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

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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 organizations identified as fulfilling an intermediary role in the Kenyan agricultural sector. The results show that these organizations fulfill 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 organizations 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.

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 what is increasingly referred to as an agricultural innovation system (Spielman 2005, World Bank 2006). An innovation system is defined as a 'network of organizations, enterprises,

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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 behavior 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 and 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 (World Bank 2006, Klerkx *et al*. 2009). Innovation systems in developing countries have especially been noted to be rather weak, with interactions between the various actors characterized 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, World Bank 2006, Szogs 2008). 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 organizations 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 emphasizes, 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 (Sulaiman and Hall 2002, Klerkx and Leeuwis 2008).

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 non-governmental agencies fulfilling new roles within an agricultural support system driven by the demands and needs of entrepreneurs (Muyanga and 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 3 summarizes the methods, followed by the results in Section 4. The contributions of the paper to understanding the diversity of intermediary structures and the broad innovation support functions they fulfill are discussed in section 5.

The paper concludes by pointing out implications of the findings for policy and further research.

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 and 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 and 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, Leeuwis and van den Ban 2004, Klerkx and Leeuwis 2008). 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 (McNie 2007, Kristjanson *et al*. 2009, 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 also enhance innovation capabilities. Intermediaries therefore act as 'bridging organizations' that facilitate access to knowledge, skills, services, and goods from a wide range of organizations.

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.

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 groundedness, definitions of intermediaries have not yet 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 organizations 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 (Winch and Courtney 2007, Klerkx and Leeuwis 2008). These specialized organizations 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 organizations combine this role with directly providing technical service (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 positions in the context of a fully privatized knowledge infrastructure (van Lente *et al*. 2003, Klerkx and Leeuwis 2008, Klerkx and Leeuwis 2009). In many developing countries, however, the context is such that innovation brokering is done as a side activity by organizations 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 and Sulaiman 2009); others argue for the potential for specialized agencies to take on a systemic intermediary role (Klerkx *et al*. 2009).

Functional characterization of innovation intermediaries

In the literature, innovation intermediaries are characterized 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 (van Lente *et al*. 2003, Smits and Kuhlmann 2004, Howells 2006, Klerkx and Leeuwis 2008, Kristjanson *et al.* 2009), we noted six broad functions that include:

(1) Demand articulation/stimulation
(2) Network building
(3) Knowledge brokering
(4) Innovation process monitoring
(5) Capacity building
(6) 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 multilayered nature of innovation processes. The functions are visualized in Figure 1, which characterizes the schematic representation that guides our analysis.

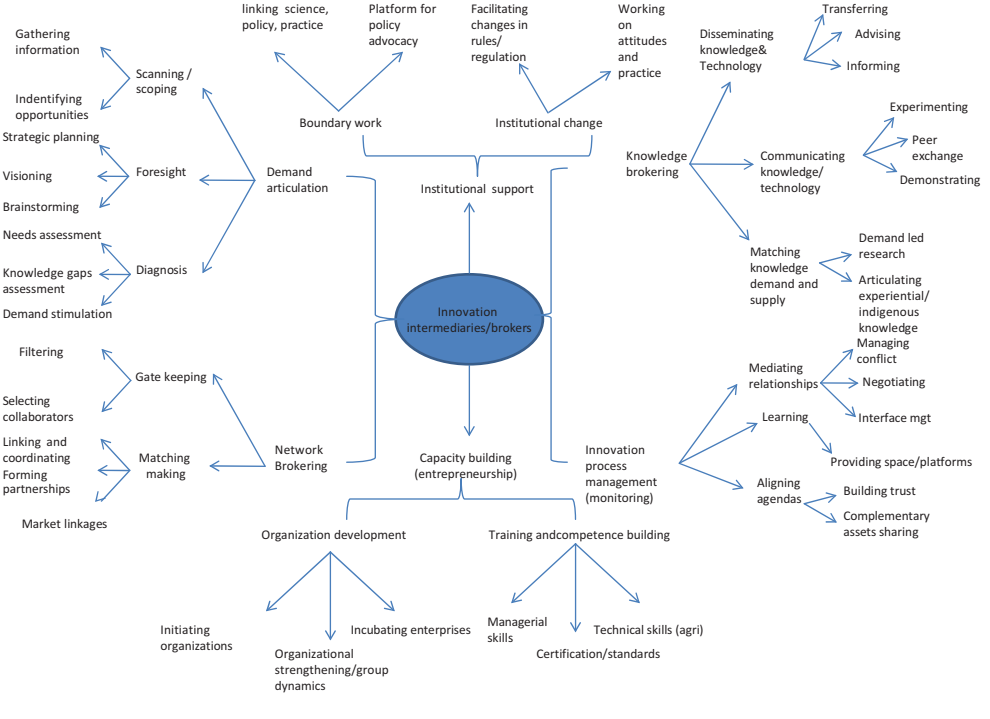

Figure 1. Range of innovation intermediaries functions.

Sources: van Lente *et al*. (2003), Smits and Kuhlmann (2004), Howells (2006), Klerkx and Leeuwis (2008, 2009), Kristjanson *et al.* (2009).

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.

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 (Reardon 2004, Kibaara *et al*. 2008, Technoserve 2008, Neven and Odame *et al*. 2009). These represent different contexts for understanding the changing intermediaries' domain in Kenya and their resultant contributions to innovation.

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 2002). Using a snowball sampling approach (Creswell 2002), 22 organizations 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 organizations 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 organizations 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 organizations. 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.

Results

The innovation intermediaries' landscape in the Kenyan agricultural sector

The study identified various organizational arrangements characterized as innovation intermediaries (see Table 1). These included government agencies, consultants, NGOs, private enterprises, producer associations, and special programmes (such as consortiums and networks). Some of the identified organizations 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 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 organizations, including KDSCP, Agriprofocus, ISAAA, and AATF, can be categorized as specialized innovation brokers as they mainly focused on catalyzing and facilitating interactions in support of different levels of innovation (see Table 1). Furthermore, the results indicate that some established organizations 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,

Table 1. Characterizing 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 micro-enterprise	1, 2, 4, 5 Collective enterprises
3. EADD (East Africa Dairy Development Project)	Consortium (NGOs and Research institutes)-2007	Dairy	Donor	Conducting needs assessment and research to identify the 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, dairy companies) Linking with processors Program coordination (lead agency)	1, 2, 3, 4, 5 Collective enterprises

(*Continued*)

Table 1. (*Continued*).

Name of organization	Type of organization and year established	Sector	Funding	Types of activities in agricultural sector	Broad functions and level of functioning**
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 farmer cooperatives on technical and business skills 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
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 post-harvest) and non-technical (business skills) Supporting access to financing including micro-finance 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
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

(*Continued*)

Table 1. (*Continued*).

Name of organization	Type of organization and year established	Sector	Funding	Types of activities in agricultural sector	Broad functions and level of functioning**
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 centers 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. Agriprofocus	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
18. ISAAA (International Services for Acquisition Agriculture)	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 centers, 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

(*Continued*)

Table 1. (*Continued*).

Name of organization	Type of organization and year established	Sector	Funding	Types of activities in agricultural sector	Broad functions and level of functioning**
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 (The most prominent functions of each organization are indicated by bold type)

they place a strong emphasis on strengthening agricultural entrepreneurs' business skills. Similarly, other intermediaries working in the dairy and horticulture sub-sectors emphasize 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.

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 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 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 of all 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 ongoing 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 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 sub-sectors. 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 organizations. In the horticulture sub-sector, intermediaries – e.g. Farmconcen, Technoserve, Today Agriculture, KHDP – 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 organizations 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 center), 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, Farmconcern, 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 1, intermediaries play a role in institutional support as boundary actors, particularly in the interface between science and practice, and also 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 1, the actors engaged in facilitating institutional support were those working at a systemic level such as KDSCP, Agriprofocus, 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 also 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.

Typology of intermediaries identified

From the results above, we characterized 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). 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.

Table 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	Farmconcern, Technoserve, SHOMAP, KHDP, EADD, Setpro, Spantrack, Precise management FPEAKSITES 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 Organizational 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 (–)

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 environment 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.

Discussion: theoretical and policy implications

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 organizations 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 *et al*. 2009). 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 *et al*. 2009, 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 organizations emerged as innovation brokers in the context of full privatization 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 (van Lente *et al*. 2003, Klerkx and Leeuwis 2008). In Kenya, the intermediary landscape is different, as indicated by the broker types identified (Table 1). This reflects a context where the focus is on building capacity for smallholder commercialization and organizing a nascent innovation system (Odame *et al*. 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).

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 and Leeuwis 2008, Klerkx and Leeuwis 2009), 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 and Leeuwis 2008, 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 and Leeuwis (2008) 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 (Phillipson *et al*. 2004, Eenhoorn 2007, Knickel *et al*. 2009). 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.

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 and 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 extension services (cf. Rivera and 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). There is therefore need to weigh up what brokering functions need to be emphasized 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 organizations, 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 also 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 organizations studied on external funding and hence their vulnerability to changing donor priorities. As Klerkx and Leeuwis (2009) 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 organizations 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.

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 need to look at how intermediaries position themselves in dynamic innovation networks and processes.

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