Chapter 9

UNRAVELING THE ROLE OF INNOVATION PLATFORMS IN SUPPORTING COEVOLUTION OF INNOVATION: CONTRIBUTIONS AND TENSIONS IN A SMALLHOLDER DAIRY-DEVELOPMENT PROGRAM[1]

Catherine W. Kilelu, Laurens Klerkx, and Cees Leeuwis

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, Pingali, and Stamoulis 2008; World Bank 2006, 2007). Such a dynamic context requires the sector to continually innovate if it is to contribute to sustainable socioeconomic 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 Africa south of the Sahara (SSA) (Hounkonnou et al. 2012; Spielman, Ekboir, and Davis 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 organizations—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 coevolutionary nature (Biggs 1990;

1 The authors extend their appreciation to various individuals within the East Africa Dairy Development-Kenya team, including the many farmers and other collaborating actors for their time and cooperation during the research. We also acknowledge the International Livestock Research Institute (ILRI) for hosting the first author as a graduate fellow, and specifically thank Isabelle Baltenweck for the invaluable support during the fieldwork period. The constructive comments of anonymous reviewers were very helpful in improving the article. We gratefully acknowledge the support of Wageningen Graduate School of Social Sciences, which enabled this study.

This chapter was originally published as an article in *Agricultural Systems* 118: 65–77 (2013).

Leeuwis and van den Ban 2004). Coevolution entails mutual interaction and adaptation over time among the technological, social, and institutional components of an innovation, and therefore innovation cannot be understood and managed by separating these different components (Edquist and Johnson 1997; Ekboir 2003; Hall and Clark 2010; Nelson and Nelson 2002). However, coevolution 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 and Aarts 2011; Smits 2002).

Following the AIS perspective, the importance of recognizing and stimulating coevolution has been noted as key to promoting smallholder agricultural development in Africa south of the Sahara, 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 multiactor arrangements have been captured using different concepts and terminology, such as coalitions (Biggs 1990), innovation configurations (Engel 1995), innovation networks (Leeuwis and van den Ban 2004); public–private partnerships (PPPs) (Hall et al. 2001; Spielman, Hartwich, and Grebmer 2010), and innovation platforms (Adekunle and Fatunbi 2012; Nederlof, Wongtschowski, and van der Lee 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, for example, Hall et al. 2001; Spielman, Hartwich, and Grebmer 2010). In this chapter, we use the concept of innovation platforms, which generally has wider application in the agricultural field. We define an innovation platform as a multiactor configuration deliberately set up to facilitate and undertake various activities around identified agricultural innovation challenges and opportunities, at different levels in agricultural systems (for example, village, country, sector, or value chain).

Recent studies from Africa south of the Sahara have shown that multistakeholder platforms are contributing to agricultural innovation, citing enhanced interdependence among actors and enhanced social capital as some contributory factors (Nederlof, Wongtschowski, and van der Lee 2011; Tenywa et al. 2011; van Rijn, Bulte, and Adekunle 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 understand innovation processes and how to support them through platforms, there is a need for more robust analysis of the dynamics of coevolution and the role of change agents in the process (Hounkonnou et al. 2012; Waters-Bayer et al. 2009). This chapter aims to fill this gap by unraveling how platforms shape and contribute to innovation processes, through a case study of the East Africa Dairy Development (EADD) program in Kenya. The EADD program provides a platform for stimulating multistakeholder collaboration aimed at improving productivity and incomes of smallholder dairy-producer households.

The chapter is organized as follows. The next section draws a conceptual framework that links the concepts of coevolution and innovation platform to provide an analytical framework to unravel innovation platforms. This is followed by a presentation of the research design. Then we present the findings, followed by a discussion of the merits and limitations of innovation platforms in supporting coevolution of innovation. We end with conclusions, which highlight some theoretical and practical implications of the findings.

Conceptual Framework

This section first discusses the concept of coevolution and innovation platforms as innovation intermediaries. We then combine these concepts to build an analytical framework to elucidate the dynamics of coevolution of the innovation process.

Operationalizing Innovation as Coevolution

AIS scholars point to coevolution 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 coevolution concept needs to be operationalized. Leeuwis and van den Ban's (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 coevolution 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 emphasizes 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 and van den Ban, 2004; Oreszczyn, Lane, and Carr 2010). The characterization of the orgware dimension follows North's (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 (for example, 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 and Whittington 2011; Klerkx, Aarts, and Leeuwis 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, Aarts, and Leeuwis 2010; Leeuwis and van den Ban, 2004; Roep, Van der Ploeg, and Wiskerke 2003).

Coevolution 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 and Aarts 2011; Smits and Kuhlmann, 2004), but also in actively trying to change the socio-institutional environment, which has been referred to as effective reformism (Klerkx, Aarts, and Leeuwis 2010; Roep, Van der Ploeg, and Wiskerke 2003). Thus, innovation processes are marked by dynamics of alignment and conflict, with often unpredictable outcomes.

Agricultural Innovation Platforms and Their Role as Intermediaries in Innovation Coevolution

Multiactor platforms have been noted as important interventions for creating spaces to orient interaction 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, Aarts, and Leeuwis 2010). The platform concept has already been applied in the agricultural-innovation context to explore different modalities for collective action among multiple stakeholders around natural-resource management, for example, farmer field schools (FFS), local research committees (CIALs), natural-resource management platforms (Braun, Thiele, and Fernández 2000; Röling and Jiggins 1998). More recently, various forms of agricultural innovation platforms have been promoted as arenas for action in operationalizing

AIS interventions (Adekunle and Fatunbi 2012; Devaux et al. 2009; Nederlof, Wongtschowski, and van der Lee 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, Wongtschowski, and van der Lee 2011; Steins and Edwards 1999).

Innovation platforms generally do not emerge autonomously, but connections among platform members need to be forged and their interaction needs to be coordinated (Leeuwis and van den Ban 2004; Röling and Jiggins 1998). Building on the theoretical and empirical insights from the broader innovation-studies literature (Howells 2006; van Lente et al. 2003; Winch and 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 multiactor configurations in the AIS (Devaux et al. 2009; Klerkx and Leeuwis 2008a; Morriss et al. 2006). Kilelu et al. (2011) provide a collated range of functions that innovation intermediaries in agricultural innovation can fulfill; we apply these to understand the role of innovation platforms (for details see Kilelu et al. 2011). These functions include

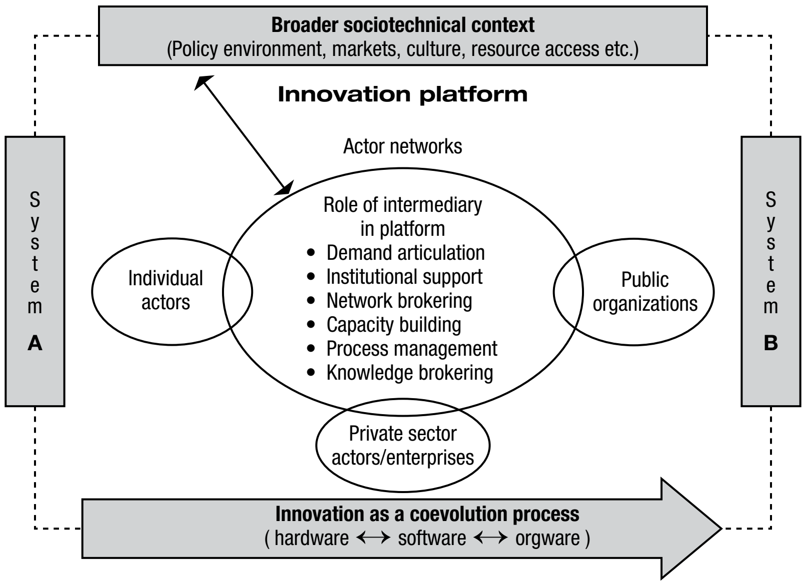
- *Demand articulation:* Facilitating the process of identifying innovation challenges and opportunities as perceived by the various stakeholders through diagnostic exercises, visioning, and needs assessment. The needs could include access to information, technologies, finance, or institutional gaps.
- *Institutional support:* Facilitating and advocating institutional change (for example, 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, Hall, and Leeuwis 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, Chapman, and Paine 2012; Klerkx, Aarts, and Leeuwis 2010; Stewart and 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 relation to realizing an innovative vision or problem, work is needed simultaneously at several interfaces in the innovation system (Klerkx, Aarts, and Leeuwis 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 to guide coevolution.

Integrating these insights distilled from the literature on coevolution of innovation, innovation platforms, and innovation intermediaries, we construct an analytical framework (presented in Figure 9.1) to unravel the role of innovation intermediaries in supporting coevolution of innovation processes on the EADD multiactor platform. The model places the platform at the center 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 characterized 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 sociotechnical context that influences how the change process evolves.

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

FIGURE 9.1 Analytical framework: innovation platforms supporting coevolution of innovation



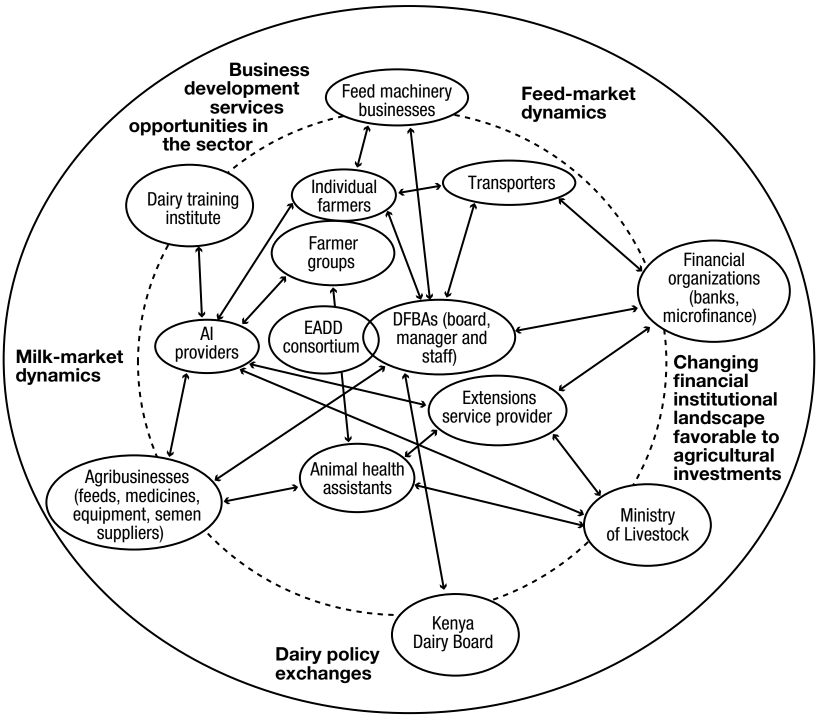
Source: Authors' elaboration based on Smits (2002), Leeuwis and van den Ban (2004), and Kilelu et al. (2011).

Case Description and Research Methods

Background of the EADD Program

The smallholder-dominated dairy sector in Kenya is considered to be relatively successful in the context of Africa south of the Sahara, but the sector still contends with many challenges that have limited its potential in terms of productivity, competitiveness, and improving livelihoods (Moll, Staal, and Ibrahim 2007; Muriuki et al. 2003; Technoserve 2008). To tackle these challenges, the EADD multiactor program 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 program as a multiactor platform (see Figure 9.2) 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 program's innovations—a dairy farmers' limited company (referred to as Dairy Farmer Business Association, DFBA) with an operational chilling plant

FIGURE 9.2 A schematic presentation of EADD Kenya as an innovation platform



Source: Authors.

Note: DFBA = Dairy Farmer Business Association; EADD = East Africa Dairy Development; AI = artificial insemination.

that evolves into a local business hub. The DFBA has a catchment area that covers a radius of approximately 10 kilometers in which it aims to attract dairy farmers to deliver milk for bulking and collective marketing (EADD 2011b).

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

The EADD staff, although coming from separate organizations, are all housed together in one office to enable them to work together collaboratively. As Figure 9.2 illustrates, the EADD as a multiactor 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 program 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, for example, 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).

Case Study Methods

In line with other studies on agricultural-innovation processes (Eastwood, Chapman, and Paine 2012; Klerkx, Aarts, and Leeuwis 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 and Araujo 2011; Yin 2003). The EADD program in Kenya was selected for this study following initial exploratory research (see Kilelu et al. 2011 for details) that identified several ongoing 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 ongoing project, it provided the opportunity to both reconstruct the innovation dynamics (Van de Ven, Polley, and Venkataraman 2008) and follow the process in real-time (Hoholm and Araujo 2011).

Because of the breadth of the program 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 agroecosystems 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 9.1 presents a summary of the data collected at each site.

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 semistructured 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 and mid-term evaluation) provided additional information. Following the analytical framework, we coded and characterized the data to identify different elements of the coevolution process in relation to the three intervention (innovation) areas and to unravel the role of the intermediaries on the platform.

Findings

In this section, we describe the process of how EADD established and executed the program, distilling from this description the components of the coevolution of the innovation processes on the platform, and we 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 above. Quotes derived from the interviews are used to illustrate key points.

The Entry Point—Setting the Agenda, Mobilizing the Platform, and the Role of EADD

The EADD program 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 understand the bottlenecks in smallholder dairy farming. These studies focused on three main areas: (1) improving breeding and animal health; (2) improving feed management and enhancing access to quality and affordable feeds; and (3) strengthening

TABLE 9.1 Overview of data collection

Methods	Study site		Information gathered
	Tanykina	Metkei	
Focus-group discussion with farmers working in DMGs (approximately 15 farmers in each focus group)	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
Focus-group discussion with non-DMG farmers (approximately 15 farmers in each focus group)	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
Semistructured 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
Semistructured interviews with service providers	4 (2 extension providers, AI, animal-health assistant)	2 (AISP/extension provider and animal-health assistant)	Views on the new DFBA 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

Source: Authors.

Note: AI = artificial insemination; AISP = artificial-insemination service provider; DFBA = Dairy Farmer Business Association; DMGs = dairy management groups; EADD = East Africa Dairy Development project.

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 sociotechnical 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 cooperatives, which are the dominant institutional model of dairy-farming enterprises in Kenya (Technoserve 2008). Dairy cooperatives 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 cooperatives. 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 (for example, division and district) and local politicians. It was thought that getting these actors on board would ease entry into communities and ensure their long-term cooperation beyond the lifespan of the program. 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 program. 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 percent) for the start-up that would go toward purchasing the cooling tanks and cover initial operational costs. To match farmers' 10 percent contribution, the EADD provided an interest-free loan of 30 percent from program funding, with the remaining 60 percent 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 setting 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 cooperative with a cooling tank (albeit running unprofitably), installed with support from Heifer International. EADD was to assist in remodeling the Tanykina cooperative into a limited company and support its further development into a business hub. In contrast, the Metkei Multipurpose DFBA was a conglomerate of four cooperative 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 among the respective cooperatives, as one EADD staff member noted:

> There is a superficial barrier where you are working through the cooperative 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 affected service delivery at later stages, as discussed below. One farmer noted the following on this confusion:

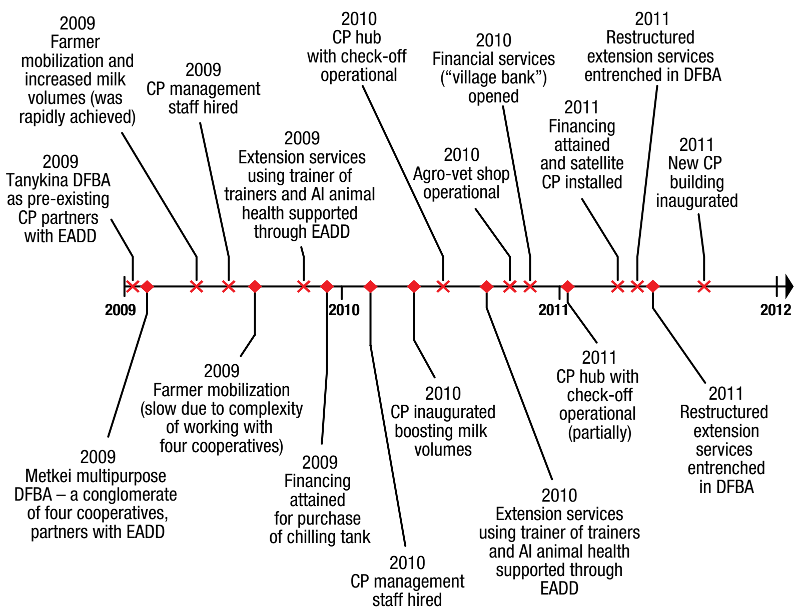
> All of us have some Metkei shares, but are registered with the cooperatives. There are four cooperatives and, according to the constitution, the members have to go through the cooperatives (Farmer focus-group discussion, Metkei, November 2011).

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

The Dynamics of Coevolution of Innovation on the EADD Platform

In this section, we unravel this coevolution 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. Figure 9.3 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 9.3 Timeline of important events in the innovation process in the two study sites



Source: Authors.
Note: CP = chilling plant; DFBA = Dairy Farmer Business Association; EADD = East Africa Dairy Development project; × = processes in Tanykina DFBA; ◆ = processes in Metkei DFBA.

ENHANCING INNOVATION FOR IMPROVED MILK MARKETING

As noted above, 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 sociotechnical and institutional innovations that in combination enhanced marketing (see Table 9.2 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 processing 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 above, 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 centers, 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 2,757 farmers sold an average of 15,000 liters per day in Tanykina; this rose to an average of 21,700 liters from 4,432 farmers. In Metkei, 1,188 farmers supplied on average 4,990 liters per day in 2009; this increased to about 17,000 liters a day from an average of 3,970 farmers. The EADD brokered negotiations for supply contracts between the DFBA and milk-processing companies as a way

TABLE 9.2 Summary of coevolution 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 • Signing supply contracts with milk-processing companies • Development of the chilling plants into business hubs that offer integrated services (for example, 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—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 • F5, F4, and F6—Providing board with technical support in negotiating contracts—TNS, Heifer • 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 (CPs)—equipped with laboratories for milk-quality monitoring • Integrating the CPs with various ICT management and information systems (including electronic weighing scales, dairy information management software) to support overall business hub operations	• F4 and F5—Technical support in procurement of various equipment and set up of CPs, including identifying suppliers and vendors through a tendering process (for example, cooling tanks, construction of the plant, software)—Heifer and TNS • F5—Providing technical support to the board and management team in various areas (for example, 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 • Recruitment of skilled management team overseeing day-to-day business management • Integrating improved procedures to ensure quality management of the CP (including milk-quality testing)	• F1—Conducting diagnostic and feasibility studies—TNS and ILRI/ICRAF • F5—Providing guidance on governance and management of hub in set up and operationalizing of hub—TNS • 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 • F4, F5, and F6—Providing technical support in managing the CP—TNS, Heifer.

Source: Authors.
Note: DFBA = Dairy Farmer Business Association; F1 = Demand articulation; F2 = Institutional support; F3 = Knowledge brokering; F4 = Network brokering; F5 = Capacity building; F6 = Innovation process management; ICRAF = World Agroforestry Centre; ICT = information and communications technology; ILRI = International Livestock Research Institute; TNS = Technoserve.

of stabilizing the markets. Milk prices also increased, as farmers in Tanykina received Kenya shillings (KES) 30 (US$0.35) per liter in 2011 compared to KES24 ($0.28) in 2009, and in Metkei the price rose from KES23 ($0.27) to KES31 ($0.36) per liter (EADD 2011a). Data from project reports indicated an increase in milk production at farmer level during the period 2009–2011: in Tanykina, farmers involved with EADD increased production from 4 liters to about 8.1 liters per cow on average, whereas in Metkei the estimated production increased from 4 liters to 6 liters (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 (for example, credit and financial services, artificial insemination, 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 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, artificial-insemination 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 broker continually and negotiate relationships.

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 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 farmgate. Both Tanykina and Metkei set up a few satellite collection centers 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 aluminum 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 neighbors mainly by women, to acquire ready cash for daily use. Whether this marketing emphasis has an effect on intrahousehold 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 coevolution 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 artificial insemination (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 program (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 privatization 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 Kenya shillings but now it has hiked to 1,000 Kenya shillings 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, but 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 9.3 summarizes and characterizes the coevolution 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

TABLE 9.3 Summary of coevolution of innovation related to breeding and the roles of intermediaries in supporting the process

Dimension of innovation	Activities	Functions of intermediary actors
Orgware	• Training of AISP to improve the AI-delivery system • Providing AI with necessary equipment (for example, motor bikes, semen tanks) through loans and integrating AI-service delivery with check-off system • Formation of DMGs as platforms for farmer training	• F4, F5, and F6—Forging partnership with various organizations for training AI service providers—Heifer and ABS-TCM • 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 • 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 • Acquisition of quality semen from various suppliers • Promoting "village bull" concept, that is, encouraging farmer groups (DMGs) to acquire semen tanks to store their preferred semen at village level	• F3 and F5—Providing information on semen tanks and facilitating their procurement—ABS-TCM and Heifer • F1, F3, and F5—Guiding procurement and distribution of selected semen at a subsidized price due to bulk buying—ABS-TCM
Software	• Improving service-delivery contracts between DFBA and AI-service providers • Promoting informed farmer decision-making and AI-service demand by farmers to improve breeding practices through training and information dissemination	• F5 and F6—Facilitating drafting and signing of contracts—Heifer • 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

Source: Authors.

Note: ABS-TCM = African Breeders Services Total Cattle Management Limited; AI = artificial insemination; AISP = artificial-insemination service provider; DFBA = Dairy Farmer Business Association; EADD = East Africa Dairy Development project; F1 = Demand articulation; F2 = Institutional support; F3 = Knowledge brokering; F4 = Network brokering; F5 = Capacity building; F6 = Innovation-process management; ILRI = International Livestock Research Institute; TNS = Technoserve.

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 program. 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 farmer, 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.

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 (for example, weak calves from the semen) and also suitability of the semen (for example, 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, or the 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 (that is, 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 (for example, 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. 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 9.4 provides a summary of how the feed innovation dynamics coevolved.

At both sites, most farmers belonging to DMGs indicated increased knowledge about different types of feeds (for example, lucerne, *Calliandra*, sweet potato vines, *Desmodium*) and feed-conservation methods (for example, 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

TABLE 9.4 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 • Establishment of demonstration plots in farmer-trainer fields for use in training on growing various types of feeds and for seed multiplication	• 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 • F3 and 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, that is, pulverizers and chuff cutters • Dissemination of various types of fodder crops (seeds, vines)	• F4—Facilitating procurement of feed-processing equipment through partnership with local small and medium enterprises—Heifer and TNS • 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 (for example, dual-purpose sweet potatoes) • Promoting change in farmer feeding and feed-conservation practices	• F1—Conducting baseline/diagnostic studies on feeding issues—ILRI • F3—Identifying sites and setup of experiments in collaboration with other scientists and farmers—ICRAF/ILRI • Facilitating information dissemination and training through extension—Heifer and ICRAF/ILRI • F3—Conducting research to draw lessons on improving feeding practices and feed markets—ILRI

Source: Authors.

Note: DMG = dairy-management group; F1 = Demand articulation; F2 = Institutional support; F3 = Knowledge brokering; F4 = Network brokering; F5 = Capacity building; F6 = Innovation-process management; ICRAF = World Agroforestry Centre; ILRI = International Livestock Research Institute; TNS = Technoserve.

farmers could not purchase them. Further, in some areas, farmers stated that the demonstration plots that 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 program as planned. Various informants attributed some of the difficulties to how the extension approach was structured when the program 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 program 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 program 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 foodcrops 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 cattle 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 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.

Analysis and Discussion

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 that 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 EADD 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 that further catalyzed business-hub development and accompanying institutional rearrangements in service delivery. Most of the innovations were institutional in nature, confirming earlier findings on institutional change as a sine qua non (essential component) 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 farmer, 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 program, 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 coevolution process that the different elements mutually reinforce one another, almost in a virtuous cycle (compare Hekkert and Negro 2009), which is also linked to changing and emergent network configurations (Ekboir 2003; Kash and Rycroft 2002; Klerkx, Aarts, and Leeuwis 2010). This is what contributes to overall system change—in our case moving from predominantly smallholder subsistence dairy farming (comparable to system A in Figure 9.1) to increasingly commercial dairy farming (system B in Figure 9.1).

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 coevolution of innovation by facilitating linkages among different stakeholders who were previously not connected for various reasons (for example, 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, Wongtschowski, and van der Lee 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 program. 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 program at various points in the innovation process, which contributed to reconfiguration among actors, including patterns of cooperation. This indicates that platforms are highly dynamic and distributed in composition, as opposed to static structures, as Nederlof, Wongtschowski, and van der Lee (2011) have also found.

The results indicate that platforms are effective in coordinating innovation because of the complementary skills and competencies that the various intermediary actors bring to them. The organizations 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 one central innovation intermediary acting as a platform facilitator, there is a set of innovation intermediaries, as other studies (Klerkx, Aarts, and Leeuwis 2010; Stewart and Hyysalo 2008) have observed.

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 and Clark 2010; Hekkert and Negro 2009; Leeuwis and Aarts 2011), coevolutionary 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 organizations each with its own objectives. In this context, each organization focused on or pursued strategies that reflected its own imperatives and mandates, and in some cases this resulted in tensions that undermined the broader vision of the program. 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 program planning. As the EADD case shows, platforms are continuously facilitating interactions with different actors, dictated by circumstances and unanticipated effects of actions. These findings confirm earlier findings that the management of innovation processes needs to be adaptive and guided by iterative learning (Klerkx, Aarts, and Leeuwis 2010; Kouévi, Mierlo, and Leeuwis 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 deal with the complex and dynamic nature of agricultural innovation (following Ekboir 2003; Hall and Clark 2010; Leeuwis and van den Ban 2004). This connects to the issue of the need to balance and reconcile results-based, milestone-focused monitoring (for example, logical frameworks) with process-based monitoring, where the intermediaries systematically capture feedback and enhance reflectivity 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 programs. Such adaptive capacity can be a challenge in development program–driven innovation platforms. One of the reasons is the scale of programs and the platforms connected to them (for example, the Sub-Saharan Africa Challenge Programme working in nine countries—van Rijn, Bulte, and Adekunle 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 also requires funding schemes that are responsive to emerging challenges or finding ways to leverage the required resources.

Conclusion

This chapter has demonstrated how innovation platforms are important mechanisms for stimulating and coordinating coevolution of innovation. A main implication of our study for theory is that the coevolving 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 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 herein. A 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 and Aarts 2013; Provan and 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 fulfill this role of overall platform facilitator. Klerkx, Hall, and Leeuwis 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 analyze the many informal intermediaries that 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.

References

Adekunle, A. A., and A. O. Fatunbi. 2012. "Approaches for Setting-Up Multi-Stakeholder Platforms for Agricultural Research and Development." *World Applied Sciences Journal* 16: 981–988.

Ayele, S., A. Duncan, A. Larbi, and T. T. Khanh. 2012. "Enhancing Innovation in Livestock Value Chains Through Networks: Lessons from Fodder Innovation Case Studies in Developing Countries." *Science and Public Policy* 39: 333–346.

Batterink, M. H., E. F. M. Wubben, L. Klerkx, and S. W. F. Omta. 2010. "Orchestrating Innovation Networks: The Case of Innovation Brokers in the Agri-Food Sector." *Entrepreneurship and Regional Development* 22: 47–76.

Biggs, S. D. 1990. "A Multiple Source of Innovation Model of Agricultural Research and Technology Promotion." *World Development* 18: 1481–1499.

Braun, A. R., G. Thiele, and M. Fernández. 2000. *Farmer Field Schools and Local Agricultural Research Committees: Complementary Platforms for Integrated Decision-Making in Sustainable Agriculture*. ODI AgREN Network Paper, No. 105. London: Overseas Development Institute.

Cleaver, F. 2002. "Reinventing Institutions: Bricolage and the Social Embeddedness of Natural Resource Management." *European Journal of Development Research* 14: 11–30.

Devaux, A., D. Horton, C. Velasco, G. Thiele, G. López, T. Bernet, I. Reinoso, et al. 2009. "Collective Action for Market Chain Innovation in the Andes." *Food Policy* 34: 31–38.

Dormon, E. N. A., C. Leeuwis, F. Y. Fiadjoe, O. Sakyi-Dawson, and A. van Huis. 2007. "Creating Space for Innovation: The Case of Cocoa Production in the Suhum–Kraboa–Coalter District of Ghana." *International Journal of Agricultural Sustainability* 5: 232–246.

EADD. 2009a. *Constraints to Use of Artificial Insemination Service and Possible Solutions.* East Africa Dairy Development Project Baseline Surveys Report 2. Nairobi: East Africa Dairy Development.

———. 2009b. *Dairy Production and Marketing.* East Africa Dairy Development Project Baseline Surveys Report 5. Nairobi: East Africa Dairy Development.

———. 2009c. *Feeds and Feeding Practices*. East Africa Dairy Development Project Baseline Surveys Report 3. Nairobi: East African Dairy Development.

———. 2009d. *Livestock Disease Challenges and Gaps in Animal Health Service Delivery*. East Africa Dairy Development Project Baseline Surveys Report 4. Nairobi: East African Dairy Development.

———. 2011a. *Milking for Profit—Mid Term Report 2008–2010*. Nairobi: East Africa Dairy Development.

———. 2011b. Kenya DFBAs Milk Production and Marketing Volumes Data. Internal Project Document. Nairobi: East Africa Dairy Development.

EADD Kenya. 2011. "The Lessons and Strategies for NCE and CE Period 2012–2013 for EADD Kenya 2011." Presentation at Annual Review and Planning Meeting, East Africa Dairy Development, Nairobi, November.

Eastwood, C. R., D. F. Chapman, and M. S. Paine. 2012. "Networks of Practice for Coconstruction of Agricultural Decision Support Systems: Case Studies of Precision Dairy Farms in Australia." *Agricultural Systems* 108: 10–18.

Edquist, C., and B. Johnson. 1997. "Institutions and Organizations in Systems of Innovation." In *Systems of Innovation: Technologies, Institutions and Organizations*, edited by C. Edquist, 41–63. London: Pinter Cassell Academic.

Ekboir, J. M. 2003. "Research and Technology Policies in Innovation Systems: Zero Tillage in Brazil." *Research Policy* 32: 573–586.

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.

Flyvbjerg, B. 2006. "Five Misunderstandings about Case-Study Research." *Qualitative Inquiry* 12: 219–245.

Hall, A., and N. Clark. 2010. "What Do Complex Adaptive Systems Look Like and What Are the Implications for Innovation Policy?" *Journal of International Development* 22: 308–324.

Hall, A., G. Bockett, S. Taylor, M. V. K. Sivamohan, and N. Clark. 2001. "Why Research Partnerships Really Matter: Innovation Theory, Institutional Arrangements and Implications for Developing New Technology for the Poor." *World Development* 29: 783–797.

Hekkert, M. P., and S. O. Negro. 2009. "Functions of Innovation Systems as a Framework to Understand Sustainable Technological Change: Empirical Evidence for Earlier Claims." *Technological Forecasting and Social Change* 76: 584–594.

Hermans, F., M. Stuiver, P. J. Beers, and K. Kok. 2012. "The Distribution of Roles and Functions for Upscaling and Outscaling Innovations in Agricultural Innovation Systems." *Agricultural Systems* 115: 117–128.

Hoholm, T., and L. Araujo. 2011. "Studying Innovation Processes in Real-Time: The Promises and Challenges of Ethnography." *Industrial Marketing Management* 40: 933–939.

Hounkonnou, D., D. Kossou, T. W. Kuyper, C. Leeuwis, E. S. Nederlof, N. Röling, O. Sakyi-Dawson, et al. 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: 715–728.

Hung, S-C., and R. Whittington. 2011. "Agency in National Innovation Systems: Institutional Entrepreneurship and the Professionalization of Taiwanese IT." *Research Policy* 40: 526–538.

Kash, D. E., and R. Rycroft. 2002. "Emerging Patterns of Complex Technological Innovation." *Technological Forecasting and Social Change* 69: 581–606.

Kilelu, C. W., L. Klerkx, C. Leeuwis, and A. Hall. 2011. "Beyond Knowledge Brokering: An Exploratory Study on Innovation Intermediaries in an Evolving Smallholder Agricultural System in Kenya." *Knowledge Management for Development Journal* 7: 84–108.

Klerkx, L., and N. Aarts. 2013. "The Interaction of Multiple Champions in Innovation Networks: Conflicts and Complementarities." *Technovation* 33 (6–7): 193–210. http://dx.doi.org/10.1016/j.technovation.2013.03.002.

Klerkx, L., and C. Leeuwis. 2008. "Balancing Multiple Interests: Embedding Innovation Intermediation in the Agricultural Knowledge Infrastructure." *Technovation* 28: 364–378.

———. 2009. "Establishment and Embedding of Innovation Brokers at Different Innovation System Levels: Insights from the Dutch Agricultural Sector." *Technological Forecasting and Social Change* 76: 849–860.

Klerkx, L., A. Hall, and C. Leeuwis. 2009. "Strengthening Agricultural Innovation Capacity: Are Innovation Brokers the Answer?" *International Journal of Agricultural Resources, Governance and Ecology* 8: 409–438.

Klerkx, L., N. Aarts, and C. Leeuwis. 2010. "Adaptive Management in Agricultural Innovation Systems: The Interactions Between Innovation Networks and Their Environment." *Agricultural Systems* 103: 390–400.

Kouévi, A. T., B. V. Mierlo, and C. Leeuwis. 2011. "Repetitive Discrepancy Between Espoused and In-Use Action Theories for Fishery Intervention in Grand-Popo, Benin." *International Journal of Learning and Change* 5: 114–138.

Leeuwis, C., and N. Aarts. 2011. "Rethinking Communication in Innovation Processes: Creating Space for Change in Complex Systems." *Journal of Agricultural Education and Extension* 17: 21–36.

Leeuwis, C., and A. van den Ban. 2004. *Communication for Rural Innovation: Rethinking Agricultural Extension*. Oxford, UK: Blackwell Science.

McCullough, E. B., P. L. Pingali, and K. G. Stamoulis, eds. 2008. *The Transformation of Agri-Food Systems: Globalization, Supply Chains and Smallholder Farmers*. Rome: Food and Agriculture Organization of the United Nations; London and Sterling, VA: Earthscan.

Moll, H. A. J., S. J. Staal, and M. N. M. Ibrahim. 2007. "Smallholder Dairy Production and Markets: A Comparison of Production Systems in Zambia, Kenya and Sri Lanka." *Agricultural Systems* 94: 593–603.

Morriss, S., C. Massey, R. Flett, F. Alpass, and F. Sligo. 2006. Mediating technological learning in agricultural innovation systems. *Agricultural Systems* 89, 26–46.

Muriuki, H. G., A. Omore, N. Hooton, M. Waithaka, R. Ouma, S. J. Staal, and P. Odhiambo. 2003. *The Policy Environment in the Kenya Dairy Sub-Sector: A Review*. SDP Research and Development Report, No. 2. Nairobi: Ministry of Livestock and Fisheries Development; Kenya Agriculture Research Institute; International Livestock Research Institute.

Nederlof, S., M. Wongtschowski, and F. van der Lee. 2011. *Putting Heads Together: Agricultural Innovation Platforms in Practice*. Development, Policy & Practice Bulletin, No. 396. Amsterdam: KIT Publishers.

Nelson, R. R., and K. Nelson. 2002. "Technology, Institutions, and Innovation Systems." *Research Policy* 31: 265–272.

North, D. C. 1990. *Institutions, Institutional Change, and Economic Performance*. Cambridge, UK: Cambridge University Press.

Oreszczyn, S., A. Lane, and S. Carr. 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: 404–417.

Provan, K. G., and P. Kenis. 2008. "Modes of Network Governance: Structure, Management, Effectiveness." *Journal of Public Administration Research and Theory* 18: 229–252.

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, the Netherlands: Boxpress.

Roep, D., J. D. Van Der Ploeg, and J. S. C. Wiskerke. 2003. "Managing Technical–Institutional Design Processes: Some Strategic Lessons from Environmental Cooperatives in the Netherlands." *NJAS Wageningen Journal of Life Sciences* 51: 195–217.

Röling, N. G., and J. Jiggins. 1998. "The Ecological Knowledge System." In *Facilitating Sustainable Agriculture: Participatory Learning and Adaptive Management in Times of Environmental Uncertainty*, edited by N. G. Röling, and M. A. E. Wagemakers, 283–311. Cambridge, UK: Cambridge University Press.

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., and S. Kuhlmann. 2004. "The Rise of Systemic Instruments in Innovation Policy." *International Journal of Foresight and Innovation Policy* 1: 4–32.

Spielman, D. J., J. Ekboir, and K. Davis. 2009. "The Art and Science of Innovation Systems Inquiry: Applications to Sub-Saharan African Agriculture." *Technology in Society* 31: 399–405.

Spielman, D. J., F. Hartwich, and K. Grebmer. 2010. "Public–Private Partnerships and Developing-Country Agriculture: Evidence from the International Agricultural Research System." *Public Administration and Development* 30: 261–276.

Steins, N. A., and V. M. Edwards. 1999. "Platforms for Collective Action in Multiple-Use Common-Pool Resources." *Agriculture and Human Values* 16: 241–255.

Stewart, J., and S. Hyysalo. 2008. "Intermediaries, Users and Social Learning in Technological Innovation." *International Journal of Innovation Management* 12: 295–325.

Sumberg, J. 2005. "Systems of Innovation Theory and the Changing Architecture of Agricultural Research in Africa." *Food Policy* 30: 21–41.

TANGO International. 2010. *East Africa Dairy Development (EADD) Project—Mid-Term Evaluation Regional Synthesis Report*. Nairobi: East Africa Dairy Development.

Technoserve. 2008. *The Dairy Value Chain in Kenya: A Report for the East Africa Dairy Development Project, Nairobi*. Washington, DC.

Tenywa, M. M., K. Rao, J. B. Tukahirwa, R. Buruchara, A. Adekunle, J. Mugabe, C. Wanjiku, et al. 2011. "Agricultural Innovation Platform as a Tool for Development Oriented Research: Lessons and Challenges in the Formation and Operationalization." *Journal of Agriculture and Environmental Studies* 2: 117–146.

Van de Ven, A. H., D. E. Polley, and S. Venkataraman. 2008. *The Innovation Journey*. New York: Oxford University Press.

van Lente, H., M. Hekkert, R. Smits, and B. van Waveren. 2003. "Roles of Systemic Intermediaries in Transition Process." *International Journal of Innovation Management* 7: 1–33.

van Mierlo, B., B. Regeer, M. v. Amstel, M. C. M. Arkesteijn, V. Beekman, J. F. G. Bunders, T. D. Cock Buning, et al. 2010. *Reflexive Monitoring in Action: A Guide for Monitoring System Innovation Projects*. Oisterwijk, the Netherlands: Boxpress.

van Rijn, F., E. Bulte, and A. Adekunle. 2012. "Social Capital and Agricultural Innovation in Sub-Saharan Africa." *Agricultural Systems* 108: 112–122.

Waters-Bayer, A., P. C. Sanginga, S. Kaaria, J. Njuki, and C. Wettasinha. 2009. "Innovation Africa: An Introduction." In *Innovation Africa*, edited by P. C. Sanginga, A. Waters-Bayer, S. Kaaria, J. Njuki, and C. Wettasinha, 1–5. London: Earthscan.

Winch, G. M., and R. Courtney. 2007. "The Organization of Innovation Brokers: An International Review." *Technology Analysis and Strategic Management* 19: 747–763.

World Bank. 2006. *Enhancing Agricultural Innovation: How to Go Beyond the Strengthening of Research Systems*. Washington, DC.

———. 2007. *Agriculture for Development: World Development Report 2008*. Washington, DC.

Yin, R. K. 2003. *Case Study Research: Design and Methods*, third edn. Thousand Oaks, CA, US: Sage.