the network and involved mainly local market traders. On the other hand, the agri-biotechnology-focused intermediaries (ISAAA and AATF) built networks around emerging technologies, engaging mainly with public and private R&D actors at both local and international levels, and private enterprises that were used to support the acquisition and dissemination of the technologies. KDSCP, which worked at a systemic level in the dairy sub-sector, was instrumental in facilitating the National Dairy Sector Task Force (NDSTF) that brought together heterogeneous public–private partners to work strategically on broadly driving sub-sector innovation.

Knowledge and technology brokering

Knowledge and technology access is an important element in supporting agricultural innovation. Almost all the intermediaries identified were involved in knowledge/ technology brokering to various degrees. Intermediaries dealing with sophisticated agri-biotechnologies (AATF and ISAAA) were primarily technology brokers that facilitated sourcing of proprietary technologies and then supporting experimentation, adaptation, and dissemination in the local context. Intermediaries focused on enterprise support, facilitated identification of enterprise opportunities (commodities), and the related knowledge and technology needs (on production and post-harvest issues). For example, FCI and Technoserve facilitated the identification of high value horticulture commodities (e.g. bananas, onions, vegetables) and, as part of enterprise development; they brokered access to technologies such as improved seed varieties through research organisations or private seed companies. In the dairy sub-sector, the intermediaries also brokered access to knowledge and technology, mostly on already available technologies (e.g. AI, fodder).

Other intermediaries, e.g. FIPs, REAL-IPM, focused on input access for poor farmers and brokered access to improved seeds and fertilizer. These results indicate that the intermediaries' role in knowledge/technology brokering related more to facilitating access to available technologies than to articulation of knowledge gaps and to influencing the research agenda for new knowledge demands.

Innovation process monitoring

From the findings, intermediaries are instrumental in organizing the spaces for interactions, for stimulating learning, and for negotiation among the different actors with diverse interests. For example, KDSCP facilitated meetings through the NDSTF convened monthly, aimed at aligning the diverse agendas of the different actors who were interested in addressing the challenges faced by the sector. NALEP also facilitated district level multi-stakeholder forums, where diverse actors supporting smallholder farming households within a specific region aligned their work to ensure complementarity and avoid duplication.

EADD facilitated what they refer to as a hub, i.e. a milk cooling plant (collection centre), which provides the physical space where actors converge to provide different services. The hub aimed to align the different actors, including the producers, business service providers, processors, and financial services, by systematizing their interactions and transactions through a check-off system where services could be offered on credit linked to milk deliveries. Also, many of the intermediaries working at the level of the farmer or with farmer collectives (e.g. Setpro, Farm Concern, SHOMAP, SDCP, and KHDP) facilitated local-level learning efforts, e.g. peer exchanges, farmer field schools, and field days to enhance innovation processes. AATF and ISAAA's role in facilitating access to biotechnology entailed negotiating and securing intellectual property rights for proprietary technologies and then managing the public–private partnerships formed for the process of adapting the technology and dissemination locally.

Enterprise capacity building

Capacity building is particularly critical in supporting innovation for smallholder producers in a developing country like Kenya. Some of the intermediaries took on a more facilitative role in linking the smallholder producers to services that could strengthen their capacity, particularly around collective action. Most of the intermediation for capacity building related to organizing the farmers into producer groups, training them on both technical (agriculture) and generic business skills. The results indicate that a good number of intermediaries were more substantively involved in capacity building using their own in-house capacity. In the dairy sub-sector, capacity building related to strengthening farmer cooperatives, and business was central. EADD for example was centrally involved in facilitating formation of what they called dairy business associations, whereas KDSCP focused primarily on strengthening cooperatives, many of which had collapsed due to management challenges. The SDCP facilitated the formation of farmer common interest groups.

Institutional support

As indicated in Figure 2.1, intermediaries play a role in institutional support as boundary actors, particularly in the interface between science and practice, and in the policy and regulatory arena in the innovation process. From the results, only a few intermediaries explicitly engaged in supporting institutional change, particularly with regard to policy or stimulating the interface between scientists and practitioners. As indicated in the last column of Table 2.1, the actors engaged in facilitating institutional support were those working at a systemic level such as KDSCP, Agri-profocus, NALEP, and those involved in (emerging) agri-biotechnology innovation – ISAAA and AATF. In addition, innovation brokering is instrumental in facilitating institutional change from the perspective of practice and attitudes. For example, facilitators such as Setpro, Spantrack and EADD, working in the dairy sub-sector as consultants, linked farmers with different services and negotiated terms of engagement with service providers, with the aim of improving quality of service delivery and building trust between these actors. Similarly, the intermediaries brokered interactions between smallholders and financial institutions (banks), stimulating a change in attitude for both parties and resulting in new financial products (e.g. insurance, loans) being developed for smallholder farmers.

2.4.3 *Typology of intermediaries identified*

From the results above, we characterised the different intermediaries based on their functions and levels of focus and distinguished four intermediary types, including systemic brokers, specialized technology brokers, enterprise development support, and pro-poor input access intermediaries (see Table 2.2). We also note the strengths and weakness of each type to provide some points of reflection that can inform policy considerations to support the inclusion of innovation brokers as part of innovation support structures in developing countries such as Kenya.

Systemic brokers

These intermediaries, who work at higher network level (e.g. sector wide), are important in facilitating interactions and coordinating efforts for long-term sector changes. They facilitate demand articulation and options for the desired changes at the system level, and broker networks at the sector level, including industry actors, policymakers, researchers, and government agencies. They also proactively manage innovation processes, including supporting learning processes aimed at aligning the goals of the different actors. These intermediaries also play an important role as boundary spanners in order to influence the policy and regulations necessary to provide an enabling environment to support necessary innovation at higher system (sub)-sector level.

Specialized technology brokers

These brokers work in the realm of emerging agri-biotechnologies and are involved in stimulating demand for new technology and facilitating intricate networks through which knowledge is shared, exchanged, and put into use. These intermediaries also focus on supporting institutional innovation relating to policy and regulatory change as these provide the conducive environments and conditions needed to make productive use of the knowledge and technologies they broker.

Enterprise development support intermediaries

These intermediaries focus mainly on agribusiness or enterprise development, guided by market demands. Some of these intermediaries work only in the agricultural sector, but a number also have a cross-sectoral focus in supporting small and medium enterprises, including agriculture. The value added of these intermediaries is therefore in bringing

together agricultural entrepreneurs and agricultural and non-agricultural business service providers. These intermediaries focus on facilitating demand articulation for business development services and support network brokering and farmers' capacity building. The networks are built around public–private partnerships, benchmarked to private sector market development approaches. Most of these intermediaries are substantively involved in the innovation process, including providing extension support (production), research, and business skills training.

Pro-poor input access intermediaries

These intermediaries work in the context of poor households with limited access to knowledge and technologies in predominantly subsistence (staples) production systems. This limited access hinders them from improving their production system. The limited adoption of technologies such as fertilizers and improved seeds has been blamed on a lack of demand for the technologies, for various socio-economic reasons, twinned with some knowledge gaps. This is exacerbated by the lack of an efficient, commercially viable input supply infrastructure in rural areas. These intermediaries therefore focus on stimulating demand for technologies through capacity building among farmers and enabling experimentation with the technologies accessed in small seed packs, thus minimizing the farmers' risk. Although this appears to be more of a transfer of technology role, the intermediaries' added value is that, in the networks they broker, they bring together several actors, such as public research institutes, input manufacturers (fertilizer companies), and a growing number of rural input stockists, in supporting such incremental innovation, with technology use as a starting point. Similar to the enterprise support category, these intermediaries also provide substantive technical support to the farmers but with a limited commercial orientation since most of the production is primarily for subsistence.

Table 2.2: Typology of intermediaries based on functions

Intermediary type	Examples	Targets areas and innovation levels	Area of focus in their functions	Strengths (+) and Weakness (-)
Systemic broker	KDSCP, NALEP, Agriprofocus	Technology Organizational Institutional Macro and meso level	Strategic demand articulation - sector agendas (including research) Network building and platform for interaction Steering sector-wide innovation process Institutional innovation - policy	Balance all innovation areas and long-term (system) changes(+) Program-based sustainability (-)
Technology broker	ISAAA, AATF	Technology Institutional Macro level	Demand stimulation Network building Knowledge/technology brokering Institutional innovation - policy and regulation	Technology push (-) Linking technology/ knowledge and institutional support(+)
Enterprise development support	Farm concern, Technoserve, SHOMAP, KHDP, EADD, Setpro, Spantrack, Precise management FPEAK SITES World Wide Sires MESPT Today Agriculture	Technology Organizational Micro level	Demand articulation – market-driven opportunities Network building Innovation process management Knowledge brokering Capacity building - human and organization	Market driven - focus on high value crops (+) Support entrepreneurship (+) Institutional engagement minimal (-)
Pro-poor input access intermediaries	FIPS, AGMARK, REAL-IPM	Technology Organisational Micro level	Demand stimulation for input use Network building Knowledge brokering Capacity building - organization and human	Technology push (inputs) and micro-level subsistence focused (-) Reaching the most vulnerable (+) Institutional engagement minimal (-)

2.5 Discussion: theoretical and policy implications

2.5.1 *Changing innovation intermediation landscapes and the influence of innovation system context*

The findings illustrate a diverse intermediary domain in an increasingly market oriented smallholder-dominated agricultural sector in Kenya, which calls for a more sophisticated and demand-driven innovation support system. A range of organisations has been identified as taking an innovation intermediary role, facilitating and coordinating interactions among heterogeneous actors in various agribusiness networks. This indicates

a pluralistic innovation support structure and corresponds to what has been noted earlier that already many actors are fulfilling innovation intermediary roles in nascent agricultural innovation systems in developing countries (Klerkx & Leeuwis, 2009a). The contributions of innovation intermediaries are illustrated by the diverse functions and activities that they undertake, including demand articulation, network brokering, innovation process management, capacity building, and institutional support. These findings confirm what others have argued, that focusing just on knowledge access and use as a starting point for innovation limits the understanding of the innovation process as well as the options for supporting this process(World Bank, 2006). This is because the context of innovation has shifted and increasingly takes place in the context of more complex and multiple relationships, and innovation intermediation entails a broad range of tasks – beyond knowledge brokering – that aim at making these relationships productive and synergistic (Howells, 2006 ; Klerkx & Leeuwis, 2009a ; Sulaiman et al., 2010).

As Klerkx et al. (2009) have argued, the emergence of innovation intermediaries is context specific. For example, in the Dutch agricultural sector, new, dedicated organisations emerged as innovation brokers in the context of full privatisation of the knowledge infrastructure, which weakened a previously closely connected innovation system. These specialized brokers have emerged to invigorate interactions and match demand and supply of R&D and advisory services in a 'knowledge market' setting (Klerkx & Leeuwis, 2008b ; van Lente et al., 2003). In Kenya, the intermediary landscape is different, as indicated by the broker types identified (Table 2.1). This reflects a context where the focus is on building capacity for smallholder commercialisation and organizing a nascent innovation system (Pant & Odame, 2009) What we see in Kenya is a broad mix of actors taking on brokering functions, where a few identify themselves as specialized brokers but the majority have a more hybrid character, of both facilitator and technical expert. This implies that context in terms of, for example, the characteristics of the R&D and extension system, the prevailing 'culture of collaboration', and previous innovation trajectories, appear to influence the emergence and configuration of the intermediary landscape, confirming ideas of (Klerkx et al., 2009).

2.5.2 *Reflections on the adequateness of the current intermediary landscape*

The study distinguished four types of innovation intermediaries in the Kenyan context. These findings beg for some reflection on the adequateness of the typology and the extent to which it can be seen to represent an optimal innovation intermediary landscape. Given the explorative nature of the study, it might be premature to draw hard conclusions on adequateness; however, the findings provide insights for initial reflection.

As Howells (2006) has noted, innovation occurs at different system aggregation levels (macro, meso, and micro) to which different intermediaries respond. The adequateness of the identified intermediary landscape can therefore be assessed by looking at the extent to which the intermediaries focused on different levels of innovation and the broad functions they fulfilled in addressing various system and market failures. Juxtaposing our findings with what other studies have found (Klerkx & Leeuwis, 2008b ; Klerkx & Leeuwis, 2009a) we argue that the intermediary landscape in Kenya broadly covers all system levels. We see the emergence of systemic brokers, which have been identified in the other studies as an important intermediary type for creating higher-level system innovation and for long-term transformations at the macro-meso level (e.g. national system or sectors). The strategic role of systemic brokers, and their potential for stimulating robust innovation systems change, result from their ability to form what Howells (2006) has referred to as an 'ecology of influence' in transforming relations among the heterogeneous actors they mobilize within such a system. Another essential role of system brokers is in matching prospective demand and supply in the knowledge market and thus guiding demand-oriented R&D within innovation processes (Klerkx & Leeuwis, 2008b ; Kristjanson et al., 2009), although this role was limited in the Kenyan context. The specialized technology brokers also operate strategically similar to systemic brokers, working in a specific context of development of agri-biotechnologies, and emerging in the absence of policy and regulatory frameworks in most developing countries. Given the contested nature of the technologies, and the institutional vacuums, the brokering occurs at the macro and micro level. These brokers mobilize broad coalitions of actors to promote access to and use of the technologies to facilitate the institutional strengthening that must accompany the technological innovation. This example advances a more

nuanced understanding of the complex and multidimensional nature of supporting innovation that goes beyond a simplistic technology transfer argument.

The enterprise focused and the pro-poor input focused category are similar to what (Klerkx & Leeuwis, 2008b) called 'innovation consultants' working either with individuals or collectives and connecting them to different services providers. These intermediaries work on more incremental innovations in all contexts and undertake a wider set of innovation support functions related to building smallholder entrepreneurship capacity and involving the facilitation of access to technical and business support. This increasing orientation toward supporting entrepreneurship development and business management in agriculture has been noted elsewhere (Eenhoorn, 2007 ; Knickel et al., 2009 ; Phillipson et al., 2004) However, these intermediaries also provide technical expertise and take on brokering as part of their broader innovation support and not as their core business.

This reflection on adequateness suggests that the innovation system's shortcomings and needs at different levels determine the types of intermediaries that emerge. We argue that the Kenyan intermediary domain has adapted itself to the context of the innovation system in which it functions, both as regards its focus areas (smallholder capacity building, often on incremental improvements) and the way it is organized (few specialized systemic innovation brokers, innovation brokering mainly as a side activity). It remains to be seen what other innovation brokering focus areas will develop in response to emerging needs of the innovation system. Furthermore, a remaining question from a general theoretical point of view is whether specialized brokers will emerge as the Kenyan agricultural innovation system matures, or whether innovation intermediation as a side activity will remain the dominant way of providing these services.

2.5.3 *Policy implications: how should brokering be supported?*

What are the implications of this changing landscape in Kenya in terms of public policy support for the innovation brokering function? Current policy support for enhancing innovation capacity for smallholder farmers in Kenya is couched in the context of a shift to demand-driven, pluralistic extension services and public–private partnerships (Muyanga & Jayne, 2008 ; Republic of Kenya, 2009) In line with this focus, given that

supporting innovation is about stimulating interaction and supporting continuous alignment among heterogeneous actors that come together in networks or along agricultural value chains, innovation support services provisioning should go beyond a simplistic conception of knowledge brokering in the form of technical services (cf. Rivera & Sulaiman, 2009). The diversity of organizational arrangements identified as taking on brokering roles even without policy support, confirms this need for broader innovation support. However, we argue for the need for deliberate policy support to embed the innovation intermediation arrangements that are necessary to support agricultural innovation agendas.

Although brokering would appear to be a pervasive activity, there are both strengths and limitations apparent in each category observed (Table 2.2). There is therefore the need to weigh up what brokering functions need to be emphasised for different kinds of innovation challenges. For example, do the main bottlenecks arise in relation to connecting farmers to technology and markets or in relation to system changes at the national level? Rather than presenting a blueprint of how the intermediary domain needs to be organized, what is important is to ensure support for the important intermediary role. A major implication for policy therefore is that it needs to better acquaint itself with the status of brokering functions being performed by different types of organisations, identify gaps, and use this to prioritize its investments. This paper has provided an initial typology that could be used to map out the main forms of brokering capacity and that could be used to guide in diagnosing gaps.

Consequently, the national government needs to recognize brokering as the critical component of national innovation capacity and support it accordingly. We noted current dependence of most of the organisations studied on external funding and hence their vulnerability to changing donor priorities. As Klerkx and Leeuwis (2009a) have noted, brokering can be considered a public good and requires public funding, in the absence of market incentives to make this role self-sufficient. However, we are cognizant that innovation support services provided by the organisations we studied cover a continuum of public–private goods and that this might require different funding strategies. Certain forms of brokering are already being performed and supported by other actors – for example as part of for-profit business models (Hall et al., 2010) – and the role of policy is

to fill gaps and link together various forms of brokering at different levels. As the innovation system and knowledge market matures, different funding mechanisms may also evolve to distinguish between public and private support services, where intermediaries may then charge a service fee for goods deemed private.

2.6 Conclusion

In conclusion, this exploratory study applied a structural approach to understanding types of intermediaries and their role in a changing agricultural sector in Kenya. The study has provided empirical insights into the innovation intermediary landscape reflected by diverse actors fulfilling broad functions to address innovation system failures or gaps at different levels of system aggregation. The findings support the argument that, although production and exchange of knowledge are important, they are not the only prerequisites for innovation. The study has revealed areas for further inquiry. This includes further mapping the agricultural sector to establish if there are other forms and types of intermediaries. Finally, to get a better insight into their contributions to innovation, there is the need to look at how intermediaries position themselves in dynamic innovation networks and processes.

CHAPTER 3

Unravelling the role of innovation platforms in supporting co-evolution of innovation: Contributions and tensions in a smallholder dairy development programme[2]

[2] Published as: Kilelu, C. W., Klerkx, L. & Leeuwis, C. (2013). Unravelling the role of innovation platforms in supporting co-evolution of innovation: Contributions and tensions in a smallholder dairy development programme. Agricultural Systems 118(0): 65-77.

Abstract

The agricultural innovation systems approach emphasises the collective nature of innovation and stresses that innovation is a co-evolutionary process, resulting from alignment of technical, social, institutional and organizational dimensions. These insights are increasingly informing interventions that focus on setting up multi-stakeholder initiatives, such as innovation platforms and networks, as mechanisms for enhancing agricultural innovation, particularly in sub-Saharan Africa. There has been much emphasis on how such platforms are organized, but only limited analysis unravelling how they shape co-evolution of innovation processes. This paper addresses this gap and conceptualizes platforms as intermediaries that connect the different actors in innovation systems in order to foster effective co-evolution. We present a case study of a smallholder dairy development programme in Kenya, led by a consortium of five organisations that provide a platform for building multi-actor partnerships to enhance smallholder dairy productivity and improve livelihoods. The findings indicate that co-evolution of innovation is a highly dynamic process with various interactional tensions and unexpected effects, and that the distributed nature of intermediation is important in resolving some of these tensions emerging at different actor interfaces. However, platforms are not always able to adapt adequately to emerging issues. This point to the need to look at platforms dynamically and pay more attention to mechanisms that strengthen feedback, learning and adaptive management in innovation processes.

3.1 Introduction

Smallholder agricultural development in developing countries faces challenges and constraints related to persistent food insecurity, food price volatility, food safety and sustainability concerns, but also is experiencing increased opportunities arising from growing domestic and global agricultural market demand (McCullough et al., 2008 ; World Bank, 2006 ; 2007). Such a dynamic context requires the sector to innovate continually if it is to contribute to sustainable socio-economic development. In this regard, the agricultural innovation systems (AIS) approach has gained currency as a framework for understanding bottlenecks and identifying opportunities for enhancing the innovation capacity of agricultural systems, particularly in sub-Saharan Africa (SSA) (Hounkonnou et al., 2012 ; Spielman et al., 2009 ; Sumberg, 2005 ; World Bank, 2006) .

AIS thinking recognizes that innovation occurs through the collective interplay among many actors– including farmers, researchers, extension officers, traders, service providers, processors, development organisations – and is influenced by factors such as technology, infrastructure, markets, policies, rules and regulations, and cultural practices (actors' values and norms). Thus, innovations are not just about technology but also include social and institutional change, and have a systemic and co-evolutionary nature (Biggs, 1990 ; Leeuwis & van den Ban, 2004). Co-evolution entails mutual interaction and adaptation over time between the technological, social and institutional components of an innovation, and therefore innovation cannot be understood and managed by separating these different components (Edquist & Johnson, 1997 ; Ekboir, 2003 ; Hall & Clark, 2010 ; Nelson & Nelson, 2002). However, co-evolution does not mean seamless and smooth evolution, but is accompanied by tensions and sometimes incongruent actions that affect the outcomes of complex innovation processes (Leeuwis & Aarts, 2011 ; Smits, 2002).

Following the AIS perspective, the importance of recognizing and stimulating co-evolution has been noted as key to promoting smallholder agricultural development in SSA, and interventions increasingly focus on supporting interaction among multiple actors at different levels in agricultural production systems and value chains to enable innovation and enhance livelihoods (Ayele et al., 2012 ; Dormon et al., 2007 ; Hounkonnou et al., 2012). Such multi-actor arrangements have been captured using

different concepts and terminology, such as coalitions (Biggs, 1990); innovation configurations (Engel, 1995) innovation networks (Leeuwis & van den Ban, 2004); public–private partnerships (PPPs) (Hall et al., 2001 ; Spielman et al., 2010) and innovation platforms (Adekunle & Fatunbi, 2012 ; Nederlof et al., 2011). While these concepts are similar in their emphasis on understanding innovation as an interactive and collective process, they are mostly used as analytical concepts rather than intervention approaches, with the exception of innovation platforms and PPPs, although the latter has mainly been described in the context of research collaboration (see e.g. (Hall et al., 2001 ; Spielman et al., 2010) In this paper, we use the concept of innovation platforms, which generally have wider application in the agricultural field. We define an innovation platform as a multi-actor configuration deliberately set up to facilitate and undertake various activities around identified agricultural innovation challenges and opportunities, at different levels in agricultural systems (e.g. village, country, sector or value chain).

Recent studies from SSA have shown that multi-stakeholder platforms are contributing to agricultural innovation, citing enhanced interdependence among actors and enhanced social capital as some contributory factors (Nederlof et al., 2011 ; Tenywa et al., 2011 ; van Rijn et al., 2012). Although these studies often point to issues such as platform composition, governance and facilitation, they do not provide a clear understanding of how and why these platforms shape the innovation process and contribute to the outcomes. Thus, innovation platforms largely remain 'black boxes'. To better understand innovation processes and how to support them through platforms, there is need for more robust analysis of the dynamics of co-evolution and the role of change agents in the process (Hounkonnou et al., 2012 ; Waters-Bayer et al., 2009). This paper aims to fill this gap by unravelling how platforms shape and contribute to innovation processes, through a case study of the East Africa Dairy Development (EADD) programme in Kenya. The EADD programme provides a platform for stimulating multi-stakeholder collaboration aimed at improving productivity and incomes of smallholder dairy producer households.

The paper is organized as follows. Section 3.2 draws a conceptual framework that links the concepts of co-evolution and innovation platform in order to provide an analytical framework to unravel innovation platforms. This is followed by a presentation of the research design in Section 3.3. We present the findings in Section 3.4, followed by a

discussion of the merits and limitations of innovation platforms in supporting co-evolution of innovation. We end with conclusions in Section 3.5 where we highlight some theoretical and practical implications of the findings.

3.2 Conceptual framework

This section first discusses the concept of co-evolution and innovation platforms as innovation intermediaries. We then combine these concepts to build an analytical framework in order to better elucidate the dynamics of co-evolution of innovation process.

3.2.1 *Operationalizing innovation as co-evolution*

AIS scholars point to co-evolution as a useful concept for understanding the complexity of the innovation process, which entails continuous interaction of technical, social and institutional elements. However, to enable a simultaneous analysis of these elements, the co-evolution concept needs to be operationalized. (Leeuwis & van den Ban, 2004) adaptation of Smits (2002) definition of innovation as alignment of hardware (technology in the form of new technical devices), software (new modes of thinking and corresponding practices and learning processes), and orgware (new institutions and socio-organizational arrangements) aptly captures this view on co-evolution of innovation and provides a heuristic for analytical purposes. The hardware elements refer to a tangible product or a well-defined set of practices that define a technology. The software dimension captures the essence of AIS thinking, which emphasises innovation as the outcome of interactive learning among multiple actors involving both explicit and tacit knowledge from different sources, such as scientific, experiential and indigenous knowledge (Leeuwis & van den Ban, 2004 ; Oreszczyn et al., 2010). The characterization of the orgware dimension follows North (1990) definition of institutions as the 'rules of the game' or as human-devised rules that structure interaction, in which a distinction can be made between formal (e.g. laws, regulations, standards) and informal (norms, attitudes, values) institutions. Institutions can be considered to have a twofold role, in that they provide the environment or conditions for collaboration necessary for innovation, but are also part of the innovation process and so they also need to be changed (Hung & Whittington, 2011 ; Klerkx et al., 2010). Conducive institutional conditions enhancing collaboration for institutional change, or conversely a lack of them, have been underlined as key elements that enable or

constrain innovation (Hounkonnou et al., 2012 ; Klerkx et al., 2010 ; Leeuwis & van den Ban, 2004 ; Roep et al., 2003).

Co-evolution thus points to deliberate efforts to align the technological and socio-institutional arrangements not only in the sense of trying to fit into pre-existing conditions (Leeuwis & Aarts, 2011 ; Smits & Kuhlmann, 2004), but also in actively trying to change the socio-institutional environment, which has been referred to as effective reformism (Klerkx et al., 2010 ; Roep et al., 2003). Thus, innovation processes are marked by dynamics of alignment and conflict, with often unpredictable outcomes.

3.2.2 *Agricultural innovation platforms and their role as intermediaries in innovation co-evolution*

Multi-actor platforms have been noted as important interventions for creating spaces to orient interaction in order to enable innovation as they stimulate changes among platform actors that eventually have greater effects in the broader environments in which these actors operate (Dormon et al., 2007 ; Klerkx et al., 2010). The platform concept has already been applied in the agricultural innovation context to explore different modalities for collective action among multi-stakeholders around natural resource management, e.g. farmer field schools (FFS), local research committees (CIALs), natural resource management platforms (Braun et al., 2000 ; Röling & Jiggins, 1998). More recently, various forms of agricultural innovation platforms have been promoted as arenas for action in operationalizing AIS interventions (Adekunle & Fatunbi, 2012 ; Devaux et al., 2009 ; Nederlof et al., 2011). Platforms can have different goals and can also be structured and conceptualized in diverse forms: the focus of platforms can be research oriented, development oriented, or both, and some platforms take on more centralized forms with central coordinating structures, whereas others consist of distributed networks of interaction (Nederlof et al., 2011 ; Steins & Edwards, 1999).

Innovation platforms generally do not emerge autonomously, but connections between platform members need to be forged and their interaction needs to be coordinated (Leeuwis & van den Ban, 2004 ; Röling & Jiggins, 1998). Building on the theoretical and empirical insights from the broader innovation studies literature (Howells, 2006 ; van Lente et al., 2003 ; Winch & Courtney, 2007), AIS scholars have argued that there is thus

an important role for so-called innovation intermediaries, who engage in coordinating and brokering relations at several interfaces in complex multi-actor configurations in the AIS (Devaux et al., 2009 ; Kilelu et al., 2011 ; Klerkx & Leeuwis, 2008a ; Morriss et al., 2006) provide a collated range of functions that innovation intermediaries in agricultural innovation can fulfil; we apply these to understand the role of innovation platforms (for details see (Kilelu et al., 2011). These functions include:

- Demand articulation: Facilitating the process of identifying innovation challenges and opportunities as perceived by the various stakeholders through diagnostic exercises, visioning, and needs assessment. The needs could include access to information, technologies, finance or institutional gaps.
- Institutional support: Facilitating and advocating institutional change (e.g. policy change, new business models and stimulating new actor relationships).
- Network brokering: Identifying and linking different actors.
- Capacity building: Strengthening and incubating new organizational forms.
- Innovation process management: Coordinating interactions and facilitating negotiation and learning among different actors.
- Knowledge brokering: Identifying knowledge/technology needs and mobilizing and disseminating the technology and knowledge from different sources.

Whereas literature which takes a more structural perspective on categorizing such innovation intermediaries in AIS suggests that a single innovation intermediary orchestrates innovation platforms (Batterink et al., 2010 ; Kilelu et al., 2011 ; Klerkx et al., 2009), innovation process-oriented studies show that several intermediaries are active and that they make different connections between actors and components in innovation processes and act as change agents (Eastwood et al., 2012 ; Klerkx et al., 2010 ; Stewart & Hyysalo, 2008). This derives from the fact that innovation processes are of a highly distributed nature in terms of space and time. To resolve different problems and uncertainties (technological, social, market-related, institutional in nature) in relation to realizing an innovative vision or problem, work is needed simultaneously at several interfaces in the innovation system (Klerkx et al., 2010). This suggests that the role of intermediaries in platforms can be conceptualized as ecologies or nested systems of

intermediaries connecting different components of AIS and fulfilling complementary functions in order to guide co-evolution.

Integrating these insights distilled from the literature on co-evolution of innovation, innovation platforms and innovation intermediaries, we construct an analytical framework, presented in Fig 3.1, to unravel the role of innovation intermediaries in supporting co-evolution of innovation processes on the EADD multi-actor platform. The model places the platform at the centre and is the arena in which intermediation of innovation processes takes place, by undertaking the various intermediation functions described above. Outlining these functions provides a frame for understanding the nature of intermediation and how this contributes to innovation outcomes on the platform. The innovation processes are characterised as change, loosely from one system (A) to another (B). The change can happen through either radical (fundamental change to the system) or incremental (stepwise improvement of a system) innovation. The platform is situated in a broader socio-technical context that influences how the change process evolves.

We now apply the analytical framework to answer the main question of this article as set out in the introduction: how do innovation platforms shape and contribute to the dynamics of coevolution?

3.3 Case description and research methods

3.3.1 *Background of the EADD programme*

The smallholder-dominated dairy sector in Kenya is considered to be relatively successful in the SSA context, but the sector still contends with many challenges that have limited its potential in terms of productivity, competitiveness and improving livelihoods (Moll et al., 2007 ; Muriuki et al., 2003 ; Technoserve, 2008). To tackle these challenges, the EADD multi-actor programme was initiated in 2008. The EADD is being implemented in three countries in East Africa: Kenya, Uganda and Rwanda, but this research focuses on Kenya only. The modality of the programme as a multi-actor platform (see Fig. 3.2) in the dairy sector was noted as interesting for an in-depth study of innovation processes. EADD Kenya works at 19 sites in the Rift Valley and Central Kenya regions where dairy production is concentrated. Such sites are defined in relation to one of the programme's

innovations – a dairy farmers' limited company (referred to as Dairy Farmer Business Association: DFBA) with an operational chilling plant that evolves into a local business hub. The DFBA has a catchment area that covers a radius of approximately 10 kilometres in which it aims to attract dairy farmers to deliver milk for bulking and collective marketing (EADD, 2011b).

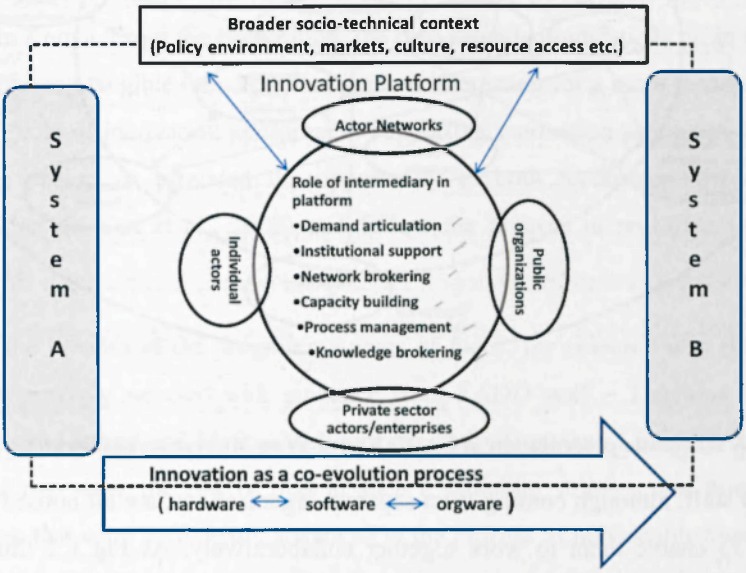

Figure 3.1: Analytical framework: innovation platforms supporting co-evolution of innovation
(Source: own elaboration based on Smits 2002; Leeuwis and van den Ban, 2004; Kilelu et al., 2011)

The EADD programme is implemented by a consortium of five organisations: Heifer International, International Livestock Research Institute (ILRI), Technoserve (TNS), African Breeders Services Total Cattle Management Limited (ABS TCM LTD.) and World Agro-forestry Centre (ICRAF). The consortium brings in different expertise including agriculture research, business development and dairy production in coordinating the programme; this enables them to shape innovation in different ways.

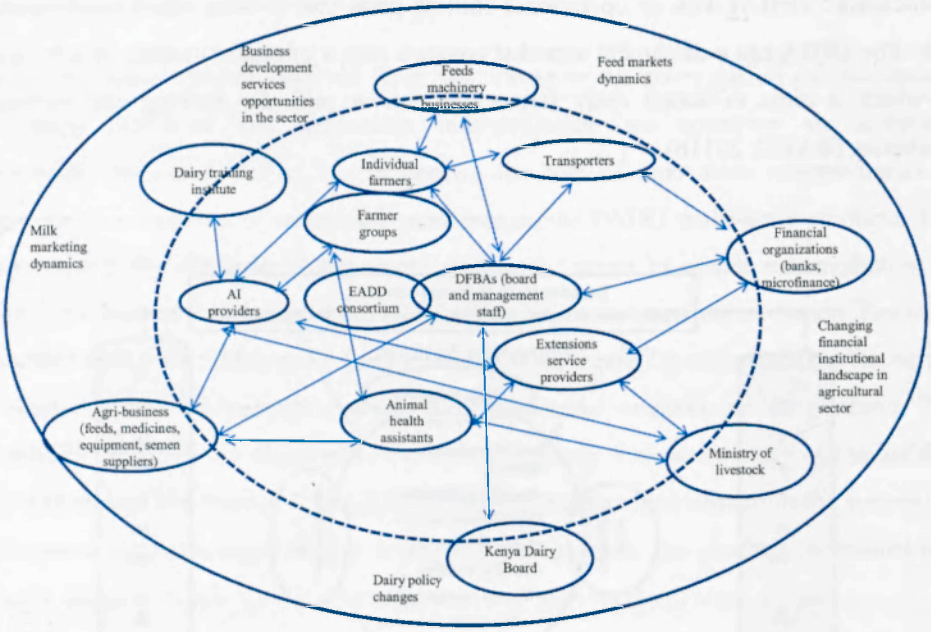

Figure 3.2: A schematic presentation of EADD Kenya as an innovation platform

The EADD staff, although coming from separate organisations, are all housed together in one office to enable them to work together collaboratively. As Fig.3 2 illustrates, the EADD as a multi-actor platform consists of complex and layered linkages. The EADD consortium acts as a central coordinating unit that facilitates linkages among different configuration of actors, including farmers, government agencies and the private sector, which interact through the different DFBAs (inner layer). Thus, each DFBA can be seen as a distributed platform for localized interactions among the various actors in an effort to meet the programme goal. The EADD platforms operate in the broader context (outer layer) of a liberalized dairy market and increasingly dynamic agribusiness environment (in terms of a growing number of input suppliers, e.g. feeds, supplements, and dairy processors and traders) in an evolving policy environment (in terms of a new dairy development policy, agricultural extension policy promoting pluralistic demand-driven service provision, policies to improve flow of credit to farmers and so forth) (see (Muriuki et al., 2003) for an overview).

3.3.2 *Case study methods*

In line with other studies on agricultural innovation processes (Eastwood et al., 2012 ; Klerkx et al., 2010), a single case study research design was selected as appropriate for providing in-depth insights into the dynamism of innovation processes (following (Flyvbjerg, 2006 ; Hoholm & Araujo, 2011 ; Yin, 2003) The EADD programme in Kenya was selected for this study following initial exploratory research (see (Kilelu et al., 2011) for details) that identified several on-going initiatives supporting smallholder agricultural innovation in Kenya. From the exploration, the case provided indications of an innovation platform achieving tangible outcomes that made it interesting for a more in-depth study to elucidate the role of innovation platforms in supporting innovation processes. Further, as an on-going project, it provided the opportunity to both reconstruct the innovation dynamics (Van de Ven et al., 2008) and follow the process in real-time (Hoholm & Araujo, 2011).

Because of the breadth of the programme areas of focus, the research was conducted at two sites purposively selected with guidance from EADD staff – Tanykina (Kipkaren) Dairy Company Limited and Metkei Multipurpose Dairy Company Limited. Although we only studied two sites, the risk of bias in such a sampling strategy was minimized by selecting sites that were sufficiently advanced in the process of hub establishment but had followed different innovation trajectories and thus provided adequate depth of diverse experiences to elucidate the innovation process. The sites are located in separate districts in the Rift Valley region with different agro-ecosystems but similar mixed farming systems. Because the two sites have different histories with dairy farming, it was possible to glean a variety of insights on the dynamics of the innovation process. Tanykina was considered a pre-established site as it had recently been established as a cooperative that had already been operating a chilling tank for cooling and bulking milk. Metkei was considered a new site where four small dairy societies worked separately and had no chilling tank. The aim of the case study was not to develop generalized, prescriptive accounts but rather to look for patterns that could provide explanatory analysis (Flyvbjerg, 2006 ; Yin, 2003).

Various data collection methods were used to understand the processes, but also to ensure reliability and validity through triangulation. The data were collected from August 2010 to December 2011. Table 3.1 presents a summary of the data collected at each site

Table 3.1: Overview of data collection

Methods	Study Sites		Information gathered
	Tanykina	Metkei	
Focus group discussion (FGD) with farmers working in dairy management groups – DMG (approximately 15 farmers in each FGD)	8	9	History of dairy in the area; dairy production and marketing issues, linkage to DFBA access to services, marketing issues, perception of role of EADD and other actors
FGD with non-DMG farmers (approximately 15 farmers in each FGD)	1	1	History of dairy in the area; production and marketing issues, linkage to DFBA access to services, marketing issues, perception of role of EADD and other actors, reasons for not working in groups
Semi-structured interviews with Ministry of Livestock district officers	1 (5 participants)	1 (4 participants)	Views on the new DFBA business model; their collaboration with EADD, production and marketing issues
Semi-structured interviews with service providers	4 (2 extension providers, AI, animal health assistant)	2 (AISP/extension provider and animal health assistant)	Views on the new DFBAs model; links with EADD, views on production issues, their collaboration with EADD as business service providers
Interviews with DFBA management team	3	4	DFBA history and governance; views on production and marketing issues, assessment of the challenges facing DFBA
Participation in meetings and discussions with DFBA Board of Directors	2	2	DFBA history and governance; views on production and marketing issues, assessment of the challenges facing DFBA and collaboration with EADD
Unstructured interviews with other actors	1 (bank manager)	1 (manager of packing firm)	Involvement with EADD, views on production and market issues, the role of EADD

Other data sources included direct observations and informal discussions from participation in various meetings and discussions during site and EADD office visits. We also conducted a semi-structured group interview with six EADD team members. All focus group discussions and interviews were taped and fully transcribed for systematic analysis. Various project reports (including annual project reports, mid-term evaluation) provided additional information. Following the analytical framework, we coded and characterised the data to identify different elements of the co-evolution process in relation to the three intervention (innovation) areas and unravel the role of the intermediaries on the platform.

3.4 Findings

In this section, we describe the process of how EADD established and executed the programme, distilling from this description the components of the co-evolution of the innovation processes on the platform, and highlight some of the issues and tensions that emerged as the process unfolded. We also examine the role of intermediaries in the processes, using the six intermediation functions described in the conceptual framework in Section 2. Quotes derived from the interviews are used to illustrate key points.

3.4.1 *The entry point – setting the agenda, mobilizing the platform and the role of EADD*

The EADD programme was established with the goal of improving the incomes of smallholder dairy households by implementing interventions that enhance both dairy production and market access. To guide these interventions, EADD first conducted diagnostic studies to better understand the bottlenecks in smallholder dairy farming. These studies focused on three main areas: (i) improving breeding and animal health; (ii) improving feed management and enhancing access to quality and affordable feeds; and (iii) strengthening market access for smallholders (EADD, 2009a ; 2009b ; 2009c ; 2009d). The studies pointed to areas of intervention; subsequently, how these were addressed evolved through testing and implementing various socio-technical and institutional innovations. Furthermore, the EADD team also conducted feasibility studies to guide site selection.

As an entry point to the communities, the EADD consortium started by advancing a vision for the establishment of farmer owned DFBAs as an alternative to dairy co-operatives, which are the dominant institutional model of dairy farming enterprises in Kenya (Technoserve, 2008). Dairy co-operatives had faced several challenges over the years, with many of them disbanding for reasons such as mismanagement coupled with the collapse of the government-owned Kenya Co-operative Creameries (KCC), the main marketing channel before liberalization of the market in 1992. This had resulted in huge losses for farmers who hence became wary of co-operatives. This context informed EADD's drive for an alternative dairy business model, as illustrated by the following quote: EADD was clear that we were only dealing with a limited liability company. Limited companies were considered less prone to challenges of accountability, governance, sound business management (EADD team interview, September 2010).

With this vision, the EADD started mobilizing dairy farming communities. A key mobilizing strategy used by the EADD team was the involvement of the local administration and relevant government ministries at different administrative levels (e.g. division and district) and local politicians. It was thought that getting bring these actors on board would ease entry into communities and ensure their long-term co-operation beyond the lifespan of the programme. Involving the local administration was also useful in supporting the process of selecting the interim leaders for the DFBAs. As one EADD team member noted on this point:

In sites where we worked with government from the word go and we had their buy in, and they contributed in selecting representatives from the community that served on the steering committee –When there was this interaction, it [mobilization] worked well (EADD team interview, September 2010).

EADD organized various public meetings to present the ideas of the programme. After these first meetings, communities were invited to nominate an interim board of directors. The board members were to represent different administrative divisions where they were expected to mobilize farmers to register and purchase shares in the new company. These meetings spurred the initial platforms for interaction among multiple actors leading to the setting up of the DFBAs. To demonstrate their commitment to the vision, farmers were

expected to raise an initial portion of the equity (10%) for the start-up that would go towards purchasing the cooling tanks and cover initial operational costs. To match farmers' 10% contribution, the EADD provided an interest free loan of 30% from programme funding, with the remaining 60% to be financed through commercial loans. Thus an important intermediation role of EADD at the early stages was to mobilize farmers, support the interim leadership of the DFBAs to draw up business plans, facilitate the set-up of governance structures, and bring on board other relevant actors as collaborators, broker their interactions and support the interim leadership to raise capital.

In Tanykina, the farmer mobilization process progressed fast because there was a pre-existing co-operative with a cooling tank (albeit running unprofitably), installed with support from Heifer International. EADD was to assist in remodelling Tanykina co-operative into a limited company and support its further development into a business hub. In contrast, the Metkei Multipurpose DFBA was a conglomerate of four co-operative societies that were still operational but struggling: Tulwobei, Metkei, Kapkitony and Kipsaos. This made mobilizing farmers a challenge. Although the cooperatives agreed to form the company, they retained their own members and respective organizational structure, making it difficult to mobilize farmers for the new Metkei Multipurpose Company, which was to encompass all four societies. There were underlying suspicions and competition between the respective co-operatives, as one EADD staff member noted:

> *"There is a superficial barrier where you are working through the co-operative as a proxy. This is why in Metkei we are stuck with membership of 2,440 though there is potential to mobilize 5,000 farmers" (EADD staff, interview September 2010).*

In Metkei, it took longer to raise the equity; this delayed the setting up of the chilling plant which began full operations in February 2010, a year after EADD started its engagement with the community. Discussions with farmers indicated that there was confusion about the new entity, and this also affected service delivery at later stages, as discussed in Sections 4.2. One farmer noted the following on this confusion:

> *"All of us have some Metkei shares but are registered with the cooperatives. There are four co-operatives and, according to the constitution, the members have to go through the co-operatives" (Farmer focus group discussion, Metkei November 2011).*

The establishment of the DFBA therefore provided the entry point and a local-level platform for interventions and multi-actor interactions as discussed below.

3.4.2 *The dynamics of co-evolution of innovation on the EADD platform*

In this section, we unravel this co-evolution of innovation and the role of intermediaries on the platform in relation to the three main areas of intervention – milk marketing, breeding and feeding. The findings also include some of the tensions that emerged in the process and affected the innovation processes in unexpected ways, revealing the complexity of such processes. Fig. 3.3 presents a broad overview of events in the innovation process at the two sites, illustrating the interweaving of technical, social and institutional dimensions of innovation that involved mobilizing different actors and resources at various points in time.

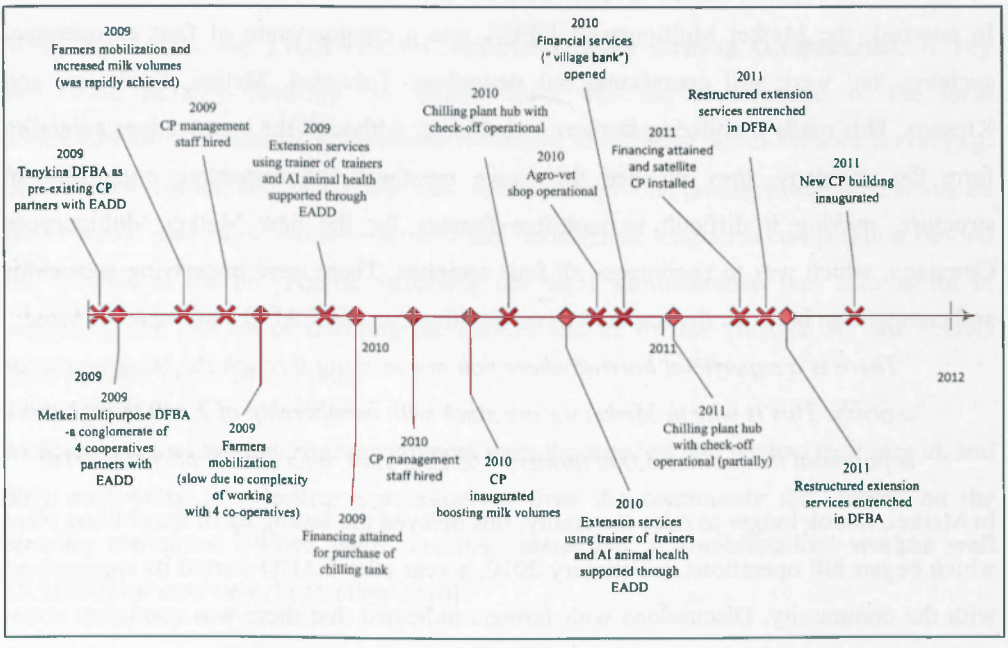

Figure 3.3: Timeline of important events in the innovation process in the two study sites

Note: X – Denotes processes in Tanykina DFBA; ◊ – Denotes processes in Metkei DFBA

Enhancing innovation for improved milk marketing

As noted in Section 3.4.1, the starting point for EADD was the establishment of dairy limited companies as an alternative dairy business model to address constraints faced by smallholders in production and marketing (EADD, 2009b ; Technoserve, 2008).

This model was in itself an institutional innovation which started by first setting up the chilling plant for bulking and cooling milk, and putting in place interim governance structures for the DFBA. This genesis provided the platform that triggered a series of other socio-technical and institutional innovations that in combination enhanced marketing (see Table 3.2 for a summary).

With support from EADD consortium partners, the DFBAs were linked to different actors to support different dimensions that were vital to improve marketing. In Metkei, EADD brought in a food pro-cessing and packaging firm as a partner that offered to finance the purchasing of a cooling tank, some laboratory equipment and the dairy management software for the DFBA. As the firm manager noted

> *"[their] interest in supporting the cooling tank in Metkei was because it was important being part of the dairy value chain to ensure an increase in the quantity and quality of milk processed" (Interview, February 2011).*

As noted in Section 3.4.1, there was already a pre-existing chilling plant in Tanykina, so the starting point was the establishment of the DFBA, but also the improvement of the facilities where the chilling plant was located. Later on, Tanykina was linked to a commercial bank that financed a loan to purchase additional cooling tanks for satellite collection centres, thereby reducing the distance to be covered and time it took for milk to be delivered, and ensuring the quality of the milk.

Farmers commented that the installation of the cooling tanks and the establishment of the DFBA with new governance structures boosted their confidence about accessing markets for their milk. This was reflected in the increased number of farmers selling their milk through the two DFBAs. In 2009, about 2757 farmers sold an average of 15,000 L per day in Tanykina; this rose to an average of 21,700 L from 4432 farmers. In Metkei, 1188 farmers supplied on average 4990 L per day in 2009; this increased to about 17,000 L a day from an average of 3970 farmers. The EADD brokered negotiations for supply contracts between the DFBA and milk processing companies as a way of stabilizing the markets. Milk prices also increased, as farmers in Tanykina received Ksh 30 (USD 0.35) per litre in 2011 compared to Ksh 24 (USD 0.28) in 2009, and in Metkei the price rose from Ksh 23 (USD 0.27) to Ksh 31 (USD 0.36) per litre (EADD, 2011a) Data from project reports indicated an increase in milk production at farmer level during the period

2009 to 2011: in Tanykina, farmers involved with EADD increased production from 4 to about 8.1 L per cow on average, whereas in Metkei the estimated production increased from 4 to 6 L (EADD, 2011a ; EADD Kenya, 2011). Although this is a notable increase, these average volumes are considered below the minimal levels estimated as necessary for households to move beyond the poverty line (TANGO International 2010 ; Technoserve, 2008).

The increased milk volumes marketed by the DFBAs and higher milk prices resulted in their profitability as enterprises and thus enabled them to expand services to farmers (EADD Kenya, 2011 ; TANGO International 2010). The interviews revealed that EADD guided the DFBAs in establishing business hubs within the chilling plants to offer a bundle of goods and services (e.g. credit and financial services, AI, feeds, drugs, extension and transportation) to farmers that supplied milk. The business hub integrated a "check-off" system where the farmers could access the goods and services through a credit system, and the cost was deducted from the monthly final payment to farmers. Tanykina was offering more services to its members than Metkei at the time of the study, but there was an overall increase in service delivery to farmers at both sites. The hub was managed by a professional team and guided by the board of directors. From observations, we noted that, in both DFBAs, older men continued to dominate the boards, reflecting the cultures of both communities. Hub development was accompanied by integration of other technological devices (weighing scales, dairy information management software). To support delivery of some services such as extension, other new organizational structures such as formation of dairy management groups (DMGs) were also put in place. From the focus group discussion, farmers who had joined DMGs associated their increased production with the training and support introduced through these groups. At both sites, EADD facilitated financing arrangements with commercial banks to buy motorbikes for various service providers, including transporters, AI service providers (AISPs) and animal health assistants linked to the DFBAs. Bringing together diverse actors with different stakes and interests required the platform intermediaries to continually broker and negotiate relationships.

Table 3.2: Summary of co-evolution of innovation relating to milk marketing and the roles of intermediaries in supporting the process

Dimension of innovation	Activities	Functions of intermediary actors*
Orgware	Establishment of Tanykina Dairy Ltd and Metkei Multipurpose Dairy Company Ltd as new dairy business enterprises	F2 and F6 – Guidance in the selection of DFBA board members and providing them with technical support – TNS and Heifer F2 – Development of strategic business plans in collaboration with the board members – and overall monitoring of performance – TNS
	Signing supply contracts with milk processing companies.	F5, F4 and F6 – Providing board with technical support in negotiating contracts – TNS, Heifer
	Development of the chilling plants into business hubs that offer integrated services (e.g. AI, animal health, extension, banking, milk transport, health insurance) and inputs (feeds, supplements, veterinary drugs, farming equipment) using a payment/credit system referred to as check-off	F2 and F6 – Technical support to the board and management team and monitoring in the stage-gate process of business hub development – TNS and Heifer
Hardware	Installation of chilling plants (CP) – equipped with laboratories for milk quality monitoring and	F4 and F5 – Technical support in procurement of various equipment and set-up of CP, including identifying suppliers and vendors through a tendering process (e.g. cooling tanks, construction of the plant, software) – Heifer and TNS
	Integrating the CP with various ICT management and information systems (including electronic weighing scales, dairy information management software) to support overall business hub operations	F5 – Providing technical support to the board and management team in various areas (e.g. human resource and financial management financial, service delivery) – All EADD consortia F4 and F6 – Mobilizing of funding by linking DFBA with various financiers (banks and microfinance institutions) – TNS and Heifer
Software	Facilitating new governance of the dairy enterprise by strengthening the functions and oversight structures of the board.	F1 – Conducting diagnostic and feasibility studies – TNS and ILRI/ICRAF F5 – Providing guidance on governance and management of hub in setting-up and operationalizing of hub – TNS
	Recruitment of skilled management team overseeing day-to-day business management	F5 – Mentoring and coaching board and management team F2 and F6 – Overseeing transparent process of recruiting skilled staff to manage the DFBA – TNS and Heifer
	Integrating improved procedures to ensure quality management of the CP (including milk quality testing)	F4, F5 and F6 – Provide technical support in managing the CP – TNS, Heifer.

Note: F1–Demand articulation; F2–Institutional support; F3–Knowledge brokering; F4–Network brokering; F5–Capacity building; F6–Innovation process management

Nonetheless, marketing remained precarious as indicated by some of the issues and tensions that emerged from discussions and observations. The bulking and cooling of milk

as a way of collective marketing was expected to streamline supply to the DFBA. But there was no control over competition among the different buyers who formed part of the broader market environment in the sector. Many farmers at both sites indicated that they divided their milk and sold through different channels, including informal milk traders. The main reasons cited for selling to different buyers were price and transportation. We observed that some farmers from both sites were located very far from the chilling plants, and some areas were unreachable even by motorbike, particularly during the rainy season. This made transportation not only expensive but also unpredictable. Many of these farmers stated that they opted to sell their milk to whoever could collect it at the farm gate. Both Tanykina and Metkei set up a few satellite collection centres to try to address this challenge.

Farmers also pointed to seasonal fluctuations in prices and indicated that in some cases the processors reduced the volumes that they bought during glut periods in the rainy season when there was increased milk production. Thus, the processing companies had control of the market and signing contracts did not deter this uncertainty in the market. Consistency in milk quality was also an issue that affected marketing. In Tanykina, it was noted that farmers continued to use plastic containers to deliver milk even though these were not hygienically ideal. The DFBA was trying to change this practice by making the more hygienic aluminium cans available through check-off, but not many farmers were using them. Further, in an effort to increase milk volumes in the DFBA, EADD was encouraging collection of evening milk. Metkei had started receiving evening milk toward the end of 2011. However, the discussions revealed that the evening milk was consumed mainly at home, and some was sold to neighbours, mainly by women, to acquire ready cash for daily use. Whether this marketing emphasis has an effect on intra-household dynamics is an area for further research.

As illustrated above, the different consortium actors fulfilled complementary intermediary functions in the innovation process. In supporting the co-evolution process, the intermediaries also shaped how the network structure of the platform changed over time. However, from interviews we found that consortium partners had divergent views regarding the goal of enhanced market access. Some partners considered that the primary focus should be on strengthening the DFBAs as agro-enterprises and enhancing their

profitability, which would then cascade down to improved productivity at farm level, whereas other partners thought that this emphasis on DFBA profitability deflected attention from the primary goal of improving productivity at farm level so that the farming households could benefit from marketing more milk. This observation was also noted in the mid-term evaluation (TANGO International 2010). This may suggest that intermediaries also brought in competing interests into such processes that needed to be negotiated.

Dynamics of improving breeding practices

The improvement of breeding practices through AI was one of the key interventions to enhance milk productivity. A combination of technical and institutional interventions to improve breeding practices was guided by a diagnostic study conducted at the early stages of the programme (EADD, 2009a). AI was not a new technology in Metkei and Tanykina as noted in discussions with farmers, but its uptake had declined over the years due to various factors, including a policy shift to privatisation of AI services, as some farmers noted:

> *There was government AI but they since stopped around the 1980s. The government used to do it for 1 Ksh but now it has hiked to 1,000 KSh so it is now only for the rich (Metkei farmer focus group discussion, November 2011).*

The first issue tackled was ensuring availability of, and access to, quality semen. To enable this, one of the EADD partners –ABS-TCM – facilitated procurement of semen tanks and semen for the DFBAs. With semen available, the DFBA had then to ensure the service was delivered to farmers. At both sites, there was a shortage of well-trained AISPs, therefore EADD supported the training of more AISPs, four in Metkei and five in Tanykina. These AISPs were then linked to the DFBA where arrangements were later made for them to provide AI services through the check-off system. The AISPs mainly used the semen that was available at the DFBA, but sometimes had to acquire other semen that was not stocked at the DFBA and which farmers demanded. The check-off system ensured quality service delivery by the AISPs who were now directly linked to DFBAs. To further ensure service delivery, the platform also facilitated AISPs to acquire equipment (AI tanks and motorbikes). Table 3.3 summarizes and characterizes the co-

evolution process, showing the interdependence of the interventions and actors and how the platform intermediaries supported the process.

Several respondents, including farmers and ministry of livestock officers, pointed at the increased uptake of AI at both sites, indicating that the innovation platform contributed to innovation outcomes. Many DMG farmers indicated that the increased uptake was facilitated by the training on breeding that improved their knowledge about AI, complemented by the check-off system that allowed them readily to access AI services. Conversely, many farmers not in a group said that they did not use AI and linked this to limited access to knowledge on breeding, as groups were the platform for training and information dissemination. However, many farmers still perceived AI to be expensive, even with the check off system and the subsidization of some semen through the programme. The perceived high cost was linked to many instances of repeat inseminations because of missed conceptions, as illustrated by the following quote:

> *When you take the cow for insemination, there are times it will fail and people will decide that if the AI is failing yet it is very costly, it will be better to go back to the bull system (Tanykina farmers' focus group discussion, August 2011).*

On the one hand, many farmers linked repeats to delayed responses by service providers, particularly because there was still a shortage of personnel and the few available had to cover long distances over very poor terrain. AISPs, on the other hand, stated that part of the challenge was that farmers were not detecting heat on time and that this resulted in delays in insemination. Thus, some farmers reverted to using bulls as a cheaper option, although the use of bulls also persisted because of other traditional practices, including uncontrolled open grazing.

Table 3.3: *Summary of co-evolution of innovation related to breeding and the roles of intermediaries in supporting the process*

Dimension of innovation	Activities	Function of intermediary actors*
Orgware	Training of AISP to improve the AI delivery system	F4, F5, F6 – Forging partnership with various organisations for training AI service providers – Heifer and ABS-TCM
	Providing AI with necessary equipment (e.g. motor bikes, semen tanks) through loans and integrating AI service delivery with check-off system	F2 and F5 – Supporting entrepreneurial development of the AISP (as a business development service) by facilitating access to finance and business skills training through partnering with relevant actors – ABS, Heifer and TNS
	Formation of dairy management groups (DMGs) as platforms for farmer training	F4, F5 and F6 – Facilitating the mobilization of farmers into groups – Heifer
Hardware	Acquisition of semen tanks by DFBAs for semen storage and distribution to AISP	F3 and F5 – Providing information on semen tanks and facilitating their procurement – ABS-TCM and Heifer
	Acquisition of quality semen from various suppliers	F1, F3 and F5. Guiding procurement and distribution of selected semen at a subsidized price due to bulk buying – ABS-TCM
	Promoting "village bull" concept, i.e. encouraging farmer groups (DMGs) to acquire semen tanks to store their preferred semen at village level	
Software	Improving service delivery contracts between DFBA and AI service providers	F5 and F6- Facilitating drafting and signing of contracts – Heifer
	Promoting informed farmer decision making and AI service demand by farmers to improve breeding practices through training and information dissemination	F1–Conducting baseline/ diagnostic studies on breeding issues ILRI F5 – Providing funding for extension services at the beginning, and later (from 2011) cost sharing with the DFBA – EADD

Note: F1–Demand articulation; F2–Institutional support; F3–Knowledge brokering; F4–Network brokering; F5–Capacity building; F6–Innovation process management

At both sites, AISPs, DFBA managers and even EADD partners were aware and agreed that missed conception was an issue, but from interviews, we noted that there was no

systematic feedback process that could guide collective learning in solving this problem. A few DMGs indicated that they had tried out the "village bull" idea that was being promoted as one way of giving farmers more control of AI services, but these groups ran into the challenge of lack of qualified service providers. The operation of a village bull depended on a group being able to hire their own service provider, but there was a shortage of locally available qualified AISPs. Some farmers expressed some reservations about the subsidized imported semen, pointing to issues of perceived poor quality (e.g. weak calves from the semen) and also suitability of the semen (e.g. adaptability). Further, the improvement of breeding practices depends also on farmers keeping proper records for all inseminations and on ear tagging; but discussions with farmers indicated that many of them did not consistently keep records on items such as AI servings, conception, calving, milking and tracking of progeny, and there was no structured support through the platform to improve these.

This section indicates that the platform to a certain extent induced the uptake of improved AI practices by building adequate linkages with different actors at different times and also by integrating new organizational and institutional structures (such as the check-off system, village bull). However, the various gaps and tensions noted indicate that the interventions could not cater for all categories of farmers and also did not put in place all necessary conditions to address the bottlenecks to successful AI innovation.

Enhancing production through improved feeds and feeding practices

In both Metkei and Tanykina, natural pastures for grazing comprised the largest portion of livestock feed. The predominant feeding system combined extensive open grazing, complemented by the use of planted fodder (mainly Napier grass and oats) and supplemented by purchased concentrate feeds. The reliance on pastures by a majority of the farmers resulted in a perennial problem of limited quality feeds, and this affected milk production. Many farmers indicated that growing fodder was a good alternative to expensive concentrate feeds. The platform supported various interventions that combined extension and training on new feed technologies (i.e. forage and fodder production) and promotion of feed conservation methods so as to maximize milk production while minimizing feed cost. First, a trainer of trainers (TOT) approach that combined model (demonstration) farmers and community- based trainers was used to disseminate

information and technologies to farmers in DMGs. ICRAF and ILRI provided dissemination support and conducted participatory research on some new fodder crops (e.g. dual purpose sweet potatoes) and on silage making. The district-level Ministry of Agriculture extension office also collaborated to support the trainers. However, the TOT approach faced challenges, as the trainers were not effectively reaching farmers as a result of an oversight relating to their supervision, because it was not clear whether they reported to the DFBA management or the EADD facilitators. This challenge resulted in extension services being halted for a period time. Consequently, a new extension approach had to be designed, whereby community extension service providers (CESPs) were to be hired directly through the DFBA; this meant that the DFBAs had to contribute financially for this service from their revenues. Table 3.4 provides a summary of how the feed innovation dynamics co-evolved.

Table 3.4: Summary of innovation activities for improved feeding and the roles of intermediaries in supporting the process

Dimension of innovation	Activities	Functions of intermediary actors*
Orgware	Training and dissemination of information on improved feeds and feed conservation management through DMGs	F2 – Facilitating extension service provision, including design of training modules and training of extension service providers in partnership with the Ministry of Livestock – Heifer and ICRAF
	Establishment of demonstration plots in farmer trainer fields for use in training on growing various types of feeds and for seed multiplication	F3, F5 – Technical backstopping of demonstration farmers including set-up, supplying seeds, and follow up – ICRAF/ILRI
Hardware	Promoting the use of small-scale feed processing technologies, i.e. pulverizers and chuff cutters	F4 – Facilitating procurement of feed processing equipment through partnership with local small and medium enterprises – Heifer and TNS
	Dissemination of various types of fodder crops (seeds, vines)	F3-Conducting research to understand uptake and use of feed processing technologies – ILRI
Software	Conducting participatory research with farmers to test various newly introduced fodder crops (e.g. dual purpose sweet potatoes)	F1 – Conducting baseline/diagnostic studies on feeding issues ILRI F3 – Identifying sites and set up of experiments in collaboration with other scientists and farmers – ICRAF/ILRI Facilitating information dissemination and training through extension – Heifer and ICRAF/ILRI
	Promoting change in farmer feeding and feed conservation practices	F3 – Conducting research to draw lessons on improving feeding practices and feeds markets – ILRI

*Note: F1–Demand articulation; F2–Institutional support; F3–Knowledge brokering; F4–Network brokering; F5–Capacity building; F6–Innovation process management

At both sites, most farmers belonging to DMGs indicated increased knowledge about different types of feeds (e.g. Lucerne, Calliandra, sweet potato vines, Desmodium) and feed conservation methods (e.g. silage, hay) compared to those that were not in groups. Most of the DMG farmers indicated that they made better use of crop residue as feed, particularly maize stovers (leaves and stalks) which previously were not highly valued as feed, and some had also planted new fodder crops. However, we generally noted from the focus group discussions with farmers that the adoption of the new feeding technologies and practices was still a challenge. The most common problem cited by farmers was the lack of access to seeds. Most of the seeds for the newly introduced feeds were not easily available at the local agro-vet shops so farmers could not purchase them. Further, in some areas, farmers stated that the demonstration plots which were to serve as multiplying sites for seeds did not work as well as expected. In Metkei, farmers indicated that most demonstration plots had not yet been established and those that were set up did not receive adequate technical support from the programme as planned. Various informants attributed some of the difficulties to how the extension approach was structured when the programme began. However, although the extension approach was restructured and incorporated into the DFBAs, the changes still did not address many of the challenges noted.

From discussions with various informants, we found that feedback and learning from some of these challenges were not systematically captured. We found that, although learning on EADD's function was embedded into the programme plan and led by one of the consortium partners (ILRI), this learning was not transferred to different levels on the platform. A mid-term evaluation report highlighted this challenge, pointing to the constraint of a focus on fulfilling programme milestones as reflected in the monitoring and evaluation system which did not necessarily link to a learning agenda at the different levels of operation of the platform (EADD, 2011b ; TANGO International 2010). Additionally, at both sites, many farmers indicated that shrinking plot size constrained the possibility of switching from food crops to fodder crops on part of their land. The issue of access to land was particularly challenging for the youth and women who had less control over land because of cultural factors. Furthermore, it emerged from both sites that poor rainfall also affected their plans to plant fodder crops, and a general lack of access to

adequate water was a critical challenge to improving dairy production. This not only affected the productivity of the cow but was also very time-consuming, particularly for women who were responsible for tasks such as taking cows to the river.

These findings point to the important role of platforms in intermediating linkages among actors by trying out various organizational arrangements. However, the gaps noted point to the importance of systematic feedback and learning in the process in order to attain the expected outcomes. Furthermore, we note how the broader context impeded the extent to which the platform could shape the innovation process. Consequently, platforms may run into major constraints which need structural change, but this is not easily achieved.

3.5 Analysis and discussion

3.5.1 *Innovation platforms synchronize mutually reinforcing developments through distributed intermediation*

The findings indicate how the innovation platform shaped the innovation process in addressing the various system weaknesses which had been impeding the enhancement of smallholder dairy farming and contributed to outcomes in relation to access to services and inputs and improved productivity. The strength of EAAD as an innovation platform was in sequentially (but with recurring and sometimes simultaneous attention to the same issues if needed) implementing combinations of technical and social institutional innovations; this also contributed to some reconfiguration of relations among different actors. As the results show, the new dairy business model as an institutional innovation integrated technological elements which further catalysed business hub development and accompanying institutional re-arrangements in service delivery. Most of the innovations were institutional in nature, confirming earlier findings on institutional change as a sine quo non for innovation (Cleaver, 2002 ; Hounkonnou et al., 2012). However, the integration of technological elements (albeit incremental technological innovation) was also of key importance because technological innovation also triggers new practices. For example, the introduction of the dairy management software for records management introduced more transparency not only in the weighing of milk but also in systematically tracking the various transactions relating to services used by each farmers, thus enhancing farmers' trust in the dairy company. Also, the establishment of dairy companies with

improved governance and management structures, coupled with a credit guarantee provided through the EADD programme, enabled companies to secure credit from commercial banks, which previously were wary of lending to farmers because of the perceived risk of agricultural enterprises. Thus, it is in the co-evolution process that the different elements mutually reinforce one another, almost in a virtuous cycle (cf. (Hekkert & Negro, 2009), which is also linked to changing and emergent network configurations (Ekboir, 2003 ; Kash & Rycroft, 2002 ; Klerkx et al., 2010). This is what contributes to overall system change – in our case moving from predominantly smallholder subsistence dairy farming (comparable to system A in Fig. 3.1) to increasingly commercial dairy farming (system B in Fig.3.1).

As our findings demonstrate, the key role of platforms is in connecting the orgware component (institutional change) to the hardware and software components of innovation by establishing effective patterns of interactions for negotiating institutional change; this confirms earlier findings (Dormon et al., 2007). Here, it clearly emerges that the intermediation on the platform is critical in strengthening more system-level capacities relating to orchestrating and organizing networks, thus enabling the co-evolution of innovation by facilitating linkages among different stakeholders who were previously not connected for various reasons (e.g. cognitive distance, high transaction costs and information asymmetry). But importantly, as others also have shown, it is the negotiated institutional changes as the outcomes of these linkages that can then provide opportunities for successful innovation for smallholders (see (Dormon et al., 2007 ; Hall et al., 2001 ; Nederlof et al., 2011).

From these findings, we note that the important role of the EADD consortium actors as innovation intermediaries could be seen from the beginning of the innovation process, facilitating the articulation of the innovation vision, and mobilizing funding and other resources necessary for the programme. This was followed by orchestrating networks of different actors who were brought in at different points in time, mainly around specific issues. This included selecting which actors were important for fulfilling particular objectives of the programme at various points in the innovation process. This contributed to reconfiguration among actors, including patterns of co-operation. This indicates that

platforms are highly dynamic and distributed in composition, as opposed to static structures, as Nederlof et al. (2011) have also found.

The results thus indicate that platforms are effective in coordinating innovation because of the complementary skills and competencies that the various intermediary actors bring to the platform. The organisations in EADD were able to connect different actors representing different ambits of the innovation process. These findings confirm the complexity of innovation intermediation, which entails fulfilling a myriad of functions distributed over time and fulfilled by different actors. Rather than just one central innovation intermediary acting as a platform facilitator, there is a set of innovation intermediaries, as other studies (Klerkx et al., 2010 ; Stewart & Hyysalo, 2008) have observed.

3.5.2 *Tensions and caveats of innovation platforms in stimulating coevolution*

Despite innovation platforms acting as catalysts for innovation systems interaction, the results also point to the limitations of platforms. As other scholars have also argued (Hall & Clark, 2010 ; Hekkert & Negro, 2009 ; Leeuwis & Aarts, 2011), co-evolutionary processes cannot be steered and controlled fully, so the platform is not a magic bullet for fully managing innovation processes. From our analysis, we can identify several tensions in relation to employing platforms as a tool to stimulate innovation.

A first tension relates to the structure of platforms in relation to purpose. As the results indicate, EADD appeared to be successful with regard to improving marketing at the DFBA level, but, despite some positive results, the platform appeared to be less successful with outcomes relating to farmer-level innovation and productivity linked to uptake of AI and improved feeding management strategies. Despite the fact that EADD enabled the formation of different lateral networks to address a variety of emerging issues relevant to the overall innovation process, the platform appeared not to have sufficient capacity to enact the effective reformism needed to change all structures; this impeded change at different levels. This raises the question of whether all innovation platforms should have a similar composition in terms of diversity of participants and governance structure, or should also differ according to different types of outcomes (such as strengthening value chain interaction, raising farm-level productivity and livelihood improvement) and the

different levels of operation (such as platforms aiming at developing innovative solutions to problems, and platforms aiming at up-scaling such solutions), as the recent findings by Hermans et al. (2012) suggest.

A second tension is that, despite the usefulness of the distributed nature of innovation intermediation, it could also be seen as a source of tension and competition among the innovation intermediaries, which are essentially different organisations each with its own objectives. In this context, each organization focused on or pursued strategies that reflected imperatives and mandates of their organisations, and in some case this resulted in tensions that undermined the broader vision of the programme. In relation to this finding, there is also a limitation in our analysis: by focusing only on the platform's formal innovation intermediaries (the EADD consortium), we did not necessarily capture the distributed agency of other actors involved in the network; but these could also be acting as innovation intermediaries in less formal ways and could even counteract overall platform objectives, as Klerkx and Aarts (2013) have observed elsewhere.

A third tension relates to the flexibility that platforms need to have vis-à-vis programme planning. As the EADD case shows, platforms are continuously facilitating interactions with different actors, dictated by circumstances and unanticipated effects of actions. This confirms earlier finding, that the management of innovation processes needs to be adaptive and guided by iterative learning (Klerkx et al., 2010 ; Kouévi et al., 2011). Although the EADD platform was designed with a learning component, it was not always sufficiently adaptive and responsive, at least in the short term, to the new problems and tensions that emerged. This implies that platforms should not be seen as a development tool for executing a preconceived plan in a blueprint fashion, but rather they should be arenas for strengthening capacities to better deal with the complex and dynamic nature of agricultural innovation (following (Ekboir, 2003 ; Hall & Clark, 2010 ; Leeuwis & van den Ban, 2004). This connects to the issue of the need to balance and reconcile results-based, milestone-focused monitoring (e.g. logical frameworks) with process-based monitoring, where the intermediaries systematically capture feedback and enhance reflectivity in order to adequately support adaptive capacity in the innovation process (Regeer, 2009 ; van Mierlo et al., 2010b).

This is an important finding in light of the increasing application of platforms in agricultural innovation and development programmes. Such adaptive capacity can be a challenge in development programme-driven innovation platforms. One of the reasons is the scale of programmes and the platforms connected to them (e.g. the sub-Saharan Challenge Programme working in nine countries – (van Rijn et al., 2012) and demands in terms of clear planning for budgeting, implementation and accountability purposes. Another reason is that some issues that emerge are beyond the scope of the platform given the broader contextual factors that impinge on the process. For example, infrastructural problems linked to inadequate access to water or poor feeder roads could not be adequately addressed by EADD. This hints at the need to be aware that adaptive management of innovation through platforms requires also funding schemes that are responsive to emerging challenges or finding ways to leverage the required resources.

3.6 Conclusion

This paper has demonstrated how innovation platforms are important mechanisms for stimulating and coordinating co-evolution of innovation. A main implication of our study for theory is that the co-evolving nature of innovation processes requires a conceptualization of platforms as dynamic and distributed networks instead of static and centralized networks. They have a nested structure comprising different intermediary actors who build bridges between the different components in innovation systems, and it is the variety of intermediary actors that makes the platform effective. A key policy implication is that supporting innovation platforms as mechanisms for enhancing innovation requires platform funding, planning and governance mechanisms that allow for continual adaptation to emerging issues. This also points to the need to integrate more reflexive forms of monitoring to optimally enable adaptive management of innovation through innovation platforms.

The study also highlights a number of areas for future research, connected to the tensions and caveats identified in section 3.5.2. The first area is about platform structure and governance in relation to the objective of the innovation platform (such as strengthening value chain interaction, raising farm-level productivity, livelihood improvement). A key question is how to determine a priori the optimal diversity of participants on innovation platforms and the optimal governance form for innovation platforms. This also relates to

issues such as the costs of operating innovation platforms (efficiency) and sustaining action initiated by innovation platforms (effectiveness). It could be relevant to explore work from organization and management studies in order to inform studies on platform composition and governance (Klerkx & Aarts, 2013 ; Provan & Kenis, 2008)

A second area relates to the role of innovation intermediaries. Our study has shown that different innovation intermediaries are complementary, but it also revealed diverging priorities among the different innovation intermediaries operating on the platform. For platform efficiency and effectiveness, a key issue is that overall facilitation should be in place to minimize such divergence and maximize complementarities between different innovation intermediaries. It is still an open question as to who is best placed to fulfil this role of overall platform facilitator. (Klerkx et al., 2009) have suggested that a specialized and independent organization has certain advantages for overall platform facilitation vis-à-vis innovation intermediaries on the platform, who also have a substantive role (for example in undertaking research or providing technical services) and a stronger normative orientation or political or commercial interest, but further research is needed to verify this. Furthermore, whereas this study focused on the formal intermediaries on the platform, future studies should analyse the many informal intermediaries which may be active on the platform or in its broader environment. Finally, a third area for future research relates to how to shape monitoring to enable adaptive management of innovation through innovation platforms. Future studies should investigate whether and how different ways of monitoring can be combined to satisfy the needs of both innovation platform participants and innovation platform funders.

CHAPTER 4

Enhancing coordination of smallholders' linkages to input and output markets: experiences of emerging hubs in the Kenyan smallholder dairy sector[3]

[3] Submitted for publication (under review) as Catherine W. Kilelu, Laurens Klerkx, Cees Leeuwis Enhancing coordination of smallholders' linkages to input and output markets: experiences of emerging hubs in the Kenyan smallholder dairy sector.

Abstract

Recent literature suggests that improving coordination is expected to address the many constraints that smallholders face in their participation in remunerative agricultural value chains. There is a key role for intermediary institutions in fostering coordination of smallholder farmers amongst themselves (horizontal coordination), between farmers and output market actors (vertical coordination), and between farmers and input and service providers (complementary coordination). Recently, the concept of hub has been applied to denote such intermediary institutions that can simultaneously foster the three types of coordination. At the centre of such hubs often are farmer organisations. While hubs are proposed as coordination mechanisms, there have been few studies on their actual functioning. This study unravels these coordination functions using a case study of a project supporting the establishment of hubs in smallholder dairy development in Kenya. The findings show that the contribution and synergistic effects of hubs in horizontal, vertical and complementary coordination lie in the combination of roles of hubs as a broker, one-stop shop and cluster. However, tensions also emerge from coordination, such as normative orientations leaving out certain groups of smallholders, in which the broker role of farmers' organisations may undermine the social capital they are based on. Our findings suggest that in resolving challenges related to smallholders positioning in value chains, coordination is not just about establishing the linkages but also continuous relationship management. We conclude that while farmer organisations as the focal points within hubs may seem best positioned to enhance coordination at the different levels, they do not have the ideal position and the necessary capacities to fulfil some intermediary roles. This indicates that there needs to be a better role division between farmers' organisations and other actors, to operationalize the different roles of hubs.

4.1 Introduction

Agricultural development in many developing countries is rapidly changing, presenting opportunities for smallholder producers related to their integration into diverse agricultural value chains. Recent literature on smallholder commercialisation has indicated the importance of mobilising and effectuating collective action of smallholder producers to enhance their innovation capacity (in terms of technological upgrading, entrepreneurship) and overcome the many challenges associated with their integration into agricultural value chains (Markelova et al., 2009 ; McCullough et al., 2008 ; Poulton et al., 2010 ; World Bank, 2007). Through collective action smallholders can create economies of scale and address market inefficiencies and institutional biases that disadvantage their position in agricultural value chains and the resultant low returns in their investment (Barrett, 2008 ; Markelova et al., 2009 ; Poulton et al., 2010). These disadvantages are linked to, for example, the high transaction costs that smallholders face in relation to participating in output markets and the related challenges of meeting quality requirements in some of these markets and reliable access to quality inputs and services (e.g. extension, credit,) in pluralistic and increasingly privatised innovation support delivery systems. This is further exacerbated by smallholders lack of political voice in influencing agricultural policies (Bingen et al., 2003 ; Kydd & Dorward, 2004 ; Poulton et al., 2010 ; Snapp et al., 2003).

To counteract such challenges it has been proposed, for example, to strengthen farmer organisations capacity to engage in coordinating pre-harvest or post-harvest input and services delivery (e.g., seeds, feed, fertiliser, extension and advisory services, transportation, packaging, storage) and organize joint marketing (Barham & Chitemi, 2009 ; Kaganzi et al., 2009 ; Shiferaw et al., 2011). Executing these proposals of strengthening smallholders' position in value chains requires coordination of different kinds of interactions and building relationships with diverse actors (Poulton et al., 2010). To simultaneously enable coordination of farmers amongst themselves (horizontal coordination), and between farmers and diverse actors including those in the output markets (vertical coordination), and in inputs and services delivery (complementary coordination), there has been a call for intermediary institutions (Devaux et al., 2009 ; Hounkonnou et al., 2012 ; Poulton et al., 2010).

Recently, the concept of hub is applied to denote such an intermediary institution that can foster such coordination (Jaleta et al., 2013 ; Kilelu et al., 2013 ; Kruse, 2012 ; Leared, 2010 ; Lenné & Ward, 2010). At the core of hubs are farmer organisations (FO) or enterprises that form the base for coordinating interactions and transactions between farmers and diverse actors in the agricultural value chains. The hub becomes the focal point for configuring and coordinating various multi-actor networks in linking smallholders to input and output markets. The hub aims to shape the relationships among the various agri-food chain actors in order to improve smallholder participation in agricultural value chains. As various authors have argued, building and maintaining multi-actor network relationships by fostering good will, cooperation, trust and interdependence is important, as a lack of these factors can threaten the sustainability and competitiveness in value chains including those involving smallholder producers. (Devaux et al., 2009 ; Klerkx et al., 2010 ; Kruijssen et al., 2009 ; Omta et al., 2001 ; Owen et al., 2000).

While hubs have been proposed as a way to enable horizontal vertical and complementary coordination of smallholders to enhance access to output markets and inputs and services, there have been few studies on the actual functioning of these coordination processes in hubs. Recently, Kruse (2012) has explained the overall hub model used in smallholder dairy development in Kenya while, Kilelu et al. (2013) briefly analysed their establishment. Jaleta et al. (2013) examined the role of hubs in the evolution of input supply and service provisioning in supporting smallholder dairy commercialisation efforts in Ethiopia. However, these studies have not looked at the different ways in which hubs are conceptualized to unravel how their coordination contributes to building effective relationships for strengthening smallholders' position in agricultural value chains networks. There is hence a gap in our knowledge on these dynamics in hubs. The aim of this article is to contribute to filling the above noted gap. We present a case study of a project supporting the development of smallholder dairy hubs in Kenya that have the goal of enhancing farmers linkages with input and output markets in order to improve their productivity and their participation in markets. The main questions the article addresses are: 1) how do relationships in the network change through the coordination by the hub, and 2) what are the outcomes of the hub's coordination efforts in linking smallholders to inputs and innovation support services, and output markets.

The article is structured as follows. We first briefly review the literature on smallholder links to value chains and distil challenges at three levels of coordination– horizontal, vertical and complementary- that affect farmers' position in markets. We then unravel the concept of hub as a mechanism that is applied to operationalize the coordination of smallholders and their relationship to input and output market actors. Section 4.3 describes the case and outlines the research methods. Section 4.4 presents the findings followed in section 4.5 by an analysis and discussion on how the hub as a coordinating mechanism changes actor networks and relationships, and the extent to which this addresses the challenges that affect smallholders' position in agricultural value chains. Based on our main findings, we conclude in section 4.6 with reflections on the concept of hub as a coordination mechanism for enhancing smallholder commercialisation efforts.

4.2 Theoretical framework

The broad literature on smallholders' coordination and their linkages to agricultural value chains highlights various challenges that impede smallholders from effectively engaging in value chains. Below we briefly review some of the challenge We then review the literature on hubs to conceptualise their role as coordination mechanisms, and finally present an analytical lens through which we interpret our results.

4.2.1 *Challenges in building horizontal, vertical and complementary relationships in coordinating smallholders' linkage to input and output markets*

Challenges related to establishing effective horizontal relationships

Despite mixed results and hence different viewpoints on their effectiveness, many scholars concur that promoting horizontal relationships through collective action remains a key avenue for enhancing the position of smallholders in agricultural value chains and promoting sustainable agricultural development (Berdegué, 2001 ; Chirwa et al., 2005 ; Kruijssen et al., 2009 ; Shiferaw et al., 2011). Such collective action is exemplified through various types of farmer organisations, such as farmer groups and cooperatives that enable horizontal coordination between farmers. While farmer groups are generally considered informal, cooperatives are entities that are more formal (Heemskerk & Wennink, 2004 ; Hellin, 2012 ; Shiferaw et al., 2011). The primary goal of such collective

action is to address a number of challenges with horizontal relationships between farmers (Fischer & Hartmann, 2010 ; Poulton et al., 2010). These include:

- Limited collaboration and loyalty that hamper the mobilization of economies of scale for participation in markets;
- Lack of mutual trust and reciprocity among farmers that can result in opportunistic behaviour and free-riding;
- Diversity of interests that limits effective organizing;
- Exclusion of some farmers from collective action; and,
- Lack of transparency in decision making processes.

Challenges related to establishing effective vertical relationships

Access to markets is considered a major obstacle to smallholder development. Many constraints that limit effective and profitable smallholder participation in output markets have been identified in the literature. The literature points to challenges such as high transaction costs related to accessing markets as result of a lack of infrastructure (e.g. storage, transportation) (Bernard & Spielman, 2009 ; Devaux et al., 2009 ; Hellin et al., 2009). However, most challenges relate to the nature of relationships between farmers and various actors in the agri-food output markets (Barrett, 2008 ; Berdegué, 2001 ; Fischer & Hartmann, 2010 ; Poulton et al., 2010). These challenges include:

- Lack of trust between farmers and market actors;
- Unequal power relationships between farmers and output market actors (e.g. for bargaining pricing or enforcing contracts, information asymmetry e.g. on quality); and,
- Inconsistency and unpredictability of actions of market actors that undermine smallholder farmers' collective action (e.g. affecting farmers' loyalty to their farmer organisations).

Challenges related to establishing effective complementary relationships

Various authors suggest that in order to enhance smallholder's productivity and enhance their participation in markets, access to and judicious use of suitable inputs and extension

services are key (Crawford et al., 2003 ; Hounkonnou et al., 2012 ; IFDC (International Fertilizer Development Center), 2000 ; Poulton et al., 2010). This literature highlights several challenges related to adequate delivery of inputs and extension services to smallholders, reflecting unequal and sometimes exploitative relationships between smallholders and input and innovation support service actors (Poulton et al., 2010 ; Sherwood, 2009 ; Snapp et al., 2003 ; van der Ploeg, 2008). These challenges include:

- Problems of reliability in accessing agro-input supplies and extension service systems (linked to delivery, affordability etc.);
- Lack of commitment in the delivery systems which is also related to the high transaction costs in input and service markets serving smallholders;
- Lack of transparency and assurance about inputs and services (includes various quality issues and concerns of some of the effects of agro-chemicals on human health, environment);
- Disconnected understanding by support service providers of the resource constraints faced by farmers and how this is linked to adoption and use of inputs; and,
- Power imbalances between supply and demand sides of input and extension service markets, which may push intensive input use in smallholder or peasant agricultural systems. This push does not adequately take into account the effect of such a model on the resilience, return on investment and sustainability concerns of smallholders.

Thus, a common thread that emerges from this literature review is that the challenges faced by smallholders in relation to establishing effective linkages with input and output markets are an indication of non-existent or imperfect relationships between the smallholders and those actors that deliver input and extension services, and those that operate the output markets (Kruijssen et al., 2009 ; Poulton et al., 2010).

4.2.2 *Different conceptualisations of hubs*

Poulton et al (2010) suggests that improving coordination is expected to address the above noted challenges that smallholders face. This is because such coordination can trigger new actor configurations and build the necessary relationships between the various actors in

the chain. FO have been shown to take on this coordination role (Berdegué, 2001 ; Bingen et al., 2003 ; Chirwa et al., 2005 ; Heemskerk & Wennink, 2004), and increasingly the term of 'hub' is used to denote the entity that coordinates multi-actor networks where value chain actors such as suppliers, buyers, government agencies, universities, industry players, and business service providers come together. The concept is applied in many sectors including Information, communication and technology (ICT), finance, technology development and industrial sectors. Through hubs complex interdependencies between actor groups and organisations emerge and are characterised by a mix of collaborative, conflicting and strategic relationships (Dhanaraj & Parkhe, 2006). Broadly, three conceptualizations of hub and related to this, three main roles can be distilled from the literature (cf. Tesfazghi, 2012):

1. The hub as a broker: Here, the hub is considered a node that connects various collaborating actors, as often within hubs there are actors that take on coordinating and facilitative roles (Chan et al., 2010 ; Dhanaraj & Parkhe, 2006 ; von Malmborg, 2007). Dhanaraj and Parkhe (2006) talk about 'hub firms' that occupy a central position within innovation networks that use this prominent role to orchestrate interactions among various actors in the network, pulling together the dispersed resources and capabilities of network members. While such hub firms have a clear economic interest in the value chain, their broker role can also be fulfilled by an independent intermediary organisations. In the agricultural sector, several authors have described various types of intermediaries that fulfil brokering roles in supporting farmers to engage with the various input and innovation support services and output market actors (Kilelu et al., 2011 ; Klerkx et al., 2009 ; Poulton et al., 2010 ; Rivera & Sulaiman, 2009). Such brokering entails undertaking a number of functions including demand articulation (e.g. for technology, knowledge, funding), matchmaking and network building, and enhancing relationships (e.g. conflict resolution, building trust, mediation etc.).
2. The hub as a one-stop shop. Here the hub is viewed as a mechanism for improving the accessibility of services, being (Hounkonnou et al., 2012) a cost-effective way of realizing business transactions by offering a suite of services in one central location. This entails integrated input and service delivery systems (e.g. business development,

technology delivery, financial services, etc.), geared toward particular economic activities. For example, in India, Agricultural Technology Information Centres (ATICs) hubs have been set up at different levels that are designed as single arrangements for the delivery of relevant technology and technology products to farmers (Sulaiman et al., 2012 ; Venkatasubramanian & Mahalakshmi, 2012).

3. The hub as a cluster. Here a hub is conceptualised as a clustering of firms for stimulating and optimizing the flow of knowledge, technology and support services for innovation (Chan et al., 2010 ; Leifer et al., 2001). In the ICT sector particularly, the notion of high tech hubs is used to denote specific regional industrial districts (e.g. Seattle and Silicon Valley) where various suppliers cluster around one or several core firms (Gray et al., 1996). An agricultural cluster would comprise a concentration of producers and other actors that are engaged in the same agricultural or agro-industrial subsector and interconnect and build value networks, either formally or informally, when addressing common challenges and pursing common opportunities (Felzensztein, 2008 ; Perez-Aleman, 2005). These hubs are socio-economic entities characterised by a group of economic agents localized in close proximity in a specific geographic region.

Figure 4.1 visualizes the analytical framework that we derive from our theoretical exploration. The framework shows the hub as a coordination mechanism that enhances the formation of linkages among a network of actors at horizontal, vertical and complementary levels in agricultural value chains. To enable this simultaneous coordination, the hub fulfils one or a combination of the roles noted above. The hub coordination aims to configure the network of actors and build the necessary relationships among these actors in order to address the various challenges that affect farmers' access to inputs and services, as well as output markets.

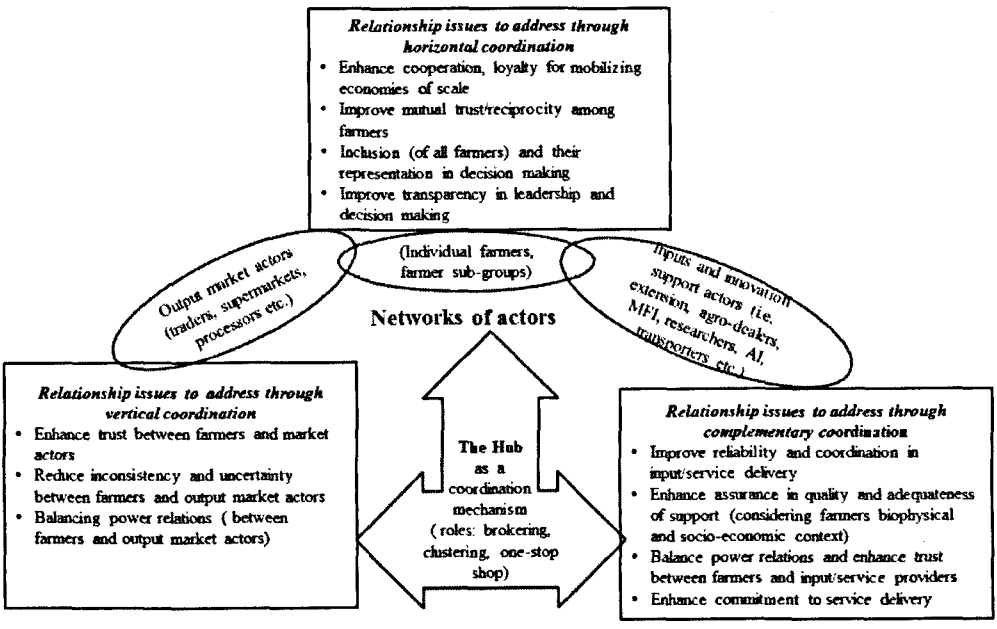

Figure 4.1: Analytical framework

(Source: own elaboration)

4.3 Case description and research methods

4.3.1 *Case introduction – the establishment of dairy hubs through EADD*

The East Africa Dairy Development (EADD) programme was a four-year pilot project working in selected regions of three East African countries Kenya, Rwanda and Uganda. It aimed to enhance smallholder dairy farming and profitability through integrated interventions in dairy production, market access and knowledge application. A consortium of five organisations that included Heifer International as the lead partner and, TechnoServe, the International Livestock Research Institute, the World Agro-forestry Centre, and African Breeders Services – Total Cattle Management managed the programme (EADD, 2011b). We carried out the case study in Kenya.

At the core of the EADD programme was the objective of enhancing farmer collective action to improve their access to inputs, services and markets. This was to be achieved through the establishment of local dairy producer enterprises called Dairy Farmers Business Associations (DFBA) that set up chilling plants (CP) for bulking and collective

marketing of milk. The DFBAs are an institutional innovation that is an alternative to the traditional dairy cooperatives. These DFBAs draw membership from farmers in a defined catchment area covering a radius of about 10 kilometres from the CP location. The CPs provided the focal point and infrastructure for the establishment of the dairy hub as the day to day operational platform for the DFBAs. The hub approach is intended to guide the development of viable input and service delivery systems integrated with output marketing as a business model through a gradual step wise process (referred to as stage-gating in EADD) to ensure sustainability. This is different from the traditional dairy cooperative model that focussed more on milk bulking without the CP and without fully integrating inputs and support service delivery as part of an integrated smallholder dairy business model. Through the hub farmers can assess various farm inputs, production technologies, supplies and services (e.g. extension, AI, credit etc.) provided by a variety of business service providers. The hub model incorporates a centralized and localized information system installed at the CP used to track and manage all the transactions thus ensuring better business management. There were twelve DFBAs with established hubs in Kenya at the time of data collection (see EADD, 2011b ; Kruse, 2012 ; TANGO International 2010 for details of the hub model).

4.3.2 *Methods*

We conducted a case study in order to gain in-depth insights on how hub coordination enhances multi-actor relationships between smallholders and inputs, services and output market actors. We selected the EADD programme as a case from an exploratory study (see Kilelu et al 2011). The case can be considered revelatory (Eisenhardt, 1989 ; Yin, 2003) as the EADD programme explicitly applied a hub model in supporting smallholder innovation and market integration processes. The unit of analysis of the case were the DFBAs. Because of the breadth of the programme, we selected two sites for the study: Tanykina (Kipkaren) Dairy Company Limited, located in Nandi County and Metkei Multipurpose Dairy Company Limited in Kerio County. The two counties are in the Rift Valley region of Kenya that is considered a high potential dairy production zone. Although we only studied two sites, the risk of bias in such a sampling strategy was minimized by selecting sites that were sufficiently advanced in the process of hub establishment and had followed different innovation trajectories and thus provided

adequate depth of diverse experiences to elucidate the process. Tanykina was already a pre-established site that was operating a chilling tank for bulking milk as a cooperative at the time of engaging with EADD programme. Metkei was a new site where four small dairy societies were amalgamated but had no chilling tank at the time of engagement with EADD programme. Also the two sites have different histories and contexts with dairy farming, thus it was possible to glean a variety of insights on the dynamics of the hub.

We collected data between August 2010 and December 2011 using multiple methods in order to triangulate the information and enhance the validity and reliability of the study (Flyvbjerg, 2006 ; Yin, 2003). We conducted semi-structured interviews with 7 service providers (3 in Metkei and 4 in Tanykina) and key informant interviews with 2 DFBA managers, 5 District Ministry of livestock officers and 5 EADD Kenya team members. We also conducted farmer focus group discussions in 15 dairy management groups (DMGs) and 2 with non-DMG farmers. We also conducted unstructured interviews with some board members in each of the DFBAs, transporters during visits to the sites and participant observations of interactions at various meetings (including board meetings and general members meetings). Other secondary data came from project documents.. The data collected focused on identifying the different types of actors and actor configurations that emerged from horizontal, vertical and complementary coordination of the hub. It also looked at how relationships among these actors were shaped through the hub and the resulting outcomes related to the challenges with accessing input and output markets.

All the interviews and discussions were tape recorded and fully transcribed for the analysis that we conducted in two steps. In the first step, drawing from data, we identified the different actor groups at the horizontal, vertical and complementary levels of coordination. This analysis enabled us to identity the different actor configurations that emerged in the hub. In the second step, we characterised how relationships between these different actors in the network changed and the outcomes in addressing the challenges at the three levels of coordination noted in the analytical framework (Figure 4.1). In the analysis, we use exemplary quotes to illustrate the findings.

4.4 Findings

This section provides a summary of the findings that address the research question. We first discuss how the actor configuration changed in the network through hub coordination. We then deepen this out to explain how this configuration shaped the quality of the relationships and the resultant effect in addressing the challenges that constrain smallholder farmers in the dairy value chain. Figure 4.2 below illustrates the different actor configurations identified.in the two hubs (shown by different shapes).

As the figure illustrates the CP provided the focal point for establishment of the hub. These hubs operate within a broad social and institutional context where other actors not directly linked to the hub also operate. Thus, these actors are part of the dynamics (represented by the dotted arrows) of the dairy value chain in each location.

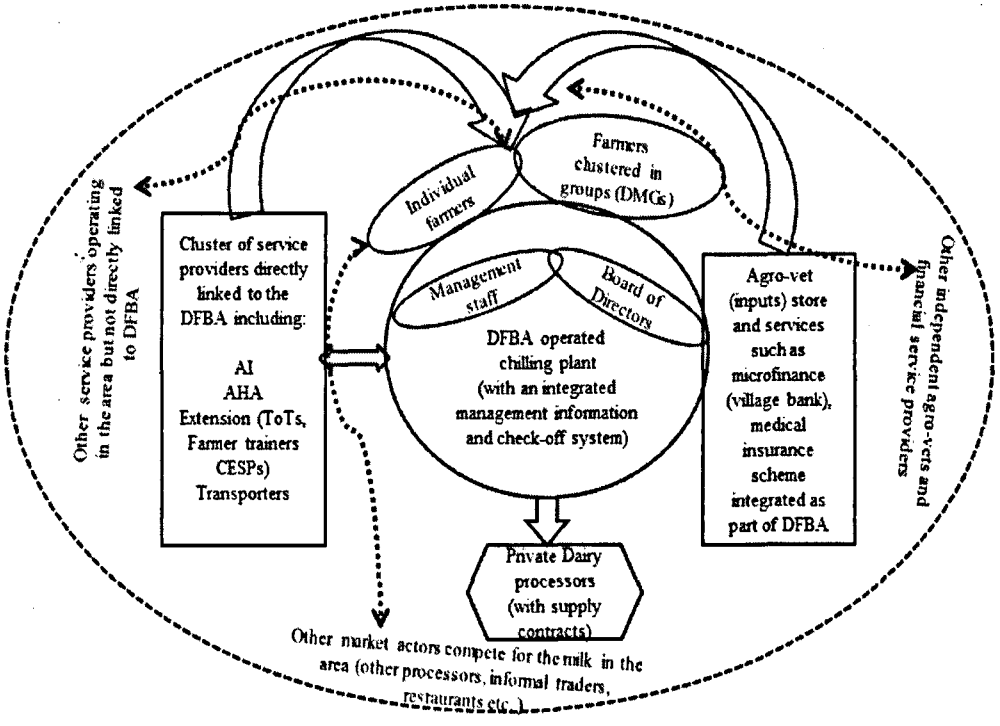

Figure 4.2: An illustration of the hub as a configuration of various actors and their interactions

4.4.1 *Horizontal coordination*

Changing actor configurations through horizontal coordination

The interviews and farmer discussions revealed that horizontal level coordination enabled new actor configurations that emerged at the DFBA leadership and at farmers' levels (see figure 4.2). At the DFBA level, some farmers were selected as board of directors representing different locations of the DFBA's catchment area. In Metkei, the board members were selected from the four existing dairy societies. In both sites, older men dominated the boards, although through a deliberate strategy of the EADD programme some women were included in order to ensure representative leadership. In addition to the board, a management team was hired through a competitive process to provide daily oversight of the DFBA. The new management teams comprised mainly local young men and women trained in various agricultural or business related fields.

At the farmers level we found several configurations. Some farmers that supplied milk also became shareholders in the DFBA while others opted to remain only as milk suppliers where they paid a minimum membership fee. In addition, the DFBA promoted the setting up of DMGs as smaller farmer clusters (about 15 farmers each) through which farmers could access services (especially extension) and for peer-to-peer exchanges. These DMGs resulted in different farmer groupings including women dominated, youth and mixed membership groups. At both sites, some of the DMGs were newly established groups while others had pre-existed in other forms mainly as self-help welfare groups. However, other farmers did not join DMGs for various reasons and thus operated more individually.

Effect of changing actor configurations on horizontal relationships

The discussions and interviews indicate that the new actor constellations triggered new patterns of horizontal interactions that addressed some of the horizontal relationship challenges highlighted in the theoretical framework. In both sites, the formation of farmer clusters through DMGs facilitated collaboration between farmers as most of them indicated that they had previously worked individually. These groups participated in joint trainings but began to meet regularly to share their experiences on dairy farming practices.

Furthermore, some groups also engaged in other joint enterprises such as vegetable, fruit and poultry production and marketing. Some of the groups, particularly the women and youth groups indicated that they assisted each other to acquire dairy cows through a revolving fund they had set up.

At the DFBA level, various interviews revealed that the new governance structure, that included a professionally recruited management team with a perceived separation of roles from the board contributed to enhanced collaboration with farmers. This was indicated by the increase in numbers who registered as members and started delivering milk for collective marketing through the DFBA. In Tanykina, the number of farmers increased from about 2760 in 2009 about to 4430, while in Metkei the number increased from 1188 in 2009 to about 4928 farmers (EADD internal report). In addition, most DMG members indicated using more services offered through the hub (e.g. Artificial Insemination (AI), training,) and purchased inputs (e.g. concentrate feed, veterinary drugs, tools) through the agro-vet store, although in Metkei some limited services and inputs (e.g. transportation, feed) were accessed mainly through the old cooperative societies.

Thus, the clustering of farmers and brokering of relations through the hub fostered horizontal relationships counteracting challenges such as the lack of cooperation and thus enhanced reciprocity and trust between farmers. Nonetheless, others issues remained unresolved and new tensions emerged. An emergent issue was that the DMG structure inadvertently excluded those farmers not in groups from accessing some services (i.e. extension and training) although they were DFBA members. Also, we found that some of the DMGs were temporary as the members stopped interacting during a brief period when the DFBA suspended extension services. This highlights the challenge of long-term commitment and sustainability of such externally-induced collaborations even among farmers. With regard to the DFBA, some farmers were still wary of the DFBA leadership and questioned their intention as illustrated by the comments below.

> *"Now we are taking our milk to the multipurpose chilling plant... although we fear that the chilling plant may swallow the cooperative along with our money." (Farmer group discussion, Metkei, 2011)*

Thus, horizontal relationships between farmers and the DFBA were still marked with distrust, even with the new governance structure. This wariness can be linked to the chequered history that led to the collapse of many dairy cooperatives in Kenya. In addition, some farmers who were struggling with improving productivity were questioning whether they benefit from the collective enterprise. As one of them noted:

> *"I look up to Tanykina and they are oppressing us. So there is no benefit at this point. My cow does not have feeds, my child is at home and not in school as I am unable to pay fees, there is no milk, and thus I am at a loss. Tanykina was good when it began but things have changed." (Farmers discussion, Tanykina)*

Moreover, from interviews, it was apparent that there were emerging tensions from the board trying to balance interest in growing a profitable enterprise and still being inclusive and supportive of all farmers. This is particularly in consideration of the poorer dairy households whose productivity was generally lower and which required considerably more support. This indicates that such competing interests affected the horizontal relationships and issues of inclusion were not fully resolved.

4.4.2 *Vertical coordination*

Changing actor configurations through vertical coordination

The CP was an important focal point for linking farmers to the output market, specifically the private dairy processing companies. These companies were the main actors involved in the cold milk chain which was the main target market for the DFBA. The CPs enabled bulking and thus could guarantee a reasonable daily volume of milk to the processors, thus enhancing collective marketing, albeit with some seasonal fluctuations. The increased volumes of milk attracted various market actors, some of whom were already operating in the respective DFBA catchments, but others were new entrants. These market actors included some of the leading private processors including Brookside in Tanykina and the new Kenya Cooperative Creameries (KCC) in Metkei. There were other smaller processors also operating in each site. In addition, other market actors increased their operations within the DFBA catchment areas including informal milk traders and an increasing number of local restaurants.

Effect of changing actor configurations on vertical relationships

The new actor configurations and interactions that emerged in the hub shaped the vertical relationship between farmers and the output market actors. With increased milk volumes, farmers were assured of a market because of the competition between different market actors identified above). According to project reports, in 2009, the average daily volumes delivered in Tanykina were 15,300 litres which had increased to an average of 21,700 litres at the time of the study in 2011, while in Metkei it increased from 5,000 litres to about 14,700 litres. In this context, the DFBA had more bargaining power to negotiate higher prices for their milk. Farmers noted that previously they sold their milk at average low of 0.15 USD per litre. This went up to an average of USD 0.35 per litre at the time of the study (EADD, 2011a). Because of the DFBAs' focus on the cold milk chain, the competition among the leading private dairy processing companies facilitated each of the DFBAs to enter into supply contracts with a specific dairy processor. Tanykina had a contract with Brookside and Metkei with new KCC although both processors were present in the two locations. Thus, the hub enhanced bulking and was instrumental in brokering these market relationships in efforts to provide a stable market for farmers. Thus, vertical coordination indicates efforts to balance power between the farmers (DFBAs) and the private processors.

But other dynamics between actors suggests that vertical relationships were still marked with contradictions and tensions. For instance, many farmers including the shareholders in both DFBAs indicated to be side-selling part of their milk to alternative markets (such as the other processors operating in the area and informal milk traders). There were many reasons noted for this practice. Some of market actors used various competitive tactics to get farmers to divert milk from DFBA. This included sometimes offering slightly higher prices than those of the processor with the supply contract with the DFBA. Many farmers also wanted to maximize on the various opportunities and benefits offered by the competitive market as illustrated by the quote below.

> *"I am a member of the DFBA so I can get loans and that is why I take my milk there. I also take to Ainabkoi who is a private buyer and offers transportation for our milk." (Farmer discussion, Metkei)*

Other farmers located in more remote areas opted to sell to other market players that were collecting the milk at the farm gate due to lack of transport. Also, during the wet season farmers indicated that processors decreased milk prices, and in addition, their milk rejection rates increased as the processor claimed poor quality milk although farmers perceived the quality measures to be arbitrary. This indicates information asymmetry around quality and price. In addition, the processors sometimes delayed payments, causing dissatisfaction among farmers. According to the managers, farmers perceived such delays to be a management and governance issue and felt that the DFBA was not responsive to their needs. All these factors had an effect on farmers' loyalty to the DFBA but also affected the DFBA relations with the processors, resulting in constant switching between dairy processors.

4.4.3 *Complementary coordination*

Changing actor configurations through complementary coordination

Through the hub the DFBAs brokered linkages with various service providers but also directly delivered some inputs and services thus becoming a one-stop shop. This resulted in diverse actor configurations of input and service providers. At the time of the study, both hubs coordinated a cluster of services that included AI, animal health, extension, milk transportation. According to interviews with managers, there were four AI providers and two AHA directly attached to the Metkei hub and three AI and two AHAs in Tanykina. The AI and AHA service providers received short term training and support in acquiring some equipment (e.g. motorbikes, AI tanks, diagnostic kits for AHAs) through the EADD programme. In addition, as shown in Figure 4.2, there were other independent services providers (AI and AHA) not directly linked with the DFBA but operating in both locations and were competitors of those coordinated through the hub.

The extension services offered through the hubs evolved over time. Initially there were farmer trainers and trainer of trainers (ToTs) with back stopping support from the local Ministry of Agriculture extension office and other EADD consortium partners. However, because of challenges in monitoring the TOTs, the DFBAs introduced a new model of community extension service providers (CESPs). There were also many milk transport service providers mainly local young men who emerged to serve the hubs. In addition, the

Tanykina hub had integrated other services including a microfinance institution (village bank), and an agro-vet shop for selling various inputs (such as feeds, equipment, veterinary drugs, etc.) and entered into a partnership with a medical insurance company to serve their members. In Metkei, some of the inputs and services (e.g. feed, transportation), were still channelled through the existing societies, adding transaction cost for farmers. Furthermore, in both sites we observed and confirmed through the interviews that the hub had a spill-over effect in stimulating other types of services and business actors (e.g., retail shops, restaurants, other independent agro-dealers etc.) within the community.

Effect of changing actor configurations on complementary relationships

As highlighted in interviews, the hub stimulated farmers' demands and eased access to inputs and support services. The hub enabled interlinked inputs and services delivery, where farmers that supplied milk to the DFBA accessed inputs and services through a "check-off" credit system. According to the DFBA managers, such complementary coordination coupled with service agreements they signed with the service providers aimed to create trust and ensure better services to farmers. While forging these relationships between farmers, and input and service providers resulted in synergies, the various data indicated some tensions also emerged. For example, while the findings indicated an increased demand for AI services, the hub did not succeed in guaranteeing AI service delivery to the full satisfaction of the farmers. There were concerns about the high cost of AI and the quality of AI service delivery. Some farmers expressed dissatisfaction with the responsiveness of service providers as indicated in the quote below:

> *"We are not completely happy with the AI services... You can call them when the cow is in heat and they will tell you to wait until the evening... It can be hard to get someone at that time and so they restrain our progress." (Metkei farmers' discussion)*

Another issue relates to assurance of quality of the semen. Some farmers felt constrained because they could not rely on the service providers to guide them in making decisions e.g. regarding the selection of the most appropriate semen to improve their breeds. As one of the farmers expressed:

> *"I had a problem whereby I advised a practitioner not to inseminate my cow with a particular breed ...but he went ahead and after nine months, it had a stillbirth...If he were a good practitioner, he would have advised me otherwise. I think they are just after your money sometimes." (Tanykina farmers' discussion)*

Similarly, the programme envisaged that in linking extension services through DMGs, farmers' extension needs would be met more effectively. However, in the early stages of the programme problems emerged with some of the TOTs in both hubs. These TOTs received an allowance directly from the EADD programme based on the number of trainings they conducted. As one of DFBA managers explained, this arrangement lends itself to opportunistic behaviour by some of the TOTs

> *"We initially used the TOTs as a link between the CP and farmers but their performance was dismal. They would sit under a tree and give us a list of those trained. The EADD became aware of this practice and decide to terminate them– (Metkei Manager)*

To address these issues, a new model of community extension service providers (CESP) contracted directly by the DFBA was introduced later. In addition, various inputs (feeds, veterinary drugs, seeds etc.) were also made available through the DFBA owned agro-vet shop. Challenges here included scarcity of inputs (seeds, and quality concentrate feeds) and in addition farmers indicated that some of the inputs at this agro-vet store were more expensive than those in other independent stores. Thus, some farmers were dissatisfied and opted to buy their inputs (e.g. seeds, feeds) through other private agro-vet stores that were operating in the area. The hub facilitated the establishment of relationships between farmers and input and service providers that intended to ensure quality of service delivery to farmers. The latter was a challenge however as it emerged that the hub coordination was not able to monitor some of the issues that affected the quality of the relationships between actors (e.g. trust, reliability, quality assurance) that underlie effective complementary linkages.

4.5 Analysis and discussion

In this section, we bring together the findings to answer the research questions. Section 4.5.1 looks at the extent to which hub coordination addresses the noted challenges that constrain smallholders' from effectively participating in value chains. Section 4.5.2 reflects on the tensions that emerged in trying to address these challenges.

4.5.1 *The intermediary role of the hub in enhancing coordination and resolving the challenges related to smallholder linkages to input and output markets*

Our findings confirm the importance of coordination mechanisms in matching demand and supply of inputs and services in enhancing smallholder innovation and participation in remunerative output markets as proposed by others (Bingen et al., 2003 ; Poulton et al., 2010). As the summary analysis in Table 4.1 below shows, the hub is a coordinating mechanism through which smallholder farmer organisations enhance linkages with input supply and service delivery and output markets, supporting earlier findings in Jaleta et al. (2013). The hub facilitated links between farmers (horizontal coordination), and with other actors in the input and output markets (vertical/complementary coordination). The additional insight our study offers is that the main strength of the hub is the synergy that it enables between simultaneous horizontal, vertical and complementary coordination which results in new actor configurations. Thus the hub enables what Poulton et al (2010) suggest is focal coordination, but with the additional element of horizontal coordination. This synergic coordination is enabled through the hub's role in brokering, clustering and acting as a one-stop shop. This confirms the importance of the broker role in building linkages and benefits of such brokering as earlier found by others (Kilelu et al., 2011; Klerkx et al., 2009). In clustering farmers and the various input and service providers, the hub stimulated demand for services and increased business transactions by matching these services (e.g. AI, extension/training) to the smallholders. For example, the formation of farmer sub-groups (DMGs) was an avenue for accessing extension services.

Table 4.1: Overview of purpose and achievement of the hub in addressing challenges of smallholders in value chains and some tensions.

Type of coordination	Purpose of hub related to challenges	Role fulfilled by the hub	Achievement of hub	Tensions and emerging issues
Horizontal	Enhance co-operation and loyalty for mobilizing economics of scale	Brokering the day to day interactions between farmers and DFBA	Many farmers joined the DFBA (some as shareholders) and enhanced collective milk marketing	Market demand (several marketing channels) contributed to farmers (including shareholders) side-selling milk thus affecting cooperation and loyalty
	Improve mutual trust/reciprocity among farmers	Clustering farmers into groups	Some farmers joined the DMGs as local units of farmer to farmer co-operation enabled reciprocity and exchanging ideas	Some farmers excluded from accessing services
	Inclusion of farmers and their representative in decision making	Facilitating farmers participation in the DFBA including in the selection of representatives (through elections)	All farmers within the catchment could supply milk to the DFBA without being shareholders	The options of farmers to be only suppliers influenced their loyalty to the DFBA
	Improve transparency in leadership and decision making	Brokering and facilitating farmer s participation in the selection of board (through elections) and ensuring a transparent hiring process for the management	New governance model with clear separation of roles between board and management team that was professionally hired increase a sense of transparency	Lingering distrust of the DFBA leaders due to the historical context of dairy cooperativescollapsing and tensions of benefit sharing through such collective action
Vertical (between farmers and market actors)	Enhance trust	Brokering linkage with the processors and facilitating bulking for collective marketing	DFBAs signed supply contracts with processors aimed at consolidating their position in the market and enhance trust with their farmer members and with the processing companies. The contract was to stabilize prices and restore farmers trust in the market	Due to seasonality affecting milk volumes, processors were not consistent about prices and milk quality issues (information asymmetry). This affects farmers trust of the processors and their loyalty
	Reduce inconsistency and uncertainty	Brokering linkages with the various services and inputs	Access to services offered through the hub was to reduce inconsistency and uncertainty of farmers delivering milk at the DFBA for collective marketing.	Divided loyalty of farmers (due to other alternative and attractive markets) resulting in side selling and fragmenting of the milk due to inconsistency in volumes supplied to the DFBA.
	Balance power relations	Brokering link between farmers (through DFBA) and market actors	The DFBA was able to mobilize milk volumes from farmers and assure quality through chilling. This gave DFBA/farmers some bargaining power and resulted in higher prices.	Dairy processors had relative monopoly of market for the DFBAs who were targeting the cold milk chain.
Complementary (between farmers and input/ innovation support service actors)	Improve reliability and commitment in input service delivery	Brokering links with service providers	Access to services enhanced through the hubs through the check-off system	Problems with the quality of some service delivery due to lack of adequate monitoring
	Enhance quality adequateness of support services	Clustering of service providers (e.g. AI, AHA, CESP) and matching them to farmers	Services providers directly linked to the DFBA and paid through the check-off system. This was expected to enhance quality and adequateness of service delivery	Emerging problems with quality and adequateness of some services (e.g. AI and extension)
	Balance power relations and enhance trust		The DFBA had oversight of service delivery through service agreements and interlinking the services with a check-off system. Some services directly integrated into the DFBA (e.g. extension and agro-input store)	Opportunistic behaviour of some service providers due to gaps in monitoring their quality of service delivery (e.g. extension services)

(Source: Authors' data)

This outcome is important because as indicated in the literature, dispersed farmer demand is a disincentive for private sector service providers to invest in service delivery to smallholder farmers (Kelly et al., 2003). Clustering also enhances vertical relationships, where farmers attract a more stable market through bulking and collective marketing. These relationships are mediated through an institutional novelty, the check-off system, which enables farmers to access the goods and services in the hub as a one-stop shop. While hubs are effective and become synergic through the combination of the roles of broker, a cluster and as a one-stop shop, this combination of roles and their execution in the hub may also lead to tensions, as we will discuss in the next section.

4.5.2 *Tensions and dilemmas in coordination through the hub*

While the hub enables simultaneous horizontal, vertical and complementary coordination, there are still several tensions and emergent issues. This mainly relates to its intertwining with farmers' organisations as part of the operational interface. As our study shows, farmers' organisations can take the lead in coordination at different levels using the hub mechanism. While some authors are wary of farmers' organisation taking on such broader roles (Berdegué, 2001 ; Chirwa et al., 2005), our results indicate that the hub that is also part of the business model of farmer organisations shows potential to enhance coordination that is necessary to catalyse their position and growth in value chains (Dorward et al., 2005 ; Poulton et al., 2010). However, while the intrinsic link between horizontal, vertical and complementary coordination in hubs can provide synergies, to the contrary it may also trigger tensions.

In terms of horizontal coordination, the double identity of farmers' organisation through the hub as a broker between farmers with intent of enhancing collective action, and it being a business-oriented entity presents dilemmas. Studies of smallholder collective action assumes some shared interest among farmers (Barham & Chitemi, 2009 ; Markelova et al., 2009 ; Shiferaw et al., 2011). However our study also point to what others have noted as dilemmas of collective action (Chirwa et al., 2005 ; Hellin et al., 2009); aligning the individual farmers' goals vis-à-vis the overall goals of the hub as part of the farmer organisations business model sometimes may require excluding some farmers who cannot deliver the required quantity and quality to cut down costs of

coordination. This contradicts the goal of the hub to expand its farmer membership base to achieve economies of scale, which is in line with the conceptualization of the hub as a cluster and be inclusive of poorer farmers. On the other hand, in trying to be inclusive to all farmers (e.g. both shareholder farmers and those that are milk suppliers only) this opens a window for more opportunistic behaviour such as farmers side-selling their milk, which is a typical problem of horizontal relationships resulting in divided loyalties as others have observed (Bingen et al., 2003 ; Chirwa et al., 2005).

In terms of vertical and complementary coordination, the findings also suggest some tensions related to unresolved power imbalances in the value chain. One tension concerns the power imbalances between milk processors and the farmers represented by the DFBA, for example with regard to determining milk prices. Despite farmers' increased bargaining power from their collective effort, they still have to contend with selling their milk at the price determined by the processors. The tension above coupled with other emergent issues like delayed payments from the processors are some of the drivers of side-selling by farmers thus it is affecting farmers' loyalty to the DFBA. These findings suggest that in resolving such tensions, coordination by the hub should not just be about establishing the linkages but also continuous relationship management by means of conflict resolution and mediation and establishing effective mechanism for countering any opportunistic behaviour (Fischer & Hartmann, 2010 ; Poulton et al., 2010).

These dilemmas and contradictions point to a broader debate surrounding commercialisation of smallholder farming. As Van der Ploeg (2008) has noted, the push toward more entrepreneurial farming is problematic to the extent that it creates new dependency relations between farmers and external actors that prescribe and condition farm/production processes. Hence, some of the tensions that the hub aims to counteract e.g. inclusion of smallholder in markets (vertical coordination) are the same tensions that hubs also suffer from at the horizontal coordination level where some farmers are inadvertently excluded. Poole et al. (2013) also critique what they see as a meta-narrative approach of smallholder commercialisation models which they argue do not pay sufficient attention to the heterogeneity among smallholder farmers. This meta-narrative is often captured in promotion of models such as hubs.

The above dilemmas also raise questions about the effectiveness of farmers' organisations (such as the DFBAs) in taking on coordination functions through hubs. This mainly relates to them being suitable to take a position as an intermediary in orchestrating horizontal, vertical and complementary relationships, and relates to their combination of roles as a broker, a cluster, and a one-stop shop. The DFBAs partly take on an intermediary role similar to hub firms (Dhanaraj and Parkhe, 2006), as they use their centrality to pull together the dispersed resources that are part of the network. In this way, they aim to extract value in relationships among actors in the networks they orchestrate. This is different from other characterizations of intermediaries as 'honest' brokers (Klerkx & Leeuwis, 2009a ; Obstfeld, 2005) who have a less strong normative orientation, and suggests a certain functional ambiguity for the FO in undertaking the intermediary role. While our study cannot yet give conclusive evidence to support either of both broker models, this would be a key issue for further research, as the legitimacy of the broker connects to arguments that the viability of the hub model in supporting smallholder agricultural development rests solidly upon the social capital of strong farmer organisations through which strong business and social relations are coordinated that can overcome the various constraints in the value chain (Ha et al., 2013 ; Heemskerk & Wennink, 2004 ; Kruse, 2012).

This links to the issue of sustainability of hubs. As some studies have suggested, farmer organisations lack some capacities that are necessary to adequately coordinate and monitor hub induced relationships through the three types of coordination, and thus cannot adequately manage some of the relationship changes over time (Bingen et al., 2003 ; Chirwa et al., 2005 ; Heemskerk & Wennink, 2004). As our findings have shown, the DFBAs take on their coordination roles with external support (i.e. the EADD programme), and it is a key question about how on one hand, farmers organisations and their respective hubs 'mature' and can do without external support and be sustainable, also in light of farmers' and value chain actors' strategic behaviour. On the other hand, as Klerkx and Leeuwis (2008b) argue, in cases where some of the coordination challenges are resolved through self-organization among actors, and transaction costs lower, some intermediary functions may become obsolete – i.e. if the hubs become effective clusters

with well-developed and autonomously functioning relationships, the broker function in them may no longer be necessary.

4.6 Conclusion

This article has examined the role of hubs in achieving horizontal, vertical and complementary coordination and in improving multi-actor relationships in order to enhance smallholders' participation in agricultural value chains. The article has contributed to an improved conceptual understanding of the hub as a coordination mechanism, as it has shown that through a combination of clustering, brokering, and one-stop-shop functions, hubs enable smallholder to achieve economies of scale, to access to information and other services, and reduce uncertainties related to market access.

While the broad and combined coordination role of hubs enables synergies between the different forms of coordination, tensions and emergent issues in the coordination process raise questions about the extent to which hub models are a panacea for solving all the problems of smallholder farmers in establishing and maintaining their position in markets. Our results show that while farmer organisations as the main drivers within hubs may seem best positioned to shape relationships in favour of smallholders in value chains, they may not have the ideal position and the necessary capacities to fulfil intermediary roles. This is particularly relevant with regards to relationship management as they struggle with dilemmas such as inclusion, loyalty, trust, and unbalanced power relations both among farmers and with other value chain actors. Thus, complementary interventions and alliances between farmer organisations and other organisations that can fulfil intermediation roles and provide additional coordination support seem to be useful here. These findings call for reflection on policies that are pushing for farmers' organisations to take on these new coordination and managerial roles which seem to put more demand on their capacities. A more appropriate policy response would be to support farmers' organisations in tandem with other instruments, including funding support to ensure the most optimal coordination mechanisms that are inclusive of different categories of smallholders.

CHAPTER 5

How dynamics of learning are linked to innovation support services - insights from a smallholder commercialisation project in Kenya[4]

[4] Published as: Kilelu, C. W., Klerkx, L., Leeuwis, C. (2013). How dynamics of learning are linked to innovation support services -insights from a smallholder commercialisation project in Kenya. The Journal of Agricultural Education and Extension. 1-20. doi: 10.1080/1389224x.2013.823876

Abstract

The important role of learning is noted in the literature on demand–driven approaches to supporting agricultural innovation. Most of this literature has focused on macro-level structural perspectives on the organization of pluralistic innovation support systems. This has provided little insight at the micro-level on the dynamics of demand articulation, and the related interplay of matching demand with supply of innovation support services. This paper contributes to understanding this interplay using the concept of dynamic learning agenda. We present a case study of a project supporting smallholder commercialisation of onions in Kenya. Data were collected in selected project sites over 7 months using key-informant interviews, focus group discussions, participant observation at various meetings and project document reviews. The results show that because learning in agricultural innovation processes is dynamic, static notions of demand articulation and related support are inadequate. Supporting learning and innovation requires an understanding of how farmers demand evolves, and require a flexible matching process with various innovation support services to achieve 'best-fit', and an awareness of sometimes competing interests of actors. The findings are useful for enhancing support of innovation processes by pointing to the need for paying attention to evolving demands and how these are matched with the right type of services, guided by effective monitoring in order to adapt the dynamic learning agenda accordingly. We add to the debate on demand-driven approaches to innovation with a dynamic analysis of pluralistic innovation support service provisioning, which has mainly been analysed statically.

5.1 Introduction

In the changing agricultural development context in developing countries, learning in innovation processes is important to address challenges and opportunities facing smallholder systems (World Bank, 2006). The imperative for learning in innovation is linked to recent insights on innovation processes as knowledge-intensive, non-linear, interactive and inherently unpredictable, and accompanied by risk conflict and uncertainty (Hall & Clark, 2010 ; Leeuwis & Aarts, 2011 ; Smits, 2002). Following these insights on innovation, it has been recognised that if agricultural innovation is to be adequately supported, it is necessary to re-conceptualise advisory services as a broad range of *innovation support services* (Christoplos, 2010 ; Leeuwis & van den Ban, 2004). These should be provided in response to growing demands from farmers and other stakeholders (i.e. demand-driven) and cover a varied range of support services. These include articulating innovation needs, accessing knowledge and technologies, enhancing entrepreneurial capacity, building multi-actor linkages and networks, facilitating action learning and experiments (e.g., Farmer Field Schools), organizing farmers and mediating conflict (Christoplos, 2010 ; Klerkx & Leeuwis, 2008b ; Rivera & Sulaiman, 2009). Establishing an adequate match between demand and supply of these various innovation support services is important, especially in the context of smallholder agricultural development in sub-Saharan Africa (SSA), where the sector is hampered by various socio-technical and institutional challenges (Hounkonnou et al., 2012 ; Poulton et al., 2010 ; World Bank, 2007).

The literature on demand-driven approaches to supporting agricultural innovation has so far mainly focused on analysing, from a macro level structural perspective, the challenges of optimally matching the needs of farmers (demand side) to innovation support services (supply side) in increasingly pluralistic innovation support service systems (Birner et al., 2009 ; Christoplos, 2010 ; Klerkx & Leeuwis, 2008b ; Parkinson, 2009 ; Swanson & Rajalahti, 2010). These studies indicate that the systems consist of a wide array of actors (e.g., public extension, private advisors, agri-business companies, researchers) that undertake a broad range of privately or publicly funded innovation support functions. Thus, a 'best-fit' between demand and supply should be sought by choosing services from a '*menu of options*' from the supply side (cf. Birner et al., 2009). They however do not

investigate how choices from this menu are made in a dynamic innovation process. Recent work has also pointed to the important role of so-called innovation intermediaries that undertake a brokering role to improve the match of demand and supply of innovation support services and hence enhance innovation processes (Kilelu et al., 2011 ; Klerkx & Leeuwis, 2008b ; Leeuwis & Aarts, 2011). However, these studies have mainly focused on characterizing types of innovation intermediaries and functions they provide. These studies thus still provide little insight at the micro level of innovation projects, on the interplay between articulating demands and matching these demands with supply of appropriate innovation support services, and the related dynamics of learning that accompany such innovation processes. While some work has indicated that needs and demands most probably require continuous re-articulation (Chowa et al., 2013 ; Kibwika et al., 2009 ; Klerkx & Leeuwis, 2009b), it has not explored this process in detail. Also, recent studies on innovation platforms that highlight learning processes in multi-actor networks (Kilelu et al., 2013 ; Nederlof et al., 2011) fall short of analysing this evolving process in relation to matching demand for innovation support services to their supply.

This paper seeks to contribute to addressing these gaps in the literature by deepening insights on understanding learning processes in agricultural innovation in connection to the role of innovation support services, using a case study of an agricultural development project on smallholder commercialisation of bulb onions in Kenya. The main research question the paper addresses is: how did the project support the matching of innovation support demands to innovation support service provisioning within an evolving learning process? In section 5.2, we briefly review literature and build a conceptual framework for the study. We then present the case study design and the findings in the subsequent sections, and end with a discussion on the theoretical and policy implications of our findings in connection to the debate on demand-driven advisory services and their role in enhancing innovation processes.

5.2 Conceptual framework:

Dynamic learning agenda and the matching of demand and supply of innovation support services

There are diverse theories for understanding learning processes. Given the purpose of this paper, our goal is not to look in depth at these different theories that provide a broad conceptual understanding of learning, intersecting between individual and collective processes, as these have been described elsewhere (see e.g., Blackmore, 2007 ; Loeber et al., 2007 for a detailed review of key conceptual issues in learning such as single or double loop learning, learning as a cognitive or a social process, etc). Instead, we study learning in relation to supporting innovation, by looking at processes of formulating a learning agenda triggered by questions or analysis of problems and opportunities which continually emerge in unfolding innovation processes (following Regeer, 2009 ; van Mierlo et al., 2010a). Such analysis usually leads to the identification of needs for knowledge and other resources necessary for innovation (e.g. technologies, research, advisory services, funding etc.), which in turn triggers demand for various innovation support services (Klerkx & Leeuwis, 2008b ; Smits, 2002 ; Sumberg & Reece, 2004). The conceptualization of a learning agenda is hence connected to the notion of demand articulation in innovation processes. Some scholars have stated that when seeing innovation as a complex process involving interactive creation of knowledge, the 'market metaphor of demand and supply' paradoxically suggests adherence to a linear perspective on innovation (Hall & Clark, 2010 ; Klerkx, 2008 ; Leeuwis, 2000). However, since innovation support is embedded in services, and the demand of these services is usually not completely determined ex ante then matching demand and supply leaves space for co-creation (see also Klerkx, 2008 ; Sarewitz & Pielke, 2007).

In the literature on agricultural innovation support and advisory services, the concept of demand articulation has often implied a notion of demand that is tied to economic elements such as willingness and ability to pay and has been related mainly to financial mechanisms (e.g. voucher schemes, competitive bids for extension services, privatisation) for optimizing demand and supply of services or inputs in pluralistic advisory systems (Birner et al., 2009 ; Christoplos, 2010 ; Klerkx et al., 2006 ; Parkinson, 2009). However, in line with ideas of a learning agenda, the notion of substantive demand noted in

innovation studies is more relevant here. Substantive demand articulation is about concretizing unspecified, sometimes latent needs into clear demands through dialogue between the 'demand' and 'supply' sides of innovation support services to effectively guide the formulation and provision of relevant innovation support services (Boon et al., 2011 ; Klerkx et al., 2006 ; Leeuwis & van den Ban, 2004).

In the changing agricultural context in developing countries, with a renewed focus on increased market orientation of smallholder farmers, there is recognition that innovation goes beyond technology development and use. It is seen to include building capacities for producers to be more strategic about their enterprises, strengthening farmer organisations and more broadly streamlining actor linkages in agricultural value chains (Chowa et al., 2013 ; Christoplos, 2010 ; Swanson & Rajalahti, 2010). Thus supporting innovation entails providing both technical and generic business (entrepreneurial) support services, which has been recognised already in the context of developed countries (Nieuwenhuis, 2002 ; Phillipson et al., 2004). Furthermore, innovation support services are not always tied to support of private demands of specific actors but also to demands related to public or societal interests such as those related to sustainability issues. These demands are often conflictive and are negotiated in innovation processes (Klerkx & Jansen, 2010 ; Leeuwis, 2000).

Generally, the articulation of demands in innovation processes has been looked at as a rather static process, with demand articulation taking place at the start of an innovation process through exercises such as diagnostic studies or needs assessments (Hall et al., 2006 ; Parkinson, 2009 ; Röling et al., 2004). However, understanding that innovation is a continuous process of planning, acting, reflecting and readjustment implies that the learning agenda should be dynamic and needs to continuously adjust in response to opportunities and problems that emerge over time and are context specific (Regeer, 2009 ; van Mierlo et al., 2010a). As studies have shown, this process is often facilitated by various types of intermediary actors (Boon et al., 2011 ; Kilelu et al., 2011 ; Klerkx & Leeuwis, 2008b).

As Figure 5.1 conceptually outlines, the dynamic learning agenda entails continuously (re) articulating needs and demands, and consequently matching them to action, often

supported by various innovation support services. This requires that the intermediary actors facilitate reflexive monitoring and capture feedback, to identify emerging demands and either a match or mismatch with innovation support services. This learning process guides the continuous adaptation of goals and plans in order to improve the interventions (Leeuwis & van den Ban, 2004 ; Regeer, 2009 ; van Mierlo et al., 2010a).

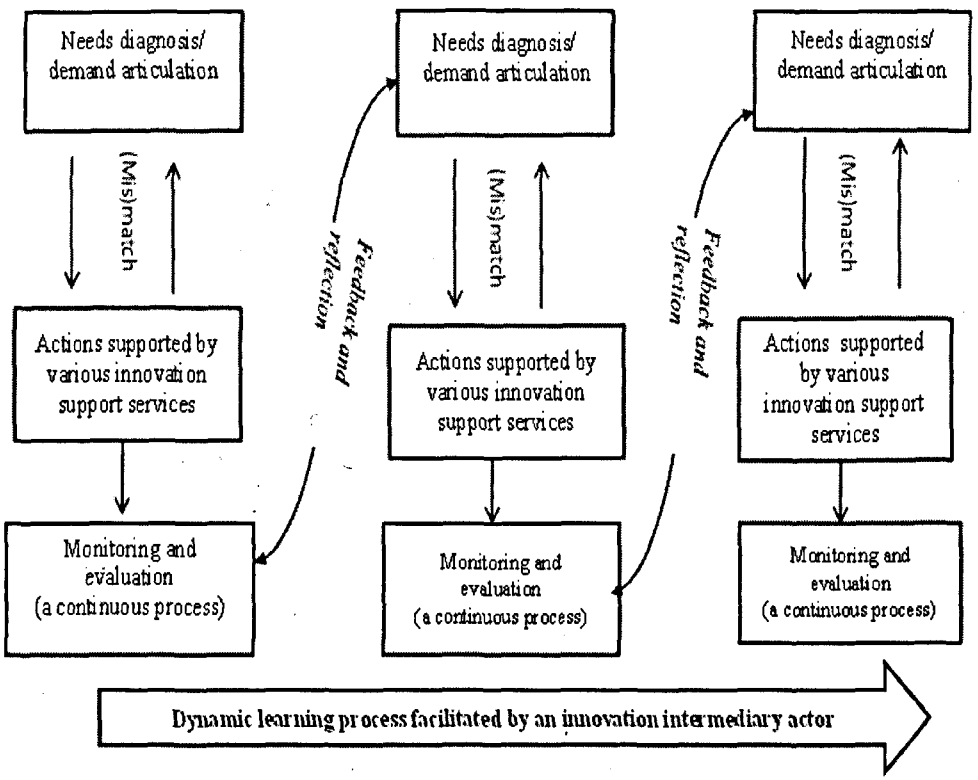

Figure 5.1: Conceptualisation of a dynamic learning agenda
(Sources: Authors; Regeer, 2009; Klerkx and Leeuwis 2009)

5.3 Case description and research methods

5.3.1 *Case description*

We apply the conceptual framework outlined in the previous section to analyse an on-going project implemented by Farm Concern International (FCI), a non-governmental organization that is supporting the commercialisation of onions by smallholders in Kieni east and west districts, in central Kenya (Farm Concern International, 2010). Despite favourable conditions for bulb onion farming in various regions in Kenya, a deficit in supply of locally produced onions has necessitated the importation of the produce, mainly from Tanzania. Studies have shown that onion yields in Kenya are considerably low and of lower market quality (e.g. storability and visual appearance) than those from Tanzania. This poor performance has been linked to the predominant use of low yielding open pollinated varieties (OPV) coupled with challenges in weed and pest management, poor post-harvest practices and marketing (Koenig et al., 2008 ; Muendo & Tschirley, 2004 ; Waiganjo et al., 2009). These challenges and the identified market opportunity provided the impetus for supporting the onion commercialisation project.

This was a scaling-up project that started in 2010 following an initial pilot implemented in 2005 in the same region. The project areas (Kieni districts) are located in the drier part of the central region in Kenya but are noted to have potential for intensive onion production with high market returns. The farmers in Kieni operate in diverse, complex, agro-ecological and socio-economic conditions and grow varied staple and horticultural crops. The project goal was to facilitate improved production and post-harvest management practices and to strengthen linkages to credit and output market channels, all aimed at boosting productivity and profitability of onion farming for the smallholder households. The project uses the Commercial Village (CV) model developed by FCI to support farmers to organise as enterprises at a village level focusing on enhancing commercialisation of onions (Farm Concern International, 2010 ; 2011 ; Roothaert & Muhanji, 2009).

5.3.2 *Research Methods*

We chose a single case study design because we were studying a process that required in-depth investigation to unravel the dynamics of learning in relation to the matching of demand and supply of innovation support services (Flyvbjerg, 2006 ; Yin, 2003). The case

was identified from an exploratory study that mapped various multi-stakeholder agricultural development projects in Kenya (see Kilelu et al., 2011). The project was selected for further in-depth research as it had a clear goal for facilitating innovation processes through matching demand with supply of different types of innovation support services. It thus fitted our research objective; moreover, because it was on-going, it allowed us to follow the process in real time. Data were gathered between August 2011 and February 2012 to coincide with the main onion production season in the project areas. This enabled us to follow the interventions of the project and gather data at various points in order to observe and understand how the process evolved over time. We used various data collection methods and sources to enable triangulation and enhance the validity of the study (Yin, 2003). Data from farmers were collected from four CV sites to enable us to get a broader view of this process. Two sites were part of the pilot project (Embaringo and Kinyaite CVs) and two were new areas (Kiaragana and Tanyai CVs). Table 5.1 below provides a summary of the methods and data collected.

The interviews and focus group discussions were tape-recorded and fully transcribed. The analytical focus was on the processes by which innovation needs and demands were articulated, and how these were matched to supply of innovation support services. We also studied the dynamics of how this process evolved over the production season. To organise and code our data, we built on Leeuwis and van den Ban (2004), and distinguished two main 'learning domains' i.e. the technical and socio–institutional. We first categorised the various technical and socio-institutional demands identified at the outset of the project. Over the production season, we examined how farmers' demands for various support evolved, and were captured through the monitoring and feedback processes. We then analysed how these demands were matched to various innovation support services.

Table 5.1: Summary of methods and data collected

Data collection methods	Sources	Overview of area of focus of information collected
Key informant interviews	2 seed companies representatives 3 agrochemical companies' agents 3 Kieni district Ministry of Agriculture officers 2 Microfinance institution (MFI) officers	Views on challenges faced by onion farmers The nature of support they provide to farmers Their engagement with the project
	4 farmer training meetings and farm visits	The concerns related to onion farming were expressed during the various meetings Types of support that is provided to the farmers by different actors How project captures feedback What follow up action was taken on farmer demands raised these meetings
	2 Farmers-traders forums	What issues were raised during interactions between farmers and traders
Focus group discussions (FGD)	4 CVs (about 15 participants in each CV)	Types of onion varieties grown The production challenges faced over the season and the support provided through the project. The challenges faced in relation to CV operations and the support provided
	1FGD with onion traders (25 participants)	The sources of onions, types of market segments, challenges faced by onion traders.
Semi-structured interviews	2 model/demonstration farmers 2 farmer-trainers and 3 CV facilitators Project field manager	Their views on challenges faced by onion farmers and their role in supporting farmers How did the project facilitate support and monitor this process.
Short questionnaire	43 farmers (at end of growing season)	Varieties, estimates of yield (kg), prices, challenges faced during production and views on the areas or gaps in support from the project.
Review of project documents	Project reports Monitoring reports	The challenges(demands) identified at the onset of the project Types of activities undertaken in the project Project monitoring and feedback processes

(Source: Authors' data)

5.4 Findings

In this section we describe and analyse how the innovation process evolved, and translated into a dynamic learning agenda, that guided the articulation of demands for support, and how these were matched, or not, with adequate innovation support services.

5.4.1 *Setting the agenda- identifying innovation needs and demands*

The project's goal to enhance onion commercialisation in Kieni district was guided by a diagnostic and market opportunity analysis conducted by FCI prior to the pilot project. According to the project field manager, the current project aimed to scale up onion

commercialisation and targeted to reach 10,000 farmers in Kieni east and west districts. Below is a list of the innovation needs identified at the outset of the project that relate to challenges in the technical and socio-institutional domains (Farm Concern International, 2010).

1. Technical domain:

a) Improved production of quality bulb onions;
b) Improved agronomic practices and use of other production technologies; and,
c) Improved post-harvest handling and storage of onions.

2. Social-institutional domain

a) Collective action through the commercial village;
b) Conducting farming as a business;
c) Improving farmer savings and credit access; and,
d) Streamlining the value chain and distribution system (linking farmers, input suppliers, extension and traders).

These needs translated into demands for various innovation support services and informed the project interventions. Below we further describe how the demands (clustered into the two learning domains) were linked to various innovation support services and how the learning agenda evolved.

5.4.2 *Matching demand and supply of innovation support services in an evolving learning agenda in the technical domain*

The main technical issues pertained to improving yield and quality of onions grown in the project area. According to the field manager, farmers used cheap OPVs before the project interventions and had an average yield of between 0.5-1 tonne per acre[5], whereas the expected yield from hybrid varieties in optimal local conditions was estimated to be about 10-14 tonnes per acre. On average farmers in the project-sites grew onions on about 0.4 acres. The project interventions started with organizing farmer mobilization meetings to

[5] The project used acre as unit for measuring farm size (1 acre= 0.4 hectare)

promote hybrid onion seed varieties (e.g., Tropicana F1, Red Pinoy F1, Red Passion F1, and Rouge FI) just before the beginning of the growing season (i.e. in August). We participated in two of these meetings where seed companies and agro-input suppliers were invited to promote their hybrid onion seed varieties and the related agro-chemicals. During these sessions, the input suppliers also provided information on improved onion production practices. The data we collected from individual farmers in the discussion groups indicated that in the older sites -Embaringo and Kinyaite CVs about 80% (n=31) of the farmers had planted hybrid varieties and a minority still grew OPVs. In the two newer CVs. i.e. Kiaragana and Tanyai, only 28% (n=28) of farmers grew hybrid varieties while about 62% indicated growing OPVs while another 12% mixed both hybrid and OPVs. Thus in the older sites there was a higher adoption of hybrid varieties.

During one of the mobilization meetings, some farmers noted that while such forums were a useful source of knowledge on onion production, they felt that they still did not have adequate information to enable them make decisions on which varieties to grow. As one of the farmers explained:

> *We have tried onion farming but were not happy with the productivity. An experiment should be conducted to understand if the seeds promoted are suitable in our area (Farmer meeting, Endarasha, September 2011).*

Thus, the concern about suitability of onion varieties triggered a demand for different innovation support. In response, the project field manager liaised with two seed companies to set up demonstration plots of their seeds in collaboration with selected lead farmers. The seed companies were to provide seeds, the various agro-chemicals and technical support to the farmers. But as one of the CV facilitators noted in discussions, only one of the companies followed up on the progress of their demonstrations. The representatives of the seed company visited the farmers weekly to monitor and discuss progress and to provide further instructions on how to proceed, including sometimes changing the types of agro-chemicals. While this demonstration plot provided an opportunity for collaborative learning, many farmers from around the area noted that the seed company did not systematically engage them in a joint learning process. This finding

shows that while the articulated demand was matched to a support service, the service was not optimally utilised and hence this can be viewed as a mismatch.

Farmers were linked to other various support services for improving crop management practices to coincide with the peak onion growing season (October to January). First, the project facilitated farmer-to-farmer visits, where lead farmers (identified mainly in the older CVs) would share their experiences with the 'new' farmers on various technical issues. During discussions farmers indicated that these visits were important avenues for acquiring information on improved production practice. Second, the project organised crop management training forums in various locations. We attended some of these forums where various agro-chemical company agents were again invited to disseminate information on standard procedures on applying fertiliser, pesticides and herbicides at different stages of onion production. While farmers were able to ask questions during these sessions about specific issues they faced, their feedback after these sessions indicated the need for more practical training on application of agro-chemicals but also concerns with the effects of using them. These forums were also meant to create direct links between farmers and the agro-chemical suppliers as a way of stimulating demand for the agro-chemical products, and to ensure farmers accessed quality products. But as farmers indicated, the investment costs also remained a constraint to the adequate use of quality inputs as illustrated by a comment of one of the farmers:

> *"We have so many chemicals available so when you use chemical X for thrips, it doesn't work although it is cheap and everyone can afford it, but when you tell someone to buy another chemical Y, that costs 600 shillings (about 6.9 USD6), while X goes for 150 shillings (about 1.7 USD). So some of these chemicals are not working" (Farmers group discussion, Tanyai, December 2011).*

[6] Exchange rate: 1 USD is equivalent to 87 Kenya shillings (Ksh)

Thus, the issue of weed and pest management (especially thrips) remained a persistent challenge. Other feedback also pointed to other issues including the constraints of high labour costs and poor germination of some seeds. Furthermore, we noted some marked gender differences in explanations about the challenges; more women than men farmers attributed their production problems to a lack of proper knowledge, including on application of agro-chemicals. While we did not pursue this in greater depth for this study, it indicates that efforts to match demands for innovation support with supply should necessarily integrate a gender analysis, and respond accordingly.

Table 5.2 provides a summary of the needs and demands in the technical domain and how these were supported and monitored based on a review of the monitoring process. We collected estimates of yield data from a small sample of farmers (n=43), in three CVs in February (Embaringo, Tanyai and Kinyaite) and found that the average production was about 3.4 tonnes per acre, with some variation in the different sites. While a more detailed study with a larger sample size would give conclusive results, our findings indicate that there was improved production in the project areas, although the volumes are still below the expected yield of between 10-14 tonnes. Furthermore, from observations at harvest time, we noted that some of the onions were small and not properly cured indicating problems of quality. Thus, the main technical challenges were not resolved, pointing to the need for continuous support.

Table 5.2: Summary of demands in the technical domain identified at the onset of the project and the matched innovation support service

Demands in the technical domain	Matched innovation support services	How the support was monitored
Production of quality onions	Organize farmer mobilization forums involving seed and agro-input companies' representatives to promote and market hybrid seeds.	Types of varieties and quantities grown by the farmers in the project Production volumes (yields estimated in kilos)
Improved agronomic practices including proper nursery management and crop management	Facilitated training forums that brought various representatives of Agro-chemical suppliers to train farmers on various onion production aspects including proper nursery management and crop management (fertilizer application and pest and weed control using various agro-chemicals and bio-fertilizer). Ministry of agriculture (MOA) extension staff were also involved in some of the training.	The number of farmers that used agro-chemical inputs (fertilizer including organic , pesticides) The number of farmers that attended the training.
	Organized new farmer groups to visit lead /farmer trainers) to learn from their experiences of onion production. One of the lead farmers participated in a weekly radio programme where he discussed various topics related to onion production.	The number of farmers that attended the training
Post-harvest management	Facilitated construction of a storage unit in one of the CV by providing part of the financing.	The number of stores built in the CVs
	Organize farmer-trader forums where traders discuss quality issues that affect onion marketing.	Number of participants in the forums
	Dissemination of flyers on pre-harvest management procedures (curing) to enhance quality.	Number of flyers distributed.

(Source: Authors' data)

5.4.3 *Matching demand and supply of innovation support services in an evolving learning agenda in the socio-institutional domain*

Following the diagnostic assessment at the onset, support for innovation in the socio-institutional domain focused on two broad areas that include: 1) enhancing collective action of farmers in the value chain and 2) strengthening entrepreneurial capacity of individual farmers.

Table 5.3 provides a summary of how the innovation demands in this domain were matched to innovation support services.

Table 5.3: Summary of demands in the socio-institutional domain identified at the onset of the project and the matched innovation support service

Demands in the socio-institutional domain	Matched innovation support services	How the support was monitored
Organizing farmers as collectives using the commercial village model	Project field manager and CV facilitators provided guidance on the establishment and structuring of commercial villages (CV).	Number of CPGs and CV established.
Increasing farmers savings through group and personal saving schemes and enhancing credit access	Project field manager coached the groups on setting up and management of group savings schemes. Facilitated linkages between the groups and a local MFI to enhance access to credit and improve on savings	Total amount of savings per CV. The total amount of credit accessed by farmers (through internal savings and external loans through MFI)
Improving business skills of farmers	General training and awareness creation records and financial management provided by partnering organisations i.e. MFI agents and MOA extension officers.	Number of trainings organized and number of participants
Streamlining value chain by improving access to quality and affordable agro-inputs, advisory services and output markets.	The project organized exposure visits to markets for farmers to understand the dynamics of onion trade through discussions with traders (e.g. market quality demands, sourcing for onions, pricing etc.)	Number of market visited and number of farmers that participated.
	Linking the CVs directly to various agro-input suppliers (seed, fertilizers, pesticides) through various forums to facilitate collective and bulk discounted purchasing.	Total value of collective inputs purchased
	Facilitate farmer- trader forums towards the harvest period to initiate marketing transactions (negotiations on expected volumes and prices) and link farmers directly to different markets. Field manager visited different markets in different cities to scout for potential market opportunities	The number of forums organized and markets visited. Volumes of onions sold and selling price.

(Source:Authors' data)

Enhancing collective action was anchored on FCI's commercial village (CV) model that brings together many farmers within an administrative village to engage in commercialised production of identified crops. The CV model is operationalized first through the formation of commercial producer groups (CPGs) made up of about 20-30 households. The CPGs within a village are then clustered to form the larger commercial village (Farm Concern International, 2011 provides details of the model). According to

the project manager, getting the CVs as new institutions operational was hinged on establishing elaborate structures, comprising several committees at the CPG and CV level. All CPG members were expected to be actively involved in at least one of the committees. It is through these structures that farmers would be able to engage in collective action through aggregating their demands for various innovation support services such as bulk purchase of inputs, advisory and extension support, financial credit; and would provide farmers with leverage to negotiate for better prices through collective marketing.

To support the establishment of CVs, the field manager periodically consulted with the CV leaders and provided them with guidance as needed. In addition, a number of individuals from the different projects sites were trained as community level CV facilitators and were expected to offer further support in operationalizing the CV as this was considered a continuous learning process. But from the interviews, we gathered that these CV facilitators provided little support in strengthening the CVs as in practice they had to spend most of their time collecting various monitoring data for the project. Furthermore, from discussions with farmers we established that the older CVs had set up most committees while the new CVs only had a few committees set up (i.e. production and marketing). However, many farmers indicated that they were not actively involved in the committees as envisaged. Others mentioned the issue of conflict within groups and a lack of collaboration between different CPGs, which affected the operation of the CVs. The field manager considered such conflict as part of internal dynamics of CVs, which the project avoided being drawn into. These findings suggest that there are some gaps with the support needed for strengthening farmer organisations where the demands for such institutional support are not well articulated.

The demand for streamlining farmers' participation in the onion value chain was also supported by linking farmers directly to the market (traders) and other innovation support services that were referred to as business development services (BDS). On marketing, the project organised a number of farmer-trader forums in order to facilitate direct market links so as to by-pass the middlemen who many farmers considered exploiters. In addition, the field manager visited various markets in different parts of the country to scout potential untapped market opportunities. Farmers noted that the direct linkages resulted in substantive increase in prices from approximately 10 Ksh (0.1 USD) before the

project to about 50 Ksh (0.57 USD per kilogram) during the season when the study was conducted. For the traders, the sourcing became better coordinated as they could order large volumes through the CVs. Thus brokering such linkages as an innovation support service enhanced the farmers' position in the high value market.

Farmers were also linked to various input suppliers and advisory services, as noted earlier. In addition, farmers were linked to a local micro finance institution (MFI), which developed a credit product specifically for onion farmers (for purchasing of inputs) that had a flexible payment plan designed to coincide with the 4-month onion growing cycle. Many farmers, particularly in the older CV had obtained credit, but as some farmers explained, the application sometimes took too long to be approved which affected timely purchase of inputs; while for others, the amount approved was significantly less than what they had applied for. This shows the need to recognise differences between farmers, which would then have a bearing on how support services are organised and how these are made available to make them suitable for the different types of farmers.

Support related to enhancing individual entrepreneurship aimed to change farmers' attitude and practices of farming as a business. According to comments from the Ministry of Agriculture (MOA) officers and MFI representatives, this need for entrepreneurial capacity of smallholder farmers seemed to be a latent demand that needed to be stimulated. To address this demand, the project facilitated forums where representatives of the MFI and the MOA agri-business officers trained farmers on basic farm records and financial management, calculating profitability combined with general discussions on what it means to do farming as a business. However, the project did not follow up to see if the farmers had incorporated some of these ideas and skills into their practices. Interestingly, the discussions with farmers showed that they associated entrepreneurial support more with facilitating access to credit and markets rather than displaying a demand for specific skills, competences and attitudes. Thus, we see that in case of such latent demands related to entrepreneurship there was an apparent mismatch with the support provided. This highlights the importance of having a better understanding of such latent demands, and detecting these demands and supporting them requires adequate monitoring and feedback. In the following section, we analyse how the monitoring and feedback process contributed to a dynamic learning agenda.

5.4.4 *The role of monitoring and feedback processes in a dynamic learning agenda*

As indicated in the conceptual framework, monitoring and feedback are important components for guiding the matching of demand for and supply of innovation support as part of dynamic learning processes. From the interviews with the field manager and a review of monitoring reports, we noted that the information gathered through the formal monitoring system was mainly geared toward reporting on project progress. The project monitoring system comprised mainly a series of forms that were used to collect data for tracking project progress. As shown in tables 5.2 and 5.3, this formal monitoring system was used to capture pre-defined outcomes of the project (e.g. using indicators such as number of farmers that were growing hybrid varieties, yields attained, amount of inputs purchased collectively etc.). These indicators were linked to the demands identified at the onset of the project through the diagnostic study. However, the data was not systematically analysed and reflected upon, particularly in relation to whether the innovation support provided adequately met farmers' demands. Thus, the formal monitoring system did not adequately guide learning and the re-orienting of innovation support based on (re)emerging demands. In addition, we observed some informal feedback processes within the project, as shown in table 5.4. Farmers mainly expressed this feedback during various meetings. For example, the demonstration plots were set up in response to farmers' demand for further guidance on seed variety selection. Such informal feedback provided avenues for demand (re)articulation. While in some instances the feedback was used to re-orient activities to match the demands, most of the demands were not addressed (see table 5.4). For example, during a meeting, farmers indicated some concerns with the effect of intensive use of agro-chemicals on soils and indicated that they wanted research to look into this matter but there was no follow-up on this issue. Thus, the emerging needs from such informal feedback and the responses to the demands for support were somewhat arbitrary. These findings indicate a gap with the intermediary role of the project in terms of being a broker between demand and supply of services and the extent to which it organised to support a dynamic learning agenda.

Table 5.4: Summary of the emerging demands in the two domains and how these were matched to innovation support services

	Emerging needs/demands from farmers feedback	Matched innovation support services
Technical domain	More guidance in selecting suitable seeds for specific agro-ecological areas	Project liaised with some seed companies in collaboration with selected lead farmers to establish demonstration plots to test several varieties
	Poor seed germination of some of the varieties; general challenge of drought	X
	Poor efficacy of some of the agro-chemicals (pesticides and herbicides) purchased	Farmers linked directly to selected agro-chemical suppliers. But many farmers bought from local agro-input dealers.
	The need for more on farm experiments on the constraints related to pests and weeds management.	Facilitated more farmer to farmer visits to some of the lead farmers.
	Request for on-farm research to understand the effects of intensive agro-chemical application in onion production on the soils.	X
	Concerns with effects of applying agro-chemicals on human health.	Awareness raising by agro-chemicals company representatives during training sessions on the use of protective gear
	Increasing labour costs	X
Socio-institutional domain	Some organizational limitations of the CVs including low involvement of members in committees in some CVs and CPGs	Some support from CV facilitators
	Limited cooperation and conflict within some CVs	X
	Inconsistency with farmers keeping records related to their onion enterprise (e.g. inputs, labour costs, farm management tasks such as fertilizer application etc.)	X
	High cost and shortage of some seeds in the market	The project signed partnerships with one seed companies to make seeds readily available and at a discount in subsequent seasons.
	Some farmers had difficulties with accessing timely credit through the MFI due to procedural issues	X

*x- Indicates no action was undertaken to address the emerging demand.
(Source: Authors' data)

5.5 Discussion

5.5.1 *Matching demand and supply of innovation support services is part of a continuous learning and negotiated process*

Our results show that supporting learning in agricultural innovation processes is tied to linking the needs of actors, particularly farmers, to various resources and services that contribute to dynamic innovation processes. Importantly, the study showed that in the context of demand-driven pluralistic innovation support, the requisite for learning that underlies innovation processes trigger the mobilization of a network of different innovation support service providers who bring in different complementary knowledge, skills and resources necessary for innovation. This confirms recent findings of Chowa et al. (2012) that pluralistic advisory support systems are better tailored to support learning, and using the words of Birner et al. (2009) they hence do provide a menu of options. Our findings also support other studies which have shown that brokering roles (in this case fulfilled by FCI) are important in facilitating linkages among various actors, as they try to optimise a demand and supply match for innovation support services (Crawford et al., 2007 ; Klerkx & Leeuwis, 2008b).

What our study adds to earlier work on demand-driven innovation support services (Birner et al., 2009 ; Christoplos, 2010 ; Klerkx et al., 2006 ; Parkinson, 2009) is to show that there are continually emerging demands in innovation processes, triggered by new problems, uncertainties and challenges or new opportunities. Because of the many interacting socio-technical factors that determine the outcome of agricultural innovation processes (cf. Hall and Clark, 2010), these emerging problems, uncertainties, challenges and opportunities are not fully predictable. Therefore, supporting learning requires a fine-grained understanding of the various service farmers demands that emerge in the process and, matching these demands to a combined supply of services (Crawford et al., 2007 ; Klerkx & Proctor, 2013). It also requires an adequate monitoring system for capturing these demands, as in the conceptual framework (Figure 5.1). This is where the challenge lies with regard to supporting a dynamic learning agenda. While our results show that the FCI project mobilised different innovation support services, the process was not always effective in addressing emerging issues and adapting the agenda accordingly (e.g. a

demand for research to understand the effect of intensive input use in onion production on soils was not incorporated into the agenda as no research partners were mobilised as collaborators in the project). This ties to arguments against generic knowledge transfer models in innovation support interventions, which are not geared towards addressing everyday farmers' concerns and practices which are diverse and evolve over time (Hall & Clark, 2010 ; Parkinson, 2009).

Furthermore, our study indicates that matching demand and supply of innovation support services in pluralistic and privatised systems is a complex process, given that there are competing interests While input suppliers played an important role in training farmers, but in line with other findings, these service providers typically gear their advice to support sales of their products (Glover, 2007 ; Poulton et al., 2010), but did not fully engage in learning processes in which also the potential negative consequences of their products are discussed. There is also an interplay of power relations in such support systems, which has been noted to disadvantage smallholder farmers (Parkinson, 2009 ; Poulton et al., 2010). Therefore, intermediaries sometimes need to take an advocacy role to empower certain groups such as farmers. Taking such an advocacy role however requires careful balancing (cf. Klerkx et al, 2009), in order to remain legitimate to be able to engage all relevant actors including input suppliers in the evolving learning process.

5.5.2 *Monitoring and feedback processes and the learning agenda*

As the findings indicate, the project continually gathered data in order to monitor progress of the interventions in relation to the pre-defined project goal, such as tracking the adoption of hybrid seed varieties by farmers and the linked yield outcomes. However, the inadequate match with appropriate support for most of the emerging demands shows the limitations of this monitoring approach. Considering that the monitoring system had a focus on tracking pre-set goals, it was not able to adequately capture useful feedback on emerging demands of farmers as the process unfolded, and hence it reproduced a linear view of innovation processes. Our findings thus confirm that an indicator driven monitoring system is limited in its ability to systematically capture feedback and enable evolving demand (re)articulation, and hence improve the efficacy of action by linking to appropriate innovation support services. This builds on the argument that a dynamic

learning agenda should be linked to reflexive learning-oriented monitoring systems (Regeer, 2009 ; Ringsing & Leeuwis, 2008 ; van Mierlo et al., 2010a ; Woodhill, 2007).

Related to the issue of emerging demands not being adequately tracked, is the issue that feedback on some demands was easier to pick-up and match to particular innovation support service than other feedback. For example, linking farmers to agro-input providers was easily achieved compared to translating the demand for problem-oriented participatory research related to pest management and pesticide application into a concrete on-farm experiment. This confirms what other scholars have found (Labarthe, 2009 ; Parkinson, 2009 ; Van Mele, 2008), that some demands are not general and require sustained support over time, which poses challenges in operationalizing demand driven innovation processes, due to the investment required of time and money.

Furthermore, the results also show that demands emerging from feedback in the socio-institutional domain (e.g., building entrepreneurship capacity) were more latent than the technical demands (e.g., access to hybrid seeds) and thus were largely not addressed (Table 5.4). The limitation of supporting farmers to incorporate generic business skills and entrepreneurial attitudes points to a mismatch as regards the appropriateness of the support provided to agricultural enterprises. As some scholars have noted (Klerkx & Leeuwis, 2009c ; Phillipson et al., 2004), part of the difficulty in providing support related to enhancing business skills in agriculture has been a lack of familiarity of non-agricultural innovation support service providers with farmers (and vice versa), but also a limited understanding by 'traditional' agricultural innovation support providers of entrepreneurial learning processes that are more tacit and contextual (Cope, 2005). While most of the studies on support of entrepreneurship of farmers have been undertaken in the context of developed countries, our findings indicates this is also a concern in developing countries. Studies emerging from other developing and emerging countries indicate that dedicated entrepreneurship support programs are highly relevant to stimulate smallholders to become more entrepreneurial and market-oriented (Berdegué, 2001 ; Kaganzi et al., 2009 ; Namdar-Irani & Sotomayor, 2011).

Given the above problems related to demand articulation, our article re-emphasises the message from earlier work (Klerkx & Leeuwis, 2009c ; Parkinson, 2009) that adequate

effort should be put in optimizing the quality of demand articulation processes, including capturing the latent needs. When not putting sufficient attention to the quality of demand articulation, interventions may miss out on the broad range of farmers' needs and demands. This means that monitoring the process through continuous capture of information from both formal and informal feedback process is needed (Ringsing & Leeuwis, 2008). This is a key task of the intermediary actors involved in these interventions as brokers, which in this case was the role of the project staff. In order to enhance a dynamic learning agenda, the emphasis of such intermediaries should not be on controlling the process and monitoring predefined outcomes. Such a focus reduces the learning potential, as it tends to overlook feedback. Rather, emphasis should be on steering the process to enable optimal interactions between the demand and supply sides of the innovation processes, guided by a learning agenda. This indicates that the three principal functions of such intermediaries (demand articulation, network formation, and innovation process monitoring – see Klerkx and Leeuwis 2009b) should be performed in tandem. As has become clear from the previous section, while executing these functions, power dynamics between actors on the demand side (e.g., farmers) and the supply side (e.g., input suppliers) need to receive sufficient attention.

5.6 Conclusion

By applying the concept of a dynamic learning agenda, we bring in a new perspective to understanding how to enhance demand-driven innovation support service delivery. Our findings have shown that there is a need for a more nuanced understanding of the concept of 'best fit' in increasingly pluralistic agricultural innovation support service systems (Birner et al., 2009). As the findings show, it is crucial that farmers are assisted to navigate these systems to enable better targeted and context-specific support, especially in a context in which there are contrasting private and public interests, and power differences between farmers and innovation support service providers. As our analysis reveals, in fact several 'best-fits' should emerge through a continuous process of articulating of demands that are then linked to an adequate network of service providers with attention to the appropriateness of service modalities. Sufficient attention needs to be paid to evolving demands, and the quality of demand articulation needs to be high to be able to inform the choice for appropriate type of innovation support. Also, there may be a need to build

capacity to be able to provide certain types of innovation support services when these are not available (for example, entrepreneurship support). Hence, following Regeer (2009), intermediaries that act as brokers between demand for and supply of innovation support services within such innovation processes should put more attention to 'making the invisible visible'. This means incorporating learning oriented monitoring systems that integrate a learning agenda that enables optimally matching demand and supply of innovation support services.

From the foregoing, two policy implications can be derived: 1) more attention needs to be given to building adequate brokering capacities and embed the brokering role more centrally in agricultural development projects (Klerkx et al., 2009) and 2) as demand for and supply of innovation support cannot be fully determined ex-ante, policy makers and funders of agricultural development projects should incorporate a degree of flexibility in project funding, design and implementation supported by learning oriented monitoring , to stay in tune with the dynamics of demand-driven innovation processes that also considers the heterogeneity of farmers.

In terms of future research, looking at the development of dynamic learning agendas over a longer timeframe is needed, as our study was only able to capture some of the dynamism. Following Klerkx and Proctor (2013) recent findings on how 'alliances of advisors' form to provide an integrated palette of innovation support services, more research on how technical and socio–institutional advice (entrepreneurship support) can be optimally combined is needed. This is especially relevant in the context of complex systems of public and private pluralistic innovation support services which have emerged in many developing countries.

CHAPTER 6

General discussion and conclusions

6.1 Introduction

This thesis has explored how the innovation intermediary landscape has changed in the evolving setting of smallholder agricultural development in Kenya, and has examined how innovation intermediaries contribute to dynamic innovation processes. The study was guided by two main research objectives:

1. To investigate and characterise the changing landscape of innovation intermediaries in evolving smallholder agricultural development in Kenya, and
2. To unravel and assess the contribution of different innovation intermediary arrangements in supporting dynamic innovation processes.

In this chapter, I bring together the findings from the different chapters of the thesis, and discuss the cross-cutting issues and overall theoretical and policy implications. Section 6.2 provides a brief summary of the main findings that answer the research questions derived from the objectives. In section 6.3, I distil the cross-cutting issues and link them to broader debates, reflecting on the literature on agricultural innovation systems and innovation intermediation. Subsequently, in section 6.4, I reflect on policy and practical implications of this study. In section 6.5, I provide an outlook for further research, followed with some final remarks in section 6.6.

6.2 Overview of the main findings

6.2.1 *The changing innovation intermediary landscape*

To understand the changing innovation intermediary landscape, I conducted an exploratory case study through which 22 organisations identified as innovation intermediaries were systematically characterised. This study indicates that in recent years, the innovation intermediary landscape in the agricultural sector in Kenya has evolved from one dominated by a monopolistic traditional public extension service to a pluralistic system of innovation support services where new actors have emerged and traditional ones have repositioned themselves (chapter 2). These actors include public research and extension service organisations, private consultants and enterprises, producer organisations, NGOs, and consortia and networks of diverse organisations. These actors undertake an expansive range of functions to support technical, organisational, and institutional dimensions of smallholder agricultural innovation. The change in the

landscape is also reflected in funding support, which has shifted from predominantly public financing to a mix of public and private funding modalities. However, public funding remains the dominant source of financing in smallholder agricultural development. On the basis of these findings, I identified a typology of four innovation intermediation arrangements that connect to the diversity of innovation trajectories of smallholder systems. The typology includes technology brokers, systemic brokers, enterprise development support providers, and pro-poor input access support providers. This typology reflects the diverse nature of intermediation and suggests that the heterogeneity of smallholder production systems (e.g. staples and subsistence systems versus high value commodities) has influenced the emergence of different types of innovation intermediation arrangements.

6.2.2 *Role of intermediaries in supporting smallholders in dynamic agricultural innovation processes*

After providing a structural overview of innovation intermediaries in the agricultural sector in Kenya, the thesis research zoomed in on the roles innovation intermediaries play in supporting innovation processes (chapters 3 to 5). I sought to understand how innovation intermediaries shape innovation processes and contribute to the resultant outcomes. Chapters 3 and 4 present a case study of the East Africa Dairy Development (EADD) programme in Kenya, which was supporting innovation in smallholder dairy development. These two chapters investigate the EADD's role in supporting processes of co-evolution and coordination to catalyse Kenyan smallholder dairy innovation and development. Chapter 3 examines how the EADD consortium stimulated co-evolution of innovation by facilitating a multi-actor innovation platform. The innovation platform concept is applied to understand the intermediary role of the EADD in orchestrating linkages and interactions with diverse stakeholders at a high (sectoral) level. The findings show that the platform is in fact a set of intermediaries, with complementary organisational capacities, including in agricultural research and extension, business development and marketing, and dairy breeding and production. This set of intermediaries supported innovation at various levels of the dairy sector with the aim of improving smallholder dairy household incomes and livelihoods. They mobilised a diverse network of actors and resources (e.g. financing, technical and entrepreneurial support, inputs, and markets) necessary to enhance innovation. This iterative process enabled co-evolution of

innovation through simultaneous interventions combining new technological devices and new socio-institutional arrangements in smallholder dairy development. For example, the results show how the installation of chilling plant technology that integrated new information management systems shaped the organisation and management of the new dairy farmers' business associations (DFBAs) as an institutional innovation. These new arrangements boosted farmers' confidence in the new farmer-owned enterprise, thus encouraging many of them to join.

The study revealed that the platforms contributed to positive outcomes at farm level, such as the improvement in farmers' dairy production practices, e.g. better feeding methods and breeding that resulted in improved milk productivity in some households. At the DFBA level, the outcomes include increased milk marketing, enhanced farmer access to services and inputs, and overall business growth. However, the study also points to some tensions and dilemmas that emerged in the process and affected the innovation processes in unexpected ways. These dilemmas included challenges in facilitating adequate access for farmers to high quality inputs and some other innovation support services (e.g. extension, AI, seeds for feeds, etc.). In addition, lack of adequate feedback to support learning and re-orientation of the platform to address emerging issues hampered the process. The study suggests that some of these problems were linked to competing interests between the various intermediary organisations and a lack of adequate monitoring systems.

Chapter 4 investigates coordination to enhance smallholder producers' integration into the dairy value chain. It examines the notion of hub that is used in the EADD programme to operationalise such coordination among diverse actors in the dairy value chain The hub is an intermediary institution through which the DFBAs foster coordination of small farmers amongst themselves (horizontal coordination), between farmers and output market actors (vertical coordination), and between farmers and input and service providers (complementary coordination). The hub orchestrated new actor configurations, reshaping relationships between different actors, and this subsequently resolved some of the issues constraining smallholders' positioning in the dairy value chain (e.g. enhancing trust and cooperation, balancing power relations between actors). As the study shows, the main strength of the hub is that it simultaneously enables horizontal, vertical, and

complementary coordination through a combination of three functions: brokering, clustering, and acting as a one-stop shop. However, despite complementarities in different hub functions, hubs did not always manage to resolve all relationship issues. Although there were improved relationships among farmers, the relationships with input and output market actors were still suboptimal: farmers still lacked trust in the market players who continued to use their monopoly to manipulate milk prices paid to farmers, and in innovation support actors who continued to provide inadequate services. These issues of lack of trust need continuous attention, and this suggests that coordination by the hub should not just be about establishing the linkages (matchmaking between actors) but also about continuous relationship management at the various actor interfaces. The findings also raises questions relating to broader debates, such as the effectiveness of farmer organisations in undertaking such coordination functions through hubs, the sustainability of such hub models, and the extent to which hubs pay sufficient attention to the heterogeneity among smallholder farmers.

Chapter 5 studies how learning as a central element in innovation processes supports market-oriented smallholder development efforts in Kenya. The dynamic learning agenda concept is applied to a case study of a project focusing on smallholder commercialisation of bulb onions, to understand whether and how, within innovation processes, continuously evolving smallholder farmers' demands for information and other types of support are adequately matched to innovation support services. The findings show that, in the context of demand-oriented and pluralistic innovation support service provision, learning relates to the interplay of matching the demands for support articulated by farmers to appropriate networks of service providers providing a varied range of production and business-oriented services. This matching was supported by the project acting as an intermediary that mobilised a network of public and private innovation support services and input providers who brought in the complementary knowledge, skills, and resources necessary for the innovation processes. This contributed to outcomes in the technical (e.g. adoption of improved onion varieties, higher onion yield) and socio-institutional (e.g. enhanced farmer collective action in accessing inputs and support services and in marketing) dimensions. The findings confirm that farmers' demands for support continually evolve as socio-technical factors in innovation processes interact in unpredictable ways. Although

the project was effective in mobilising a diverse network of innovation support services, it did not always adapt to address emerging demands for support along the process. For example, there was no follow-up on farmers' feedback on concerns about the effects of agro-chemicals on soils and their demand for related research support. This pointed to gaps in the project's monitoring and feedback approach, which mainly tracked pre-set project goals. Thus, there was no systematic capturing of feedback and re-orienting of the interventions according to emergent needs in line with a dynamic learning agenda.

In summary, the thesis shows that the role of intermediaries in supporting agricultural innovation processes is pervasive and highly multi-faceted. As figure 6.1 below illustrates, dynamic innovation processes occur simultaneously in multiple cycles and at multiple levels. The intermediaries are anchored through various forums such as platforms and hubs to fulfil various functions in order to support these processes.

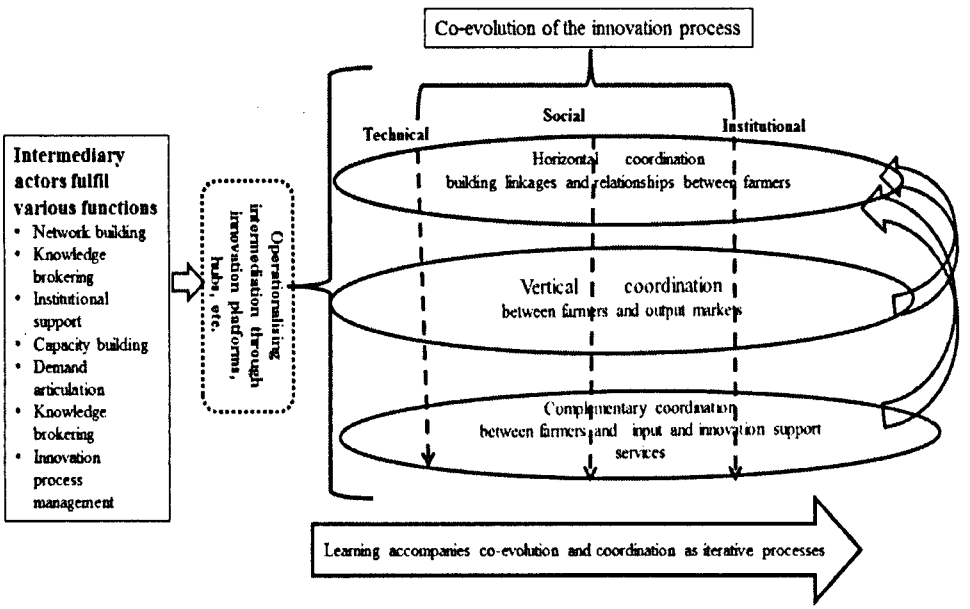

Figure 6.1: Overview of the role of innovation intermediaries in supporting dynamic and complex innovation processes

6.3 Discussion of cross-cutting issues and conclusions

The findings of the thesis touch upon several cross-cutting issues that contribute to various theoretical debates about the role of innovation intermediaries in shaping and contributing to supporting smallholder agricultural innovation processes, and to the generic literature on innovation intermediaries. I reflect on three major issues:

i) The ways in which systems of innovation intermediaries are shaped in specific contexts,

ii) Micro-level action of innovation intermediaries and the dynamic roles innovation intermediaries play in innovation processes, and

iii) Tensions and dilemmas of intermediation.

6.3.1 *The structural view on intermediaries: The ways in which systems of innovation intermediaries are shaped in specific contexts*

The literature suggests that the emergence of innovation intermediaries is highly dependent on their specific historical and institutional settings, in which they emerge, with a resultant influence on their set-up and functions (Klerkx et al., 2009). Chapter 2 clearly shows in the Kenyan context a great diversity of intermediary actors who undertake a broad range of functions. These include demand articulation, network brokering, knowledge brokering, innovation process management, capacity building, and institutional support.

An important finding here, which adds to earlier studies on the functions of innovation intermediaries (Batterink et al., 2010 ; Howells, 2006 ; Klerkx et al., 2009), is that, in the context of smallholder development, innovation intermediaries are not taking on a "neutral facilitator" role but contribute substantively to the innovation process by providing knowledge, institutional support, and doing advocacy. They not only aim to optimise interactions in innovation systems, but given the immaturity of these systems, they actively fill gaps by taking up roles that are elsewhere fulfilled by other actors. To fulfil these functions, the intermediaries undertake various activities, most of which are geared towards capacity building and institutional support (e.g. initiating and organising farmer groups, changing actor attitudes, and training). It hence appears that, given the context of smallholder development, empowerment and advocacy are much more

important goals of innovation intermediaries, whereas this is less the case in developed countries. This supports earlier findings by Goldberger (2007) and Kingiri and Hall (2012), and alludes to what other authors have noted, that is: the role of intermediaries in supporting institutional change is central to enhancing smallholder innovation and agricultural development (Hounkonnou et al., 2012 ; Poulton et al., 2010).

Furthermore, chapter 2 proposes a typology of intermediary actors representing the evolving and diverse smallholder farming systems. The typology shows the diversity of innovation intermediaries exist, thus reflecting the heterogeneity of smallholder agricultural systems that include a mix of subsistence and increasingly market-oriented production systems. This underscores the important role of context in determining the types of innovation intermediaries that emerge, as suggested byKlerkx et al. (2009), and reinforces the importance of going beyond "one-size-fits-all" models (Tödtling & Trippl, 2005). Chapter 2 confirms the importance of acknowledging diversity, but it also shows that, regardless of context, innovation intermediary structures may follow certain trends related to some types of innovation intermediaries. As all chapters show, the re-orientation of the agricultural sector towards an entrepreneurial model leads to a need for innovation intermediaries in linking farmers to business support to complement technical support. This is particularly important because of the lack of familiarity between farmers and those that provide business support services. The focus on connecting agricultural entrepreneurs to business support has already been found in emerging and developed countries (Berdegué, 2001 ; Klerkx & Leeuwis, 2008b ; Phillipson et al., 2004), and has now also emerged in developing countries such as Kenya, given the push towards the commercialisation of smallholder farming (Ochieng, 2007 ; Wongtschowski et al., 2013) .

The emphasis on context also adds to the understanding of the institutional and organisational set-up of the innovation intermediary landscape. The study by Klerkx and Leeuwis (2009a) showed that, in the Dutch context, new dedicated organisations emerged as innovation brokers in the context of full privatisation of the agricultural knowledge infrastructure and the emergence of a knowledge market. Chapter 2 shows that, in the Kenyan context, this distinction of specialised brokers is less apparent - only a few organisations identify themselves as specialised brokers but the majority have a more hybrid character, of both facilitator and technical expert. The intermediary landscape in

Kenya combines both public and private actors that have evolved in a policy context of a shift towards demand-driven, pluralistic extension services and public–private partnership modalities for supporting smallholder agricultural innovation and development. This has implications for suggestions made in the literature that innovation intermediation, especially in developing countries, can be understood as a reframing of the role and the functions of public extension services (Christoplos, 2010 ; Rivera & Sulaiman, 2009). In relation to the challenges articulated by Rivera and Sulaiman (2009) and Devaux et al. (2009) to retool extension for this purpose, chapter 2 shows that extension is lagging behind the reality of other organisations taking up this role, and it may hence no longer be a viable option for public extension services.

6.3.2 *Micro-level actions of innovation intermediaries in supporting agricultural innovation processes*

As noted in the chapter 1, Sapsed et al. (2007) point to a lack of understanding of how intermediaries contribute to innovation processes and what makes them effective. In connection with this gap in the literature, chapters 3 to 5 analyse the micro-level action of intermediaries in supporting key processes in innovation, including co-evolution, coordination, and learning. From the findings, two cross-cutting issues emerge: i) the distributed nature of intermediation in innovation processes and ii) the dynamic interplay between demand for and supply of innovation support services.

The distributed nature of intermediation

As regards the distributed nature of intermediation in innovation processes, the findings in chapters 3, 4 and 5 show that agricultural innovation processes are multi-layered, multi-level, and iterative involving a complex constellation of actors. As such, the role of intermediaries in support of these processes is distributed. Chapter 2 focused on a sector and country wide overview of the system of innovation intermediaries, and identified consortiums as one of the intermediary arrangements used to facilitate innovation processes; but the analysis did not show how these structures operate. In the EADD case study (chapter 3); this consortium comprising five different organisations working together was unravelled. The analysis shows that such intermediary arrangements comprise sets of innovation intermediaries; this enables division of labour among the

various organisations, which bring in different competencies and skills that enable them to fulfil various intermediary functions. Hence, some of the organisations focused more on providing business-related support, whereas others concentrated on technical and knowledge (in this case for dairy production) support. The complementarity of roles integrating technical and socio-institutional aspects to support smallholder agricultural development is what makes such distributed intermediary structures effective in shaping co-evolution of innovation processes.

The distributed nature of intermediation should be understood not only from the perspective of different functions fulfilled by different organisations in the EADD consortium, but also from the perspective of how this support is performed spatially and temporally to address different aspects of innovation in dairy production (breeding, feed improvement) and marketing. The results in chapters 3, 4, and 5 show that the catalysing and the facilitation of innovation processes require a project structure or a forum that enables intermediaries to operate; this also seems to be linked to geographically delineated locations. In chapter 3, these structures are denoted as innovation platforms (IP) that operate at higher levels and strategically facilitate interactions among diverse actors in the dairy sector in order to achieve the objectives of the EADD programme. At the local level, hubs and the commercial village model are the structures that provide the forum for day-to-day interactions among multiple actors, the majority of whom are input and innovation support service providers and output market players (chapters 4 and 5, respectively).

The findings on how sets of innovation intermediaries operate through platforms and hubs contrast with earlier work which has always looked at a single innovation intermediary's actions in innovation processes (e.g. (Batterink et al., 2010 ; Katzy et al., 2013) and supports findings by others (Hermans et al., 2013 ; Klerkx & Aarts, 2013 ; Stewart & Hyysalo, 2008). The findings in chapter 3 provide evidence to confirm Stewart and Hyysalo (2008) proposition that ecologies of intermediaries exist, where different intermediaries working together on the same innovation project effectively support innovation because of their different capabilities based on their organisational backgrounds. However, as our results also show, such arrangements are prone to competition and conflict between the different intermediaries, as also noted by Klerkx and Aarts (2013), and further analysis is required on how these dynamics affect their

contribution to innovation processes. Because the co-evolution process cannot be determined ex-ante, the coordination of these processes need to be adaptive (Klerkx et al., 2010 ; Moors et al., 2004), and the analysis shows that one of the weaknesses of the distribution of roles among the different innovation intermediaries is that they are not able to respond to some of the emerging issues, and a key question for further research is what causes such inertia.

Dynamic interplay between demand for and supply of innovation support services

In relation to the cross-cutting issue of the dynamic interplay between demand and supply for innovation support services, chapters 4 and 5 analyse the role of innovation intermediaries in relation to facilitating demand-driven and pluralistic innovation support. In both chapters, the analysis shows that, in market-oriented smallholder agricultural development, farmers rely on a variety of external knowledge and support services to develop their enterprises. Consequently, intermediaries are crucial to linking smallholder farmers to adequate networks of input providers and innovation support service providers. This is particularly important in what are considered emerging "knowledge markets" in agricultural innovation systems (Clark, 2002 ; Leeuwis, 2000). The study adds to earlier work on demand-driven agricultural innovation support services which have taken a rather static view on describing demand-driven service provision (Birner et al., 2009 ; Christoplos, 2010 ; Klerkx et al., 2006 ; Parkinson, 2009). The study shows that in innovation processes there are continually emerging demands from smallholders for adequate support services, triggered by new problems, uncertainties, and challenges, or new opportunities. This requires intermediaries to continuously facilitate demand articulation or stimulation, aggregate these demands and provide guidance in the search and matching process, and continually connect smallholders to networks of actors who can provide appropriate inputs and services. The findings critique a static notion of demand articulation as a one-off activity, and support findings of other authors who emphasise the role of intermediaries in guiding the iteration of demand articulation and matching to the relevant support services (Boon et al., 2008 ; Kibwika et al., 2009).

As chapters 4 and 5 show, innovation intermediaries juggle many tasks in such processes (demand articulation, network brokering, monitoring and feedback) and engage in

different types of coordination between different actors (horizontally, vertically and complementary), thus producing synergetic effects and making intermediary work effective. However, the intermediaries still face difficulties in improving the quality of relationships between actors (chapter 4) and in capturing feedback and supporting the learning process (chapter 5). A main implication is that innovation intermediation should be seen as a task requiring relational embeddedness within innovation networks and an active role in innovation processes, instead of a limited involvement (i.e. leaving after initial demand articulation and network brokering), as others have also argued (Agogué et al., 2013).

6.3.3 *Tensions, dilemmas, and gaps of innovation intermediaries*

The need for deliberate efforts to facilitate smallholder commercialisation is guided by current policy and practice discourse on agricultural development. Although the results of this thesis show that innovation intermediaries such as the EADD and the farmer organisations connected to the hubs are contributing to shaping innovation processes, in line with earlier findings (Klerkx & Leeuwis, 2009a) their functioning is fraught with tensions and dilemmas. The findings in chapters 3, 4, and 5 indicate that the main tension lies in a combination of: 1) intermediaries' capacities for innovation intermediation and 2) intermediaries' normative orientation and hence blind spots and gaps in the services they provide.

Chapter 4 highlights farmer organisations' limited capacity and clout in the coordination and management of relationships to influence power and information asymmetries between various actors in agri-value chains. This raises questions about farmer organisations' competencies for innovation intermediation, and about the assumption that farmer organisations can take on broader roles in brokering value chain coordination, as is increasingly promoted in development discourse (Biénabe & Sautier, 2005 ; World Bank, 2007). Others have argued that power, negotiation skills, and political representation are necessary if farmer organisations are to take on such broad value chain coordination roles. This remains a challenge for most smallholder farmer organisations (Biénabe & Sautier, 2005 ; Chirwa et al., 2005 ; Yang, 2013). Furthermore, in chapters 3 and 5 the findings point to capacity problems in relation to the effective monitoring necessary for adaptively

supporting innovation processes. To enhance effective monitoring, the intermediaries need to support continuous reflexivity guided by a well-defined learning agenda in the process (Regeer, 2009 ; van Mierlo et al., 2010a). This limited capacity is partly caused by the broader institutional context of project-driven interventions. Our case studies show that agricultural innovation projects in Kenya rely on external and donor-driven funding. Most of these projects are designed with pre-define outcomes that constrain intermediaries from adapting project agendas in response to emergent needs and unexpected outcomes. This suggests, as indicated in chapter 2 and noted in the literature (Klerkx et al., 2009), that a more permanent source of funding for innovation intermediation would improve its quality.

A finding in relation to blind spots, and connected to the above-noted capacity issues, is that interventions (e.g. through EADD platforms, hubs, and the commercial villages in the bulb onion project – see chapters 3, 4, and 5) in most cases provide generic support and do not pay sufficient attention to smallholder farmers' heterogeneity and the related agri-production systems and value chains in which they are embedded. This is informed by intermediaries' normative orientation towards supporting public policy goals in promoting smallholder commercialisation. Balancing the ambition to integrate enterprises into value chains while still being inclusive and defending the interests of all their diverse members is shown to be a challenge for many smallholder farmer organisations (Chirwa et al., 2005 ; Ton & Bijman, 2006). This is line with what Poole et al. (2013) have cautioned, that many interventions geared towards supporting smallholder commercialisation are promoting homogenous models that do not take into account smallholder diversity in terms both of opportunities and of ambitions and goals. This links to other arguments showing that supporting innovation requires careful consideration of farmers' risks, resource constraints (including biophysical), and broader sustainability concerns of smallholders and more generally of family farming (Schut et al., 2011 ; Snapp et al., 2003 ; van der Ploeg, 2008). Given the largely dispersed smallholder producers, the challenge of providing individualised support to farmers, particularly in a context where farmers may not be able to pay for individual advisory services, and addressing that challenge, requires more experimentation on which modalities would best fit.

Viewed in the light of earlier findings that note similar issues around normativeness (which might be needed to bring about change) versus neutrality in brokering relationships and funding limitations (Klerkx et al., 2009), these tensions appear to support the notion that innovation intermediary work is about continuous balancing. Although, as noted in section 6.2.1, the Kenyan innovation intermediary landscape in the agricultural sector has evolved to fit the context (e.g. limited occurrence of specialised innovation intermediaries), this has its own limitations as this section has shown.

6.4 Implications for policy and practice

From the above cross-cutting analysis, several implications for policy and practice can be derived:

- Agricultural development policy goals in Kenya and elsewhere have shifted towards demand-driven and pluralistic system approaches that emphasise coordination of interactions between multiple public and private actors in innovation processes. To foster such interactions then, there is need to pay explicit public policy attention to innovation intermediaries. Supporting these mechanisms will require public funding or a more long-term donor commitment, in the absence of market incentives to make this role self-sufficient.
- Another key implication relates to the current policy orientation towards supporting smallholder commercialisation. To advance this policy agenda, the government should support various innovation intermediation models rather than a one-size-fits-all model, in order to match both smallholder diversity and some sectoral differences. This means that public policy needs to determine which models or organisations are best suited to supporting different innovation contexts. Thus, the government needs to better acquaint itself with the diversity of functions that intermediary organisations undertake in order to guide investments.
- In order to entrench the innovation intermediary role in the Kenyan agricultural innovation system and elsewhere in sub-Saharan Africa (SSA), policy needs to pay attention to building adequate innovation intermediation capacities. It needs to provide support to innovation intermediaries, including funding, coaching, and mentoring, in order to embed the innovation intermediation role more centrally in

agricultural development projects. As demand for, and supply of, innovation support cannot be fully determined ex-ante, policymakers and funders of agricultural development projects should incorporate a degree of flexibility in project funding, design, and implementation, supported by learning-oriented monitoring.

- To strengthen in developing countries the role of innovation intermediaries that are increasingly working together through forums such as hubs and platforms, government needs to provide support to such arrangements, paying attention to how an optimal division of labour between public and private innovation intermediaries can be achieved. This study reinforces earlier observations that such platforms can be operationalised in different ways.

6.5 Outlook for further research

In this section, based on the different chapters, recommendations for further research are formulated in relation to the role of intermediation in agricultural innovation systems.

- Future policy-oriented research could provide guidance to determine the suitability of different innovation intermediary models to accommodate the diversity of smallholder innovation trajectories. This is particularly important for Kenya, similar to other SSA countries, as the innovation system and knowledge market is maturing. It includes further mapping the agricultural sector to establish whether there are other forms and types of innovation intermediaries, or whether an evolution can be observed in terms of the scope, focus, and functions of existing intermediaries.
- Future research on innovation network governance, examining different forms of innovation intermediation arrangements for different innovation objectives (following (following Provan & Kenis, 2008), would be useful to guide in determining which innovation intermediation arrangements work for which scenario, with particular attention to farmers' heterogeneity. Following Poncet et al. (2010) and Klerkx and Aarts (2013), this also includes analysing role division between formally appointed innovation intermediaries and informal intermediaries.

- To understand how to better embed learning-oriented monitoring, future research could investigate how different forms of monitoring can be combined to better guide adaptive management of innovation platforms. Such analysis should also focus on how conflicts between intermediaries affect the innovation process and how these are resolved, and how innovation intermediaries decide on labour divisions when new issues emerge (to avoid inertia).
- Some of the findings indicate that there are some gendered dimensions to how effective intermediaries support smallholder agricultural innovation. While this study did not provide a critical gender analysis of the processes, the findings suggest this is an area for further research. Sarapura (2013) has identified several areas of research on gender and agricultural innovation processes. However, given this study's findings, it would be of particularly interest to understand the extent to which innovation intermediaries provide gender responsive support.

6.6 Final remarks

Overall, this thesis has situated innovation intermediaries as central rather than as tangential (Howells, 2006) to understanding innovation processes. The findings have shown the complexity of intermediation in innovation processes- a complexity that tends to be underestimated in theoretical and empirical analyses in innovation studies. By exploring the structure of innovation intermediaries in the Kenyan agricultural sector, the thesis has provided an in-depth overview of the diversity of innovation intermediaries that reflects the diverse realities and innovation trajectories of smallholders. The findings add insight into the diversity and dynamics aspects of intermediation in supporting various innovation processes, including co-evolution, coordination, and learning, that occur simultaneously but not always congruently. The findings demonstrate how various intermediaries work together, taking on complementary roles in the unpredictable but continuously evolving processes. In these processes, the innovation intermediaries are confronted with tensions, dilemmas, and gaps that affect their effectiveness as innovation support actors. Thus, an overarching conclusion is that the embedding of innovation intermediaries in agricultural innovation systems is important in supporting and catalysing innovation processes, and that their emergence, positioning, and contributions are contingent on the specific socio-political and even biophysical context.

References

Adekunle, A. A. & Fatunbi, A. O. (2012). Approaches for setting-up multi-stakeholder platforms for agricultural research and development. World Applied Sciences Journal 16(7): 981-988.

Agogué, M., Ystrom, A. & Le Masson, P. (2013). Rethinking the role of intermediaries as architect of collective exploration and creation of knowledge in open innovation. International Journal of Innovation Management 17(02): 1350007.

Assefa, A., Waters-Bayer, A., Fincham, R. & Maxwell, M. (2009). Comparison of frameworks for studying grassroots innovation: Agricultural Innovation Systems (AIS) and Agricultural Knowledge and Innovation Systems (AKIS). In Innovation Africa : enriching farmers' livelihoods. P. C. Sanginga, A. Waters-Bayer, S. Kaaria, J. Njuki and C. Wettasinha. London, Earthscan: 35-56.

Ayele, S., Duncan, A., Larbi, A. & Khanh, T. T. (2012). Enhancing innovation in livestock value chains through networks: lessons from fodder innovation case studies in developing countries. Science and Public Policy 39(3): 333-346.

Barham, J. & Chitemi, C. (2009). Collective action initiatives to improve marketing performance: lessons from farmer groups in Tanzania. Food Policy 34(1): 53-59.

Barrett, C. B. (2008). Smallholder market participation: concepts and evidence from eastern and southern Africa. Food Policy 33(4): 299-317.

Batterink, H., M, Wubben, M., F, E, Klerkx, L. & Omta, F., W, S (2010). Orchestrating innovation networks: the case of innovation brokers in the agri-food sector. Entrepreneurship & Regional Development 22(1): 47-76.

Berdegué, J. A. (2001). Cooperating to compete: associative peasant business firms in Chile. PhD thesis. Wageningen, Wageningen University.

Bernard, T. & Spielman, D. J. (2009). Reaching the rural poor through rural producer organizations? A study of agricultural marketing cooperatives in Ethiopia. Food Policy 34(1): 60-69.

Biénabe, E. & Sautier, D. (2005). The role of small scale producers' organizations to address market access (draft). International seminar on Beyond agriculture: making markets work for the poor. London, 28th February- 1st March.

Biggs, S. (2007). Building on the positive: an actor innovation systems approach to finding and promoting pro-poor natural resources institutional and technical innovations. International Journal of Agricultural Resources Governance and Ecology 6(2): 144-164.

Biggs, S. D. (1990). A multiple source of innovation model of agricultural research and technology promotion. World Development 18(11): 1481-1499.

Bingen, J., Serrano, A. & Howard, J. (2003). Linking farmers to markets: different approaches to human capital development. Food Policy 28(4): 405-419.

Birner, R., Davis, K., Pender, J., Nkonya, E., Anandajayasekeram, P., Ekboir, J., Mbabu, A., Spielman, D. J., Horna, D., Benin, S. & Cohen, M. (2009). From best practice to best fit: a framework for designing and analyzing pluralistic agricultural advisory services worldwide. The Journal of Agricultural Education and Extension 15(4): 341-355.

Blackmore, C. (2007). What kinds of knowledge, knowing and learning are required for addressing resource dilemmas?: a theoretical overview. Environmental Science & Policy 10(6): 512-525.

Blaikie, N. W. H. (2000). Designing social research: the logic of anticipation. Cambridge, UK; Malden, MA, Polity Press.

Boon, W. P. C., Moors, E. H. M., Kuhlmann, S. & Smits, R. E. H. M. (2008). Demand articulation in intermediary organisations: The case of orphan drugs in the Netherlands. Technological Forecasting and Social Change 75(5): 644-671.

Boon, W. P. C., Moors, E. H. M., Kuhlmann, S. & Smits, R. E. H. M. (2011). Demand articulation in emerging technologies: Intermediary user organisations as co-producers? Research Policy 40(2): 242–252.

Braun, A. R., Thiele, G. & Fernández, M. (2000). Farmer field schools and local agricultural research committees: complementary platforms for integrated decision-making in sustainable agriculture. ODI AgREN Network paper 105: 1-20.

Chan, K.-Y. A., Oerlemans, L. A. G. & Pretorius, M. W. (2010). Knowledge exchange behaviours of science park firms: the innovation hub case. Technology Analysis & Strategic Management 22(2): 207-228.

Chirwa, E., Dorward, A., Kachule, R., Kumwenda, I., Kydd, J., Poole, N., Poulton, C. & Stockbridge, M. (2005). Walking tightropes: supporting farmer organizations for market access. Natural Resource Perspectives 99:1-6.

Chowa, C., Garforth, C. & Cardey, S. (2013). Farmer experience of pluralistic agricultural extension, Malawi. The Journal of Agricultural Education and Extension 19(2): 1-20.

Christoplos, I. (2010). Mobilizing the potential of rural and agricultural extension. Rome, FAO.

Clark, N. (2002). Innovation systems, institutional change and the new knowledge market: implications for third world agricultural development. Economics of Innovation and New Technology 11(4): 353 - 368.

Clark, N., Hall, A. & Sulaiman, R. (2003). Research as capacity building: the case of an NGO facilitated post-harvest innovation system for the Himalayan Hills. World Development 31(11): 1845-1863.

Cleaver, F. (2002). Reinventing institutions: bricolage and the social embeddedness of natural resource management. The European Journal of Development Research 14(2): 11-30.

Cope, J. (2005). Toward a dynamic learning perspective of entrepreneurship. Entrepreneurship Theory and Practice 29(4): 373-397.

Crawford, A., Nettle, R., Paine, M. & Kabore, C. (2007). Farms and learning partnerships in farming systems projects: a response to the challenges of complexity in agricultural innovation. The Journal of Agricultural Education and Extension 13(3): 191-207.

Crawford, E., Kelly, V., Jayne, T. S. & Howard, J. (2003). Input use and market development in Sub-Saharan Africa: an overview. Food Policy 28(4): 277-292.

Creswell, W., J (2002). Research design: Qualitative, quantitative and mixed method approaches. Thousand Oaks, California, Sage.

Davis, K. (2008). Extension in sub-Saharan Africa: overview and assessment of past and current models and future prospects. Journal of International Agricultural and Extension Education 15(3): 15-28

Denzin, N. K. (1970). The research act; a theoretical introduction to sociological methods. Chicago, Aldine Pub. Co.

Devaux, A., Andrade-Piedra, J., Horton, D., Ordinola, M., Graham, T., Thomann, A. & Claudio, V. (2010). Brokering innovation for sustainable development: the Papa Andina case. ILAC working paper 12.Institutional Learning and Change (ILAC) Initiative.

Devaux, A., Horton, D., Velasco, C., Thiele, G., López, G., Bernet, T., Reinoso, I. & Ordinola, M. (2009). Collective action for market chain innovation in the Andes. Food Policy 34(1): 31-38.

Dhanaraj, C. & Parkhe, A. (2006). Orchestrating Innovation Networks. The Academy of Management Review 31(3): 659-669.

Dormon, E. N. A., Leeuwis, C., Fiadjoe, F. Y., Sakyi-Dawson, O. & van Huis, A. (2007). Creating space for innovation: the case of cocoa production in the Suhum-Kraboa-Coalter District of Ghana. International Journal of Agricultural Sustainability 5(2-3): 232-246.

Dorward, A., Kydd, J. & Poulton, C. (2005). Beyond liberalisation: "developmental coordination" policies for African Smallholder Agriculture. IDS Bulletin 36(2): 80-85.

EADD (2009a). Constraints to use of artificial insemination service and possible solutions. East Africa Dairy Development project baseline surveys report 2 Nairobi, EADD.

EADD (2009b). Dairy production and marketing. East African Dairy Development project baseline surveys report 5. Nairobi, EADD.

EADD (2009c). Feeds and feeding practices. East African Dairy Development project baseline surveys report 3. Nairobi, EADD.

EADD (2009d). Livestock disease challenges and gaps in animal health service delivery . East Africa Dairy Development project baseline surveys report 4. Nairobi, EADD.

EADD (2011a). Kenya DFBAs milk production and marketing volumes data. internal project document. Nairobi.

EADD (2011b). Milking for profit: Mid term report 2008-2010. Nairobi, EADD.

EADD Kenya (2011). The lessons and strategies for NCE and CE period 2012-2013 for EADD Kenya. presentation at annual review and planning meeting. November 2011. Nairobi, EADD

Eastwood, C. R., Chapman, D. F. & Paine, M. S. (2012). Networks of practice for co-construction of agricultural decision support systems: Case studies of precision dairy farms in Australia. Agricultural Systems 108: 10-18.

Edquist, C. & Johnson, B. (1997). Institutions and organizations in sytems of innovation. In Systems of innovation: technologies, institutions, and organizations. C. Edquist. London, Pinter, Casell Academic.

Eenhoorn, H. (2007). Food security and entrepreneurship. Wageningen, Centre for sustainable development and food security, Wageningen University.

Eisenhardt, K. M. (1989). Building theories from case study research. The Academy of Management Review 14(4): 532-550.

Ekboir, J. M. (2003). Research and technology policies in innovation systems: zero tillage in Brazil. Research Policy 32(4): 573-586.

Ekboir, J. M. & Vera-Cruz, A. O. (2012). Intermediary organisations to foster the agricultural system of innovation: the Mexican produce foundation. International Journal of Technological Learning, Innovation and Development 5(1): 111-125.

Engel, P. G. H. (1995). Facilitating innovation: an action-oriented approach and participatory methodology to improve innovative social practice in agriculture. PhD thesis. Wageningen University, Wageningen, The Netherlands.

Ewing, M. & Msangi, S. (2009). Biofuels production in developing countries: assessing tradeoffs in welfare and food security. Environmental Science & Policy 12(4): 520-528.

Farm Concern International (2010). Enhancing regional trade alliance for bulb onions exit report. Nairobi, Farm Concern International.

Farm Concern International (2011). Smallholder commercialization through the commercial villages model: learning from experience. A draft report. Nairobi, Farm Concern International.

Felzensztein, C. (2008). Clusters, social networks and marketing collaboration in small firms: Exploratory evidence from Chile and Scotland. International Journal of Entrepreneurship and Small Business 6(2): 230-244.

Fischer, C. & Hartmann, M. (2010). Agri-food chain relationships. Wallingford, CABI.

Flyvbjerg, B. (2006). Five misunderstandings about case-study research. Qualitative Inquiry 12(2): 219-245.

Gebremedhin, B., Hoekstra, D. & Tegegne, A. (2006). Commercialization of Ethiopian agriculture: extension service from input supplier to knowledge broker and facilitator. IPMS working paper no. 1, ILRI.

Gerring, J. (2004). What is a case study and what is it good for? American Political Science Review 98(2): 341-354.

Gildemacher, P. R. (2012). Innovation in seed potato systems in Eastern Africa. PhD thesis. Wageningen University, Wageningen, The Netherlands.

Glover, D. (2007). Farmer participation in private sector agricultural extension. IDS Bulletin 38(5): 61-73.

Goldberger, R. J. (2007). Non-governmental organizations, strategic bridge building, and the "scientization"of organic agriculture in Kenya. Agriculture and Human Values 25(2): 1-19.

Gray, M., Golob, E. & Markusen, A. (1996). Big firms, long arms, wide shoulders: the 'hub-and-spoke' industrial district in the Seattle region. Regional Studies 30(7): 651-666.

Ha, T. T. T., Bush, S. R. & van Dijk, H. (2013). The cluster panacea?: questioning the role of cooperative shrimp aquaculture in Vietnam. Aquaculture 388–391: 89-98.

Hall, A., Bockett, G., Taylor, S., Sivamohan, M. V. K. & Clark, N. (2001). Why research partnerships really matter: innovation theory, institutional arrangements and implications for developing new technology for the poor. World Development 29(5): 783-797.

Hall, A. & Clark, N. (2010). What do complex adaptive systems look like and what are the implications for innovation policy? Journal of International Development 22(3): 308-324.

Hall, A., Clark, N. & Frost, A. (2010). Bottom-up, bottom-line: development-relevant enterprises in east africa and their significance for agricultural Innovation. RIU Discussion Paper. 2.

Hall, A., Mytelka, L. & Oyeyinka, B. (2006). Concepts and guidelines for diagnostic assesments of agricultural innovation capacity. Maastricht, UNU/MERIT.

Hargadon, A. B. (2002). Brokering knowledge: linking learning and innovation. Research in Organizational Behavior 24: 41-85.

Hartwich, F. & Tola, J. (2007). Public-private partnerships for agricultural innovation: concepts and experiences from 124 cases in Latin America. Int. J. Agricultural Resources, Governance and Ecology 6(2): 240-255.

Heemskerk, W. & Wennink, B. (2004). Building social capital for agricultural innovation : experiences with farmer groups in sub-Saharan Africa. Bulletins of the Royal Tropical Institure. Amsterdam, Royal Tropical Institute (KIT). Bulletin 368.

Hekkert, M. P. & Negro, S. O. (2009). Functions of innovation systems as a framework to understand sustainable technological change: empirical evidence for earlier claims. Technological Forecasting and Social Change 76(4): 584-594.

Hellin, J. (2012). Agricultural Extension, collective action and innovation systems: lessons on network brokering from Peru and Mexico. The Journal of Agricultural Education and Extension 18(2): 141-159.

Hellin, J., Lundy, M. & Meijer, M. (2009). Farmer organization, collective action and market access in Meso-America. Food Policy 34(1): 16-22.

Hermans, F., Stuiver, M., Beers, P. J. & Kok, K. (2013). The distribution of roles and functions for upscaling and outscaling innovations in agricultural innovation systems. Agricultural Systems 115: 117-128.

Hermans, F., van Apeldoorn, D., Stuiver, M. & Kok, K. (2012). Niches and networks: explaining network evolution through niche formation processes. Research Policy 42(3): 613-623.

Hoholm, T. & Araujo, L. (2011). Studying innovation processes in real-time: the promises and challenges of ethnography. Industrial Marketing Management 40(6): 933-939.

Hounkonnou, D., Kossou, D., Kuyper, T. W., Leeuwis, C., Nederlof, E. S., Röling, N., Sakyi-Dawson, O., Traoré, M. & van Huis, A. (2012). An innovation systems approach to institutional change: smallholder development in West Africa. Agricultural Systems 108: 74-83.

Howells, J. (2006). Intermediation and the role of intermediaries in innovation. Research Policy 35(5): 715-728.

Hung, S.-C. & Whittington, R. (2011). Agency in national innovation systems: institutional entrepreneurship and the professionalization of Taiwanese IT. Research Policy 40(4): 526-538.

IFDC (International Fertilizer Development Center) (2000). A strategic framework for African agricultural input supply system, IFDC. Funded by USAID.

InterAcademy Council (2004). Realizing the promise and potential of African agriculture : science and technology strategies for improving agricultural productivity and food security in Africa. Amsterdam, InterAcademy Council.

Jaleta, M., Gebremedhin, B., Tegegne, A., Jemaneh, S., Lemma, T. & Hoekstra, D. (2013). Evolution of input supply and service hubs in dairy development at Ada'a milk shed in Ethiopia. Development in Practice 23(2): 249-263.

Jayne, T. S., Mather, D. & Mghenyi, E. (2010). Principal Challenges Confronting Smallholder Agriculture in Sub-Saharan Africa. World Development 38(10): 1384-1398.

Juma, C. (2011). The new harvest: agricultural innovation in Africa. USA, Oxford University Press.

Kaganzi, E., Ferris, S., Barham, J., Abenakyo, A., Sanginga, P. & Njuki, J. (2009). Sustaining linkages to high value markets through collective action in Uganda. Food Policy 34(1): 23-30.

Kash, D. E. & Rycroft, R. (2002). Emerging patterns of complex technological innovation. Technological Forecasting and Social Change 69(6): 581-606.

Katzy, B., Turgut, E., Holzmann, T. & Sailer, K. (2013). Innovation intermediaries: a process view on open innovation coordination. Technology Analysis & Strategic Management 25(3): 295-309.

Kelly, V., Adesina, A. A. & Gordon, A. (2003). Expanding access to agricultural inputs in Africa: a review of recent market development experience. Food Policy 28(4): 379-404.

Keskin, E., Steglich, M., Dijkman, J. & Hall, A. (2008). Private capacity and public failure: contours of livestock innovation response capacity in Kenya. Maastrich, UNU-MERIT.

Kibaara, B., Ariga, J., Olwande, J. & Jayne, T. S. (2008). Trends in Kenyan agricultural productivity: 1997-2007. Tegemeo WPS. Nairobi, Tegemeo. 31/2008

Kibwika, P., Wals, A. E. J. & Nassuna-Musoke, M. G. (2009). Competence challenges of demand-led agricultural research and extension in Uganda. The Journal of Agricultural Education and Extension 15(1): 5-19.

Kilelu, C. W., Klerkx, L. & Leeuwis, C. (2013). Unravelling the role of innovation platforms in supporting co-evolution of innovation: Contributions and tensions in a smallholder dairy development programme. Agricultural Systems 118(0): 65-77.

Kilelu, C. W., Klerkx, L., Leeuwis, C. & Hall, A. (2011). Beyond knowledge brokering: an exploratory study on innovation intermediaries in an evolving smallholder agricultural system in Kenya. Knowledge Management for Development Journal 7(1): 84-108.

Kingiri, A. N. & Hall, A. (2012). The role of policy brokers: the case of biotechnology in Kenya. Review of Policy Research 29(4): 492-522.

Klein-Woolthuis, R., Lankhuizen, M. & Gilsing, V. (2005). A system failure framework for innovation policy design. Technovation 25(6): 609-619.

Klerkx, L. & Aarts, N. (2013). The interaction of multiple champions in orchestrating innovation networks: conflicts and complementarities. Technovation 33(6-7): 193-210.

Klerkx, L., Aarts, N. & Leeuwis, C. (2010). Adaptive management in agricultural innovation systems: the interactions between innovation networks and their environment. Agricultural Systems 103(6): 390-400.

Klerkx, L., de Grip, K. & Leeuwis, C. (2006). Hands off but strings attached: the contradictions of policy-induced demand-driven agricultural extension. Agriculture and Human Values 23(2): 189-204.

Klerkx, L., Hall, A. & Leeuwis, C. (2009). Strengthening agricultural innovation capacity: are innovation brokers the answer? International Journal of Agricultural Resources, Governance and Ecology 8(5-6): 409-438.

Klerkx, L. & Jansen, J. (2010). Building knowledge systems for sustainable agriculture: supporting private advisors to adequately address sustainable farm management in regular service contacts. International Journal of Agricultural Sustainability 8(3): 148-163.

Klerkx, L. & Leeuwis, C. (2008a). Balancing multiple interests: embedding innovation intermediation in the agricultural knowledge infrastructure. Technovation 28: 364-378.

Klerkx, L. & Leeuwis, C. (2008b). Matching demand and supply in the agricultural knowledge infrastructure: Experiences with innovation intermediaries. Food Policy 33(3): 260–276.

Klerkx, L. & Leeuwis, C. (2009a). Establishment and embedding of innovation brokers at different innovation system levels: Insights from the Dutch agricultural sector. Technological Forecasting and Social Change 76(6): 849-860.

Klerkx, L. & Leeuwis, C. (2009b). Operationalizing demand-driven agricultural research: institutional influences in a public and private system of research planning in the Netherlands. The Journal of Agricultural Education and Extension 15(2): 161-175.

Klerkx, L. & Leeuwis, C. (2009c). Shaping collective functions in privatized agricultural knowledge and information systems: the positioning and embedding of a network broker in the Dutch dairy sector. The Journal of Agricultural Education and Extension 15(1): 81-105.

Klerkx, L. & Proctor, A. (2013). Beyond fragmentation and disconnect: networks for knowledge exchange in the english land management advisory system. Land Use Policy 30(1): 13-24.

Klerkx, L., van Mierlo, B. & Leeuwis, C. (2012). Evolution of systems approaches to agricultural innovation: Concepts, analysis and interventions. In Farming systems research into the 21st century the new dynamic. I. Darnhofer, D. Gibbon and P. Dedieu Benoît. Dordrecht; New York, Springer: 457-483.

Klerkx, L. W. A. (2008). Matching demand and supply in the Dutch agricultural knowledge infrastructure. The emergence and embedding of new intermediaries in an agricultural innovation system in transition. PhD thesis, Wageningen University, Wageningen, The Netherlands.

Knickel, K., Brunori, G., Rand, S. & Proost, J. (2009). Towards a better conceptual framework for innovation processes in agriculture and rural development: from linear models to systemic approaches. The Journal of Agricultural Education and Extension 15(2): 131 - 146.

Koenig, T., Blatt, J., Brakel, K., Kloss, K., Nilges, T. & Woellert, F. (2008). Market-driven development and poverty reduction: A value chain analysis of fresh vegetables in Kenya and Tanzania. SLE publication, Humboldt Universität zu Berlin.

Kouévi, A. T., Mierlo, B. V. & Leeuwis, C. (2011). Repetitive discrepancy between espoused and in-use action theories for fishery intervention in Grand-Popo, Benin. International Journal of Learning and Change 5(2): 114-138.

Kristjanson, P., Reid, S., R, Dickson, N., Clark, C., W, Romney, D., Puskur, R., MacMillan, S. & Grace, D. (2009). Linking international agricultural research knowledge with action for sustainable development. Proceedings of the National Academy of Sciences 9(13): 1-6.

Kruijssen, F., Keizer, M. & Giuliani, A. (2009). Collective action for small-scale producers of agricultural biodiversity products. Food Policy 34(1): 46-52.

Kruse, G. (2012). The chilling hub model and social capital in dairy value chain development: A case of Heifer International in Kenya. Nairobi, Heifer International-Kenya.

Kydd, J. & Dorward, A. (2004). Implications of market and coordination failures for rural development in least developed countries. Journal of International Development 16(7): 951-970.

Labarthe, P. (2009). Extension services and multifunctional agriculture. lessons learnt from the French and Dutch contexts and approaches. Journal of Environmental Management 90, Supplement 2(0): S193-S202.

Larsen, K., Kim, R. & Theus, F. (2009). Agribusiness and innovation systems in Africa. Washington, DC, The World Bank.

Laszlo, K. C. & Laszlo, A. (2002). Evolving knowledge for development: the role of knowledge management in a changing world. Journal of Knowledge Management 6(4): 400-412.

Leared, H. (2010). The case for agricultural hubs as platforms for growth and development in sub-Saharan Africa. Perspectives on Agriculture. The Brenthurst Foundation, South Africa.

Leeuwis, C. (2000). Learning to be sustainable. does the Dutch agrarian knowledge market fail? The Journal of Agricultural Education and Extension 7(2): 79-92.

Leeuwis, C. & Aarts, N. (2011). Rethinking communication in innovation processes: creating space for change in complex systems. The Journal of Agricultural Education and Extension 17(1): 21-36.

Leeuwis, C. & van den Ban, A. (2004). Communication For Rural Innovation: Rethinking Agricultural Extension. Oxford, Blackwell Science.

Leifer, R., O'Connor, G. C. & Rice, M. (2001). Implementing radical innovation in mature firms: The role of hubs. Academy of Management Executive 15(3): 102-113.

Lenné, J. M. & Ward, A. (2010). Improving the efficiency of domestic vegetable marketing systems in East Africa: constraints and opportunities Outlook on Agriculture 39(1): 31-40.

Loeber, A., Mierlo, B. V., Grin, J. & Leeuwis, C. (2007). The practical value of theory : conceptualising learning in pursuit of sustainable development. In Social learning towards a sustainable world : principles, perspectives, and praxis. A. E. J. Wals. Wageningen, the Netherlands, Wageningen Academic Publishers: 83-97.

Markelova, H., Meinzen-Dick, R., Hellin, J. & Dohrn, S. (2009). Collective action for smallholder market access. Food Policy 34(1): 1-7.

McCullough, E. B., Pingali, P. L. & Stamoulis, K. G., Eds. (2008). The transformation of agri-food systems : globalization, supply chains and smallholder farmers. London; Sterling, VA, Food and Agriculture Organization of the United Nations. Earthscan.

McNie, E. C. (2007). Reconciling the supply of scientific information with user demands: an analysis of the problem and review of the literature. Environmental Science & Policy 10(1): 17-38.

Meyer, M. (2010). The rise of the knowledge broker. *Science Communication* 2010 32(1): 118-127.

Michaels, S. (2009). Matching knowledge brokering strategies to environmental policy problems and settings. Environmental Science & policy 12: 994-1011

Moll, H. A. J., Staal, S. J. & Ibrahim, M. N. M. (2007). Smallholder dairy production and markets: a comparison of production systems in Zambia, Kenya and Sri Lanka. Agricultural Systems 94(2): 593-603.

Moors, E. H. M., Aries, R. & Wiskerke, J. S. C. (2004). The dynamics of innovation: A multilevel co-evolutionary perspective. In Seeds of transition: essays on novelty production, niches and regimes in agriculture. J. S. C. Wiskerke and J. D. van der Ploeg. Assen, Van Gorcum: 31-56.

Morriss, S., Massey, C., Flett, R., Alpass, F. & Sligo, F. (2006). Mediating technological learning in agricultural innovation systems. Agricultural Systems 89(1): 26-46.

Muendo, M. & Tschirley, D. (2004). Improving Kenya's domestic horticultural production and marketing system: current competitiveness, forces of change, and challenges for the future Tegemeo Institute of Agricultural Policy and Development, Nairobi,

Muriuki, H. G., Omore, A., Hooton, N., Waithaka, M., Ouma, R., Staal, S. J. & Odhiambo, P. (2003). The policy environment in the Kenya dairy sub-sector: A review. Nairobi, MoLFD; KARI; ILRI.

Muyanga, M. & Jayne, T. S. (2008). Private agricultural extension system in Kenya: practice and policy lessons. The Journal of Agricultural Education and Extension 14(2): 111 - 124.

Namdar-Irani, M. & Sotomayor, O. (2011). Le conseil agricole au Chili face à la diversité des agriculteurs. Cah. Agric. Cahiers Agricultures 20(5): 352-358.

Nederlof, S., Wongtschowski, M. & van der Lee, F., Eds. (2011). Putting heads together: agricultural innovation platforms in practice. Development, Policy & Practice. Bulletin 396. Amsterdam, KIT Publishers.

Nelson, R. R. & Nelson, K. (2002). Technology, institutions, and innovation systems. Research Policy 31(2): 265-272.

Neven, D. & Reardon, T. (2004). The rise of Kenyan supermarkets and the evolution of their horticulture product procurement systems. Development Policy Review 22(6): 669-699.

Ngigi, M. (2005). The Case of Smallholder Dairying in Eastern Africa. IFPRI Washington D.C,,

Nieuwenhuis, L. F. M. (2002). Innovation and learning in agriculture. Journal of European Industrial Training 26(6): 283-291.

North, D. C. (1990). Institutions, institutional change, and economic performance. London, Cambridge University Press.

Nyambo, B., Sief, A., Varela, A., Lohr, B., Cooper, J. & Dobson, H. (2009). Private extension-service provision for smallholder horticultural producers in Kenya: an approach. Development in Practice 19: 94-102.

Obstfeld, D. (2005). Social networks, the tertius lungens orientation, and involvement in innovation. Administrative Science Quarterly 50(1): 100-130.

Ochieng, C. M. O. (2007). Revitalising African agriculture through innovative business models and organisational arrangements: promising developments in the traditional crops sector. The Journal of Modern African Studies 45(1): 143-169.

Odame, H. & Muange, E. (2011). Can agro-dealers deliver the Green Revolution in Kenya? IDS Bulletin 42(4): 78-89.

Odame, H., Musyoka, P. & Kere, J. (2009). Country agribusiness report-Kenya: maize, dairy and tomato- links and coordination within the innovation system. In Agribusiness and innovation systems in Africa Larsen K, Kim R and Theus F. Washington, DC, The World Bank Institute and Institute and Agriculture and Rural Development: 89-134.

Omta, S., Trienekens, J. & Beers, G. (2001). Chain and network science: A research framework. Journal on Chain and Network Science 1(1): 1-6.

Oreszczyn, S., Lane, A. & Carr, S. (2010). The role of networks of practice and webs of influencers on farmers' engagement with and learning about agricultural innovations. Journal of Rural Studies 26(4): 404-417.

Owen, L., Howard, W. & Waldron, M. (2000). Conflicts over farming practices in Canada: the role of interactive conflict resolution approaches. Journal of Rural Studies 16(4): 475-483.

Pant, P., L & Odame, H., H (2009). Innovations systems in renewable natural resource management and sustainable agriculture: a literature review. African Journal of Science, Technology, Innovation and Development 1(1): 103-135.

Parkinson, S. (2009). When farmers don't want ownership: reflections on demand-driven extension in sub-Saharan Africa. The Journal of Agricultural Education and Extension 15(4): 417-429.

Perez-Aleman, P. (2005). Cluster formation, institutions and learning: The emergence of clusters and development in Chile. Industrial and Corporate Change 14(4): 651-677.

Phillipson, J., Gorton, M., Raley, M. & Moxey, A. (2004). Treating farms as firms? The evolution of farm business support from productionist to entrepreneurial models. Environment and Planning C: Government and Policy 22: 31-54.

Poncet, J., Kuper, M. & Chiche, J. (2010). Wandering off the paths of planned innovation: The role of formal and informal intermediaries in a large-scale irrigation scheme in Morocco. Agricultural Systems 103(4): 171-179.

Poole, N. D., Chitundu, M. & Msoni, R. (2013). Commercialisation: A meta-approach for agricultural development among smallholder farmers in Africa? Food Policy 41(0): 155-165.

Poulton, C., Dorward, A. & Kydd, J. (2010). The future of small farms: new directions for services, institutions, and intermediation. World Development 38(10): 1413-1428.

Poulton, C. & Kanyinga, K. (2013). The Politics of revitalising agriculture in Kenya. Future Agricultures working paper 59. Brighton, Institute of Development Studies, University of Sussex

Provan, K. G. & Kenis, P. (2008). Modes of network governance: structure, management, and effectiveness. Journal of Public Administration Research and Theory 18(2): 229-252.

Reardon, T., Timmer, C. P., Barrett, C. B. & Berdegué, J. (2003). The rise of supermarkets in Africa, Asia, and Latin America. American Journal of Agricultural Economics 85(5): 1140-1146.

Regeer, B. (2009). Making the invisible visible: analysing the development of strategies and changes in knowledge production to deal with persistent problems in sustainable development. Oisterwijk, Boxpress.

Republic of Kenya (2005). Draft National Agricultural Sector Extension Policy (NASEP). Nairobi, Kenya, Government of Kenya.

Republic of Kenya (2009). Agricultural sector development strategy 2009-2020 prepared by the agricultural sector ministries www.ascu.go.ke/DOCS/ASDS%20Final.pdf

Ringsing, B. & Leeuwis, C. (2008). Learning about advocacy. Evaluation 14(4): 413-436.

Rivera, W. M. & Sulaiman, R. V. (2009). Extension: object of reform, engine for innovation. Outlook on Agriculture 38: 267-273.

Roep, D., Van Der Ploeg, J. D. & Wiskerke, J. S. C. (2003). Managing technical-institutional design processes: some strategic lessons from environmental co-operatives in the Netherlands. NJAS - Wageningen Journal of Life Sciences 51(1–2): 195-217.

Röling, N. (2009). Conceptual and methodological developments in innovation. In Innovation Africa: enriching farmers' livelihoods. P. C. Sanginga, A. Waters-Bayer and S. Kaaria. London, Earthscan: 9-34.

Röling, N., Hounkonnou, D., Kossou, D., Kuyper, T. W., Nederlof, S., Sakyi-Dawson, O., Traoré, M. & van Huis, A. (2012). Diagnosing the scope for innovation: linking smallholder practices and institutional context: Introduction to the special issue. NJAS - Wageningen Journal of Life Sciences 60–63(0): 1-6.

Röling, N. G., Hounkonnou, D., Offei, S. K., Tossou, R. & Van Huis, A. (2004). Linking science and farmers' innovative capacity: diagnostic studies from Ghana and Benin. NJAS - Wageningen Journal of Life Sciences 52(3-4): 211-235.

Röling, N. G. & Jiggins, J. (1998). The ecological knowledge system. In Facilitating sustainable agriculture : participatory learning and adaptive management in times of environmental uncertainty. N. G. Röling and M. A. E. Wagemakers. Cambridge, Cambridge University Press: 283-311.

Roothaert, R. & Muhanji, G. (2009). Profit making for smallholder farmers. proceedings of the 5th MATF experience sharing workshop, 25th - 29th May 2009, Entebbe, Uganda.

Sapsed, J., Grantham, A. & DeFillippi, R. (2007). A bridge over troubled waters: bridging organisations and entrepreneurial opportunities in emerging sectors. Research Policy 36(9): 1314-1334.

Sarapura, S. L. (2013). Gender and agricultural innovation in peasant production of native potatoes in the Central Andes of Peru. Unpublished thesis, University of Guelph, School of Environmental Design and Rural Development

Sarewitz, D. & Pielke, J. R. A. (2007). The neglected heart of science policy: reconciling supply of and demand for science. Environmental Science & Policy 10(1): 5-16.

Schut, M., van Paassen, A., Leeuwis, C., Bos, S., Leonardo, W. & Lerner, A. (2011). Space for innovation for sustainable community-based biofuel production and use: lessons learned for policy from Nhambita community, Mozambique. Energy Policy 39(9): 5116-5128.

Sherwood, S. G. (2009). Learning from Carchi: agricultural modernisation and the production of decline. PhD thesis. Wageningen University, Wageningen, The Netherlands.

Shiferaw, B., Hellin, J. & Muricho, G. (2011). Improving market access and agricultural productivity growth in Africa: what role for producer organizations and collective action institutions? Food Security 3(4): 475-489.

Silverman, D. (2009). Interpreting qualitative data: methods for analyzing talk, text and interaction. Los Angeles, California Sage.

Smedlund, A. (2006). The roles of intermediaries in a regional knowledge system. Journal of International Capital 7(2): 204-220.

Smits, R. (2002). Innovation studies in the 21st century: question from a user's perspective. Technological Forecasting and Social Change 69: 861-883.

Smits, R. & Kuhlmann, S. (2004). The rise of systemic instruments in innovation policy. International Journal of Foresight and Innovation Policy 1(1-2): 4-32.

Snapp, S. S., Blackie, M. J. & Donovan, C. (2003). Realigning research and extension to focus on farmers' constraints and opportunities. Food Policy 28(4): 349-363.

Southall, R. (2005). The Ndungu report: land & graft in Kenya. Review of African Political Economy 32(103): 142-151.

Spielman, D., Davis, K., Negash, M. & Ayele, G. (2011). Rural innovation systems and networks: findings from a study of Ethiopian smallholders. Agriculture and Human Values 28(2): 195-212.

Spielman, D. J. (2005). Innovation systems perspectives on developing country agriculture: a critical review. IFPRI.

Spielman, D. J., Ekboir, J. & Davis, K. (2009). The art and science of innovation systems inquiry: Applications to Sub-Saharan African agriculture. Technology in Society 31(4): 399-405.

Spielman, D. J., Hartwich, F. & Grebmer, K. (2010). Public–private partnerships and developing-country agriculture: evidence from the international agricultural research system. Public Administration and Development 30(4): 261-276.

Stake, R. E. (1978). The case study method in social inquiry. Educational Researcher Educational Researcher 7(2): 5-8.

Steglich, M., Keskin, E., Hall, A. & Dijkman, J. (2012). Are international market demands compatible with domestic social needs? Challenges in strengthening innovation capacity in kenya's horticulture industry. International Journal of Technology Management & Sustainable Development 10(3): 201-215.

Steins, N. A. & Edwards, V. M. (1999). Platforms for collective action in multiple-use common-pool resources. Agriculture and Human Values 16(3): 241-255.

Stewart, J. & Hyysalo, S. (2008). Intermediaries, users and social learning in technological innovation. International Journal of Innovation Management 12(3): 295-325.

Sulaiman, V. R., Hall, A., Kalaivani, N. J., Dorai, K. & Reddy, T. S. V. (2012). Necessary, but not sufficient: critiquing the role of information and communication technology in putting knowledge into use. The Journal of Agricultural Education and Extension 18(4): 331-346.

Sulaiman, V. R., Hall, A., Vamsidhar, R. T. S. & Dorai, K. (2010). Studying rural innovation management: a framework and early findings from RIU in South Asia. RIU Discussion Paper 11.

Sulaiman, V. R. & Hall, A. J. (2002). Beyond technology dissemination: reinventing agricultural extension. Outlook on Agriculture 31(4): 225-233.

Sumberg, J. (2005). Systems of innovation theory and the changing architecture of agricultural research in Africa. Food Policy 30(1): 21-41.

Sumberg, J. & Reece, D. (2004). Agricultural research through a new product development lens. Experimental Agriculture 40(03): 295-314.

Suvinen, N., Konttinen, J. & Nieminen, M. (2010). How necessary are intermediary organizations in the commercialization of research? European Planning Studies 18(9): 1365-1389.

Swanson, B. E. & Rajalahti, R. (2010). Strengthening agricultural extension and advisory systems: procedures for assessing, transforming, and evaluating extension systems. Washington DC, World Bank.

Szogs, A. (2008). The role of mediator organisations in the making of innovation systems in least developed countries: evidence from Tanzania. Int. J. Agricultural Resources, Governance and Ecology 4(3): 223-237.

TANGO International (2010). East African Dairy Development (EADD) project-mid-term evaluation: regional synthesis report. Nairobi, EADD.

Technoserve (2008). The dairy value chain in Kenya: a report for the East Africa Dairy Development project. Nairobi.

Tenywa, M. M., Rao, K., Tukahirwa, J. B., Buruchara, R., Adekunle, A., A.,, Mugabe, J., Wanjiku, C., Mutabazi, S., Fungo, B., Kashaija, N. I., Pali, P., Mapatano, S., Ngaboyisonga, C., Farrow, A., Njuki, J. & Abenakyo, A. (2011). Agricultural innovation platform as a tool for development-oriented research: lessons and challenges in the formation and operationalization. Learning Publics Journal of Agriculture and Environmental Studies 2(1): 117-146.

Tesfazghi, Z. (2012). Hub Formation in strengthening goat value chains and collective action in India (imGoats project) Udaipur, Rajasthan- Thesis proposal. Wageningen University, Knowledge, Technology and Innovation group

Tödtling, F. & Trippl, M. (2005). One size fits all?: towards a differentiated regional innovation policy approach. Research Policy 34(8): 1203-1219.

Ton, G. & Bijman, J. (2006). The role of producer organizations in the process of developing an integrated supply chain; experiences from Quinoa chain development in Bolivia. In International agri-food chains and networks: management and organization. J. Bijman, S. Omta, J. Trienekens, J. Wijnands and E. Wubben. Wageningen, Wageningen Academic Publishers: 97-111.

USAID-KDSCP (2008). USAID Kenya Dairy Sector Competitiveness Program-milkshed assessment and small business organizations needs analysis. Nairobi, Land O'Lakes.

van de Ven, A. H., Polley, D. E. & Venkataraman, S. (2008). The Innovation Journey. New York, Oxford University Press.

van der Ploeg, J. D. (2008). The new peasantries struggles for autonomy and sustainability in an era of empire and globalization. London; Sterling, VA, Earthscan.

van Lente, H., Hekkert, M., Smits, R. & van Waveren, B. (2003). Roles of systemic intermediaries in transition process. International Journal of Innovation Management 7(3): 1-33.

van Mele, P. (2008). The importance of ecological and socio-technological literacy in R&D priority setting: the case of a fruit innovation system in Guinea, West Africa. International Journal of Agricultural Sustainability 6(3): 183-194.

van Mierlo, B., Arkesteijn, M. & Leeuwis, C. (2010a). Enhancing the reflexivity of system innovation projects with system analyses. American Journal of Evaluation 31(2): 143-161.

van Mierlo, B., Regeer, B., van Amstel, M., Arkesteijn, M., Beekman, V., Bunders, J., de Cock Buning, T., Elzen, B., Hoes, A.-C. & Leeuwis, C. (2010b). Reflexive monitoring in action: a guide for monitoring system innovation projects. Wageningen, Wageningen UR, Communication and Innovation studies.

van Rijn, F., Bulte, E. & Adekunle, A. (2012). Social capital and agricultural innovation in sub-Saharan Africa. Agricultural Systems 108(0): 112-122.

Venkatasubramanian, V. & Mahalakshmi, P. (2012). Innovative institutional approaches for agricultural knowledge system management in India. Improving Agricultural Knowledge and Innovation Systems: OECD conference proceedings, OECD: 131-150.

von Malmborg, F. (2007). Stimulating learning and innovation in networks for regional sustainable development: the role of local authorities. Journal of Cleaner Production 15(17): 1730-1741.

Vorley, W., Fearne, A. & Ray, D. (2007). Regoverning markets: a place for small-scale producers in modern agrifood chains? Aldershot, Gower.

Waiganjo, M. M., Kiritu, J. & Kuria, B. (2009). Effects of weeds on growth of bulb onion and some cost-effective control options at Thika, Kenya. Afr. J. Hort. Sci. 2: 92-102.

Waters-Bayer, A., Sanginga, P. C., Kaaria, S., Njuki, J. & Wettasinha, C. (2009). Innovation Africa: an introduction. In Innovation Africa. P. C. Sanginga, A. Waters-Bayer, S. Kaaria, J. Njuki and C. Wettasinha. London, Earthscan: 1-5.

Wiggins, S., Kirsten, J. & Llambí, L. (2010). The future of small farms. World Development 38(10): 1341-1348.

Winch, G. M. & Courtney, R. (2007). The organization of innovation brokers: an international review. Technology Analysis & Strategic Management 19(6): 747-763.

Wongtschowski, M., Belt, J., Heemskerk, W. & Kahan, D., Eds. (2013). The business of agricultural business services: working with smallholders in Africa. Royal Tropical Institute, Amsterdam; Food and Agriculture Organization of the United Nations, Rome; and Agri-ProFocus, Arnhem.

Woodhill, J. (2007). M&E as learning: rethinking the dominant paradigm. In Monitoring and evaluation of soil conservation and watershed development projects. J. de Graaff, A. de Bruin, J. Cameronet al. Enfield, NH, Science Publishers: 83-107

World Bank (2006). Enhancing agricultural innovation:how to go beyond the strengthening of research systems. Washington DC, World Bank.

World Bank (2007). Agriculture for development: World Development Report 2008. Washington DC, World Bank.

Yang, H. (2013). Farmer cooperatives as intermediaries for agricultural and rural development in China. PhD thesis. Wageningen University, Wageningen, The Netherlands.

Yin, R. K. (2003). Case Study Research: design and methods. Thousand Oaks, California, Sage.

Summary

Understanding agricultural innovation processes and recognizing the potential for catalysing them is crucial for many countries in sub-Saharan Africa (SSA), including Kenya. This is because the smallholder dominated agricultural sector remains critical to realizing economic growth and poverty reduction goals. The need to enhance innovation in smallholder agriculture is driven by, on one hand, challenges related to food and nutrition insecurity, which have recently been exacerbated by drivers such as climate change and other sustainable development concerns. On the other hand, there are increased opportunities through growing and dynamic domestic and global agri-food markets. Linked to these dynamics are recent insights in innovation studies that indicate that innovation results from coordinated action among an increasingly diverse network of interdependent actors. However, studies have shown that mobilizing partnerships and fostering linkages, interactions and learning among networks of diverse actors with diverging interests remains a challenge in the agriculture sector in SSA. In this regard, there is a growing focus in agricultural innovation studies on understanding how innovation processes are orchestrated and particularly the role of innovation intermediaries that have emerged as specialised actors that support such processes. However, there has been limited systematic analysis of these developments in the context of smallholder agricultural innovation systems. This thesis aims to unravel this changing landscape of innovation intermediaries and to investigate their role in shaping innovation processes using case studies from Kenya.

To account for the research process and findings, this thesis is structured around six chapters. **Chapter 1** is the general introduction which sets the scene of the study justifying the research choices, research objectives and questions, and the methodology used to answer the research questions. Following an exploration of the knowledge gaps related to the role of innovation intermediaries in smallholder agricultural innovation systems, two main objectives of the study are formulated. The objectives are i) to explore and increase understanding of the characteristics and functions of innovation intermediaries in the evolving smallholder agricultural development in Kenya; and, ii) to

investigate how different innovation intermediary arrangements support dynamic innovation processes.

As an entry point for the thesis, **Chapter 2** documents how the innovation intermediary landscape in the agricultural sector in Kenya has evolved, reflected in the emergence of new actors and the re-positioning of existing ones. This exploratory case study looks at 22 organisations identified as fulfilling an intermediary role. These include public research and extension organisations, private consultants and enterprises, farmer organisations, NGOs and a mix of programmes such as consortia and networks .The results show that these organisations fulfil functions that are not limited to distribution of knowledge and putting it into use but also include fostering interaction among the diverse actors engaged in the innovation networks, and working on various technological, organizational, and institutional innovations. Moreover, the study identified various organizational arrangements of innovation intermediaries, with some organisations fulfilling a specialized innovation brokering role and other intermediaries taking on brokering as a side activity, while substantively contributing to the innovation process. On the basis of these findings, the study distinguishes four types of innovation intermediaries in the Kenyan context, namely, technology brokers, systemic brokers, enterprise development support intermediaries, and pro-poor input access intermediaries. This exploratory study concludes that the Kenyan intermediary domain has adapted itself to the context of supporting diverse smallholder production systems (e.g. staples and subsistence or high value crops), reflected in how it is organized (few specialized systemic innovation brokers and innovation brokering mainly as a side activity). Thus, contextual factors are important in shaping how the innovation intermediary landscape emerges and evolves. Finally, the study notes that innovation intermediation is already a pervasive role but requires deliberate policy support to build the necessary capacity for entrenching this role further in the agricultural innovation system. But, policy needs to be cognisant of the diverse innovation trajectories of heterogeneous smallholders that will require different intermediation mechanisms and funding.

The point of departure for **Chapter 3** is the view that innovation is a coordinated and co-evolution process through which technical, social and institutional dimensions align. This chapter deepens the understanding of the role of innovation intermediaries in supporting

such dynamic processes by investigating the East Africa Dairy Development (EADD) programme which provided a platform for facilitating innovation processes in smallholder dairy development in Kenya. In unravelling the concept of innovation platforms (IP), the study analyses how the EADD consortium facilitates multiple actors' linkages through an iterative process where different networks of actors are mobilized to enable co-evolution. This co-evolving occurs in tandem through mutual shaping of the technical and socio-institutional arrangements. For example, the integration of the chilling plant technology also shaped the structuring of the dairy farmers' business association (i.e. DFBAs) as an institutional innovation that is accompanied with refined governance structures and management practices. In unbundling this process, the findings show that the different intermediaries contributed to positive outcomes at the technological, social and institutional level. This is because of their complementary skills and competencies that allowed them to mobilize different resources required in the process. This enabled the platform to link the smallholders to various resources and support through a co-evolving network of actors that came in at different junctures in the process. An important insight from the study is that it shows intermediation as a distributed process based on the synergistic roles of the different organisations. The findings also point to some of the tensions that emerged affecting the innovation processes in unexpected ways, revealing the complexity of such processes. This alludes to some of the contradictions and vagaries that exist in innovation processes. As such, we argue that platform structures and governance need to be adaptive in order to be responsive to emerging issues in dynamic innovation processes.

Chapter 4 revisits the debate on coordination of smallholders related to their integration in value chains in efforts to enhance their market orientation. A growing body of literature argues that supporting smallholder agricultural intensification and commercialisation, which is linked to effective access to both input and output markets is often hampered by lack of effective coordination. This chapter contributes to the understanding of how coordination mechanisms work in practice. It presents the findings of a case study of the EADD programme which used a hub model through which the DFBA fostered coordination of small farmers amongst themselves (horizontal coordination), between farmers and output market actors (vertical coordination), and between farmers and inputs

and services providers (complementary coordination). Our findings confirm the importance of coordination mechanisms in matching demand and supply of inputs and services for enhancing smallholder innovation and participation in remunerative output markets. The main strength of the hub is the synergy that it enables between simultaneous horizontal, vertical and complementary coordination which results in new actor configurations that begin to address various relationship constraints at the different coordination levels. However, the study identify various tensions and gaps in the process that raise questions about the effectiveness, capacity and clout of farmers' organisations in taking on broader coordination roles in value chains.

Chapter 5 contributes to the understanding of learning as central to innovation process in the context of increasing market-oriented smallholder development in Kenya. In this chapter, the concept of dynamic learning is applied to a case study of a project on smallholder commercialisation of bulb onions to understand how, in continually evolving innovation processes, demands for smallholder farmers are adequately supported. The findings show that supporting innovation is tied to learning to match farmers' demands with the necessary support that includes a mix of private and public services. This matching intermediated through the project that facilitated and mobilized a network of services providers contributed to outcomes in the technical (e.g. improved productivity) and socio-institutional (e.g. organizing farmers for collective action) domains. An additional insight of the study is that farmers' demands for support are continually evolving because of the dynamic nature of innovation processes where many socio-technical factors interact in unpredictable ways. As is evident from the findings, while such innovation projects mobilize different innovation services, the process is not always adaptive to emerging issues. For example, there was no follow up on farmers' feedback about concerns on the effects of agro-chemicals on soils and the demand for research. The results indicate that this gap is a result of the accompanying monitoring and feedback process which mainly tracked pre-set project goals and did not systematically capture feedback and re-orient according to emergent needs in line with a dynamic learning agenda. Furthermore, it seems that some emerging demands were more difficult to address. This indicates the complexity of operationalizing demand-oriented support in increasingly privatized innovation service systems where interplay of power and

competing interests limits effective support to farmers. Thus, the findings provide a new perspective that had previously not been looked into, in understanding learning as a process in agricultural innovation of matching demands of farmers to the supply of innovation support services. The lack of adequate matching is a result of static notions of demand articulation and inadequate monitoring and feedback processes. This implies that in increasingly pluralistic innovation support systems, smallholder farmers need support to navigate these systems continuously. This requires supporting continuous reflection between the different actors in the demand and supply side.

Finally, **Chapter 6** recalls the research questions and synthesises the main findings. Here the main conclusions are presented together with implications for policy and practice and suggestions for further research. The thesis shows that the role of intermediaries is pervasive and highly complex in supporting agricultural innovation processes. The findings point to a diverse typology of intermediary actors undertaking a broad range of functions. One the key finding is that the shaping of innovation intermediaries systems is context specific. For this reason, the role of intermediaries in supporting institutional change is central to enhancing smallholder innovation and agricultural development. Furthermore, the typology identified shows a diversity of intermediaries that fit with the heterogeneity of smallholder agricultural systems. The emphasis on context also adds to the understanding of the institutional and organisational set-up of the innovation intermediary landscape. From the analysis of the micro-level action of intermediaries in supporting key innovation processes, namely, co-evolution, coordination and learning, two cross-cutting issues emerge. First, that innovation intermediation is a distributed process both spatially and temporally. Second is that in agricultural innovation, the intermediaries' support is about a dynamic interplay between linking farmers demands related to improving their agricultural enterprises and supply for inputs and innovation support services, followed by linkages to output markets. While our results show that innovation intermediaries contribute to shaping innovation processes, their functioning is marked with some tensions and dilemmas. These tensions relate to innovation intermediaries' capacities to perform innovation intermediation. In addition, their normative orientation results in blind spots and gaps that affects their effectiveness in shaping innovation processes and their outcomes. From these findings, a number of policy

and practice recommendations are made related to entrenching and supporting innovation intermediaries' roles in agricultural innovation systems. This requires a mix of policy interventions to identify appropriate intermediaries models based on 'fit for purpose', diverse funding options in the absence of market incentives for supporting the intermediary role and for building adequate capacities of innovation intermediaries.

Samenvatting

Inzicht in agrarische innovatieprocessen met als doel om deze beter te kunnen katalyseren is van cruciaal belang voor veel landen in Sub-Sahara Afrika (SSA), waaronder Kenia. Hun door kleinschaligheid gedomineerde landbouwsector blijft cruciaal voor het realiseren van doelstellingen van economische groei en armoedebestrijding. De noodzaak om innovatie te stimuleren in kleinschalige landbouw wordt aan de ene kant aangedreven door uitdagingen die verband houden met voedselonzekerheid en die nog worden verergerd door zaken als klimaatverandering en andere duurzame ontwikkelingsproblemen. Aan de andere kant zijn er meer mogelijkheden door dynamische ontwikkelingen op groeiende binnenlandse en wereldwijde markten van landbouw- en voedselproducten. Hieraan gekoppeld zijn recente inzichten binnen innovatiestudies die laten zien dat innovatie het resultaat is van gecoördineerde actie tussen een steeds gevarieerder netwerk van onderling afhankelijke actoren. Studies hebben echter aangetoond dat het mobiliseren van partnerschappen en het bevorderen van verbanden, interacties en het leren in netwerken van verschillende actoren met uiteenlopende belangen een uitdaging blijft in de landbouwsector in SSA. In dit opzicht is er een groeiende interesse in agrarische innovatiestudies om te begrijpen hoe innovatieprocessen worden georkestreerd, met in het bijzonder de opkomende rol van innovatie-intermediairs als gespecialiseerde actoren die dergelijke processen ondersteunen. Echter, er is maar een beperkte systematische analyse van deze ontwikkelingen gemaakt in het kader van kleinschalige agrarische innovatiesystemen. Dit proefschrift heeft tot doel dit veranderende landschap van innovatie-intermediairs te ontrafelen en om hun rol te onderzoeken in het vormgeven van innovatieprocessen aan de hand van een aantal case studies uit Kenia.

Het onderzoeksproces en de bevindingen van dit proefschrift zijn uitgewerkt in zes hoofdstukken. Hoofdstuk 1 is de algemene inleiding, waarin de context van de studie wordt gegeven en daarnaast de keuzes worden gerechtvaardigd die zijn gemaakt rondom onderzoeksdoelstellingen en -vragen en de gehanteerde methodologie om deze onderzoeksvragen te beantwoorden. Na een verkenning van de kennislacunes met betrekking tot de rol van innovatie-intermediairs in kleinschalige agrarische

innovatiesystemen, worden de twee belangrijkste doelstellingen van de studie geformuleerd. Deze doelstellingen zijn: i) het verkennen en vermeerderen van de kennis over de eigenschappen en functies van innovatie-intermediairs in de veranderende ontwikkeling van de kleinschalige landbouw in Kenia, en , ii) om te onderzoeken hoe de verschillende arrangementen rondom innovatie-intermediairen dynamische innovatieprocessen kunnen ondersteunen.

Als startpunt van dit proefschrift laat Hoofdstuk 2 zien hoe het landschap van innovatie-intermediairs in de agrarische sector in Kenia is geëvolueerd, weerspiegeld in de opkomst van nieuwe actoren en de herpositionering van bestaande. Deze verkennende casusstudie kijkt naar 22 organisaties die een bemiddelende rol vervullen. Deze omvatten het publieke onderzoek en voorlichting en extensie organisaties, particuliere adviseurs en bedrijven, boerenorganisaties, NGO's en een mix van programma's zoals consortia en netwerken. De resultaten laten zien dat deze organisaties functies vervullen die niet beperkt blijven tot de distributie en toepassing van kennis, maar ook de integratie en interactie bevorderen tussen de diverse actoren betrokken bij innovatienetwerken en die werken aan verschillende technologische , organisatorische en institutionele innovaties. Bovendien worden er in deze studie verschillende organisatorische arrangementen van innovatie-intermediairs geïdentificeerd, met een aantal organisaties die een gespecialiseerde innovatiemakelaarsrol op zich nemen terwijl andere innovatiemakelaars dit meer als een nevenactiviteit op zich nemen en meer inhoudelijk bijdragen aan het proces van innoveren. Op basis van deze bevindingen wordt onderscheid gemaakt in vier typen innovatie-intermediairs in de Keniaanse context, namelijk de technologiemakelaar, de systeemmakelaar, de intermediairen gericht op ondernemerschapsiontwikkeling, en intermediairen die toegang van arme boeren tot inputs vergemakkelijken . Deze verkennende studie concludeert dat het Keniaanse landschap van innovatiemakelaars zich heeft aangepast aan de context van het ondersteunen van een verscheidenheid van kleinschalige productiesystemen (bijv. basis- en levensonderhoudsgewassen tegenover hoogwaardige gewassen) en dit wordt weerspiegeld in de manier waarop het is georganiseerd (met enkele gespecialiseerde systemische innovatiemakelaars , en daarnaast innovatiemakelaarschap als nevenactiviteit). Hieruit blijkt dat contextuele factoren belangrijk zijn bij het vormgeven van de manier waarop de innovatie-intermediaire sector

ontstaat en evolueert. Tot slot wordt opgemerkt dat innovatiebemiddeling al een zeer belangrijke rol speelt, maar tegelijkertijd dat deze vraagt om een bewuste ondersteuning vanuit beleid om de noodzakelijke capaciteit van deze rol in het agrarische innovatiesysteem te verankeren. Echter, het beleid moet zich terdege bewust zijn van de diverse innovatietrajecten die verschillende typen kleine boeren doorlopen en die ook verschillende mechanismen van financiering en ondersteuning vergen.

Het uitgangspunt van Hoofdstuk 3 is dat innovatie een gecoördineerd en co-evolutionair proces is waarbij technische , sociale en institutionele dimensies worden afgestemd. Dit hoofdstuk verdiept het inzicht in de rol van *innovatie intermediairs in het ondersteunen* van dergelijke dynamische processen. Hiertoe is het Oost-Afrikaanse Ontwikkelingsprogramma voor Zuivel (*East Africa Dairy Development Programme*: EADD) bestudeerd. Dit programma voorzag in een innovatieplatform ter bevordering van innovatieprocessen voor de ontwikkeling van kleinschalige zuivel in Kenia. Door het ontrafelen van het begrip innovatieplatforms (IP), onderzoekt het hoofdstuk hoe het EADD-consortium verbanden tussen meerdere actoren faciliteerde door middel van een iteratief proces waarbij verschillende netwerken van actoren worden gemobiliseerd om co-evolutie mogelijk te maken. Deze co-evolutie resulteerde in een wederzijdse beïnvloeding van de technische en sociaal-institutionele arrangementen. Bijvoorbeeld, de integratie van de koelinstallatietechnologie gaf ook vorm aan de structurering van de ondernemersvereniging voor melkveehouders (de '*dairy farmers business association*', DFBA) *als een institutionele innovatie die gepaard gaat met verfijnde bestuursstructuren* en managementpraktijken. Het uitpluizen van dit proces laat zien dat de verschillende tussenpersonen bijdroegen aan positieve resultaten op technologisch, sociaal en institutioneel niveau. *Hun complementariteit in vaardigheden en competenties zorgde* ervoor dat ze verschillende middelen die nodig waren in het proces konden mobiliseren. Het platform koppelde de kleine boeren aan verschillende ondersteuningsbronnen door middel van een co-evoluerend netwerk van actoren die op verschillende momenten het proces binnenkwamen. Een belangrijk inzicht uit de studie is dat bemiddeling moet worden gezien als een gedistribueerd proces dat plaatsvindt op basis van de synergetische rol van verschillende organisaties. De bevindingen wijzen ook op een aantal van de spanningen die ontstonden in het proces en die de innovatieprocessen op onverwachte

manieren beïnvloedden, waaruit de complexiteit van dergelijke processen nogmaals wordt geïllustreerd. Als zodanig, dienen platformstructuren en hun bestuursstructuren adaptief te zijn om te kunnen inspelen op nieuwe kwesties in dynamische innovatieprocessen.

Hoofdstuk 4 herziet het debat over de coördinatie van kleinschalige landbouwers in verband met hun integratie in waardenketens en de inspanningen om hun marktgerichtheid te verbeteren. Een groeiende hoeveelheid studies stelt dat het ondersteunen van kleinschalige agrarische intensivering en commercialisering, welke is gekoppeld aan de daadwerkelijke toegang tot grondstof- en afzetmarkten, vaak wordt belemmerd door een gebrek aan doeltreffende coördinatie. Dit hoofdstuk draagt bij aan het begrip over hoe coördinatiemechanismen in de praktijk werken. Het presenteert de resultaten van een case study van het EADD programma dat een 'knooppuntmodel' *('hub –model')* introduceerde, waardoor de DFBA de coördinatie kon faciliteren van kleine boeren onderling (horizontale coördinatie), tussen boeren en ketenspelers (verticale coördinatie), en tussen boeren en dienstverleners (complementaire coördinatie). De bevindingen bevestigen het belang van coördinatiemechanismen in het matchen van de vraag naar en het aanbod van grondstoffen en diensten voor het verbeteren van innovatie door kleine boeren en de deelname aan profijtelijke afzetmarkten. De grote kracht van het knooppunt is de synergie die het aanbrengt in gelijktijdige horizontale, verticale en complementaire coördinatie wat resulteert in nieuwe actorconfiguraties die beginnen om de diverse beperkingen op de verschillende coördinatieniveaus aan te pakken. Dit hoofdstuk identificeert echter verschillende spanningen en hiaten in het proces die vragen oproepen over de effectiviteit, capaciteit en slagkracht van boerenorganisaties om bredere coördinatierollen in waardenketens te op zich te nemen.

Hoofdstuk 5 draagt bij aan het begrip van leren als innovatieproces in de context van toenemende marktgerichte ontwikkeling van kleine boeren in Kenia. In dit hoofdstuk wordt het concept van dynamisch leren toegepast op een casusstudie: een project over de kleinschalige commercialisering van uien om daarmee te begrijpen hoe in voortdurend evoluerende innovatieprocessen de kennisbehoeften van kleine boeren voldoende kunnen worden ondersteund. De bevindingen tonen aan dat het ondersteunen van innovatie is gebonden aan een leerproces, waarin kennisbehoeften van boeren adequaat moeten worden gekoppeld aan de benodigde ondersteuning, die bestaat uit een mix van private en

publieke diensten. Dit proces van koppeling via het project heeft bijgedragen aan resultaten in het technische domen (bijv. verbeterde productiviteit) en het socio-institutionele domein (bijv. het organiseren van boeren voor collectieve actie). Het project faciliteerde en mobiliseerde een netwerk van dienstverleners. Een extra inzicht van de studie is dat de eisen van boeren met betrekking tot ondersteuning zich continu ontwikkelen vanwege de dynamische aard van innovatieprocessen waar veel socio-technische factoren interacteren op onvoorspelbare wijze. Zoals blijkt uit de bevindingen, zijn dergelijke innovatieprojecten wel degelijk in staat tot het mobiliseren verschillende innovatiediensten, kunnen projecten zich niet altijd aanpassen aan nieuwe vraagstukken. Zo werd er geen gehoor gegeven aan de terugkoppeling van de boeren met betrekking tot hun bezorgdheid over de effecten van agro-chemicaliën op hun bodem en de vraag naar onderzoek hierover. Deze kloof is een resultaat van een monitoring en terugkoppelingssysteem dat voornamelijk vooraf ingestelde projectdoelstellingen volgde en niet systematisch feedback vastlegde om zich zodoende opnieuw te kunnen oriënteren op van opkomende behoeften. Bovendien lijkt het erop dat sommige nieuwe vragen moeilijker aan te pakken waren en dit zegt iets over de complexiteit van in een toenemende mate geprivatiseerd innovatie-ondersteunende-systemen waar macht en concurrerende belangen zorgen dat boeren niet altijd de optimale ondersteuning krijgen. Aldus bieden de bevindingen een nieuw perspectief, dat niet eerder was onderzocht, op het begrip van leren als een proces in agrarische innovatie waarbij en continue koppeling moet plaatsvinden tussen kennisbehoeften van boeren met de juiste dienstverlening. Het ontbreken van adequate koppeling is een gevolg van een statisch begrip van vraagarticulatie en gebrekkige controle- en feedbackmechanismen. Dit houdt in dat in deze in toenemende mate pluralistische systemen die innovatieondersteunende diensten bieden, kleine boeren steun nodig hebben om deze systemen te navigeren. Dit vereist het ondersteunen van voortdurende reflectie tussen de verschillende actoren aan de vraag- en aanbodzijde .

Tot slot, Hoofdstuk 6 kijkt terug op de onderzoeksvragen en synthetiseert de belangrijkste bevindingen. Hier worden de belangrijkste conclusies gepresenteerd met de implicaties voor beleid en praktijk, en suggesties voor verder onderzoek. Het proefschrift laat zien dat de rol van innovatie-intermediairs belangrijk is voor het ondersteunen van agrarische

innovatieprocessen, maar ook zeer complex. De bevindingen wijzen op diverse types intermediaire actoren die een breed scala van functies vervullen. Een van de belangrijkste bevindingen is dat systemen van innovatie-intermediairs context specifiek zijn. Vooral voor de verbetering van kleinschalige innovatie en landbouwontwikkeling is bijvoorbeeld de ondersteuning van institutionele verandering cruciaal. De typologie van in Kenya geïdentificeerde innovatie intermediairs toont een diversiteit die ook past bij de heterogeniteit van kleinschalige agrarische systemen. De nadruk op de context draagt ook bij aan het begrip van de institutionele en organisatorische set-up van het landschap van innovatie-intermediairs. Uit de analyse van acties van innovatie-intermediairs bij ondersteunen van belangrijke innovatieprocessen op het microniveau (co-evolutie, coördinatie en leren) komen twee algemene thema's naar voren:, Ten eerste, dat innovatie intermediaire activiteiten gedistribueerd zijn over zowel ruimte als in de tijd. Ten tweede, dat in agrarische innovatie de ondersteuning van innovatie intermediairs een dynamische proces is van het koppelen van vragen van boeren met betrekking tot het verbeteren van hun agrarische bedrijven en het aanbod van grondstoffen en innovatie ondersteunende diensten, gevolgd door het maken van koppelingen naar de afzetmarkten. Hoewel de resultaten laten zien dat innovatie-intermediairs bijdragen aan het vormgeven van innovatieprocessen, wordt hun functioneren getekend door een aantal spanningen en dilemma's. Deze spanningen hebben betrekking op de capaciteiten van innovatie intermediairs om effectieve innovatie bemiddeling te kunnen doen. Bovendien leidt hun normatieve oriëntatie tot blinde vlekken en hiaten die hun effectiviteit in het vormgeven van innovatieprocessen en hun resultaten beïnvloedt. Op basis van deze bevindingen, worden een aantal beleids- en praktijkaanbevelingen gedaan met betrekking tot het verankeren en steunen van de rol van innovatie-intermediairs in agrarische innovatiesystemen, zoals een mix van beleidsmaatregelen om geschikte bedrijfsmodellen te identificeren voor innovatie intermediairs , diverse financieringsmogelijkheden bij het ontbreken van marktprikkels voor de ondersteuning van de intermediaire rol te creëren, en voor het ondersteunen van adequate capaciteiten van innovatie intermediairs.

About the author

Catherine Wakesho Kilelu was born in Nairobi, Kenya in 1972. After completing high school, she joined the University of Nairobi where she attained a Bachelor of Arts (honours) degree. In 1997, she received a scholarship to attend Lakehead University in Thunder Bay, Ontario, Canada where she attained a Masters of Arts in Sociology. Her thesis entitled a gender analysis of the Green Belt Movement of Kenya looked critically at the gendered dimensions of natural resource management and rural livelihoods.

From 2003, Catherine joined the International Development Research Centre (IDRC) in Ottawa, Canada as a research assistant with Cities Feeding People program where she conducted research on the challenges of wastewater use in urban agriculture. She then continued to work with several programs at IDRC including as a research officer for Ecosystems Approaches to Human Health and as program officer for Rural Poverty and Environment until 2008. Her work was to support researchers from developing countries to undertake action—oriented research for development mainly in relation to various aspects of natural resource management and rural livelihoods. Most of her work has focused on several countries in sub-Saharan Africa. These experiences sparked her interest in pursuing a PhD in order to understand processes aimed at enhancing innovation in smallholder agricultural development.

In November 2008, Catherine was awarded the Open scholarship of the Wageningen School of School of Social Sciences to pursue her PhD studies. She started her studies in February 2009 with the Knowledge, Technology and Innovation (formerly known as Communication and Innovation) Chair group.

Wageningen School of Social Sciences (WASS)
Completed Training and Supervision Plan

Name of activity	Department/Institute	Year	ECTS
Project related competencies			
Institutions, information and knowledge	University of Copenhagen, Denmark	2009	6
Advanced Social Theory (RSO -32806)	WUR	2009	6
Introduction of communication and innovation studies (COM 22804)	WUR	2009	6
6th PhD School on Innovation and Economic Development- Globelics Academy	ISEG, Technical University of Lisbon, Portugal	2009	3
Qualitative Data Analysis: Procedures and Strategies (YRM-60806)	WUR	2010	6
Doing interpretative Analysis	WASS	2010	6
Systems thinking and practice in PhD Research: Making connections to Farming Systems Research	IFSA PhD course Aarhus University; Arhus, Denmark	2012	3
General competences			
Mansholt Introduction Course	WASS	2009	1.5
Competences for Integrated Agricultural Research	CERES	2009	1
PhD competence assessment	WASS	2009	0.3
Career related competencies			
Information literacy for PhD including Endnote	WGS	2009	0.6
Course Assistant Techniques and Data Analysis for Field **Research (RDS**-22306)	WUR	2010	2.8
Scientific Writing	WUR	2010	1.5
Presentations skills	WUR	2012	2
Presentation of research results			
"Beyond knowledge brokerage; An exploratory study of Innovation Intermediaries in an evolving Smallholder Agricultural System in Kenya	1st conference on Innovation in extension conference: November, Nairobi, Kenya	2011	1
"Unraveling innovation platforms: insights on co-evolution of smallholder dairy development in Kenya"	WASS PhD Day, WUR	2012	1
"The role of innovation platforms in supporting innovation- Unraveling a smallholder dairy development programme in Kenya"	10th European Int. Farming Systems Association Symposium, Aarhus, Denmark	2012	1
"Learning to match demand and supply of innovation support service- insights from a smallholder onion commercialisation project."	21st European Seminar on Extension Education Antalya, Turkey	2013	1
Total			**49.7**

Funding

This research was funded primarily by the Wageningen School of Social Sciences – WASS (formerly the Mansholt Graduate School of Social Sciences) Open Scholarship programme. Additional support was granted through the Research into Use programme of the DFID.

Propositions

1. The organisational forms and functions of innovation intermediaries are shaped by the specific context in which they emerge.
   (this thesis)

2. Innovation intermediation is a distributed process, rather than the work of a single actor.
   (this thesis)

3. Demand articulation and network building in innovation processes are iterative and cyclic processes which a narrow results-based project monitoring and evaluation system does not adequately support. (this thesis)

4. Interventions in smallholder agricultural development focused only on commercialization instead of broader livelihoods strategies of farming households will fail.

5. The contribution of agricultural research and development will remain sub-optimal unless sufficient attention is paid to involving smallholders in agenda setting and execution.

6. The dominant attention to the yield gap in African agricultural development is a tunnel vision approach to addressing the challenges of food and nutrition security.

7. Representative democracy in Africa is the institutionalisation of unaccountable leadership.

8. The PhD process is a team sport.

Propositions belonging to the thesis, entitled:

'Unravelling the role of innovation intermediaries in smallholder agricultural development: Case studies from Kenya'

Catherine Wakesho Kilelu
Wageningen, 19th November 2013.