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How Dynamics of Learning are Linked to Innovation Support Services: Insights from a Smallholder Commercialization Project in Kenya

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How Dynamics of Learning are Linked to Innovation Support Services: Insights from a Smallholder Commercialization Project in Kenya

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

KEY WORDS: Dynamic learning agenda, Demand articulation, Innovation support services, innovation brokering, Learning-oriented monitoring, Reflexivity

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Introduction

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

The literature on demand-driven approaches to supporting agricultural innovation has so far mainly focused on analyzing, from a macro-level structural perspective, the challenges of optimally matching the needs of farmers (demand side) to innovation support services (supply side) in increasingly pluralistic innovation support service systems (Birner et al. 2009; Christoplos 2010; Klerkx and Leeuwis 2008; Parkinson 2009; Swanson & Rajalahti 2010). These studies indicate that the systems consist of a wide array of actors (for example, public extension, private advisors, agri-business companies, researchers) that undertake a broad range of privately or publicly funded innovation support functions. Thus, a 'best-fit' between demand and supply should be sought by choosing services from a '*menu of options*' from the supply side (cf. Birner et al., 2009). They do not, however, investigate how choices from this menu are made in a dynamic innovation process. Recent work has also pointed to the important role of so-called innovation intermediaries that undertake a brokering role to improve the match of demand and supply of innovation support services and hence enhance innovation processes (Kilelu et al. 2011; Klerkx and Leeuwis 2008; Leeuwis and Aarts 2011). However, these studies have mainly focused on characterizing types of innovation intermediaries and the functions they provide. These studies thus still provide little insight at the micro-level of innovation projects, on the interplay between articulating demands and matching these demands with supply of appropriate innovation support services, and the related dynamics of learning that accompany such innovation processes. While some work has indicated that specifying farmers' needs and demands most probably require continuous re-articulation (Chowa et al. 2013; Kibwika et al. 2009; Klerkx and Leeuwis 2009a), it has not explored this process in detail. Also, recent studies on innovation platforms

that highlight learning processes in multi-actor networks (Kilelu et al. 2013; Nederlof et al. 2011) fall short of analyzing this evolving process in relation to matching demand for innovation support services to their supply.

This paper seeks to contribute to addressing these gaps in the literature by deepening insights on understanding learning processes in agricultural innovation in connection to the role of innovation support services, using a case study of an agricultural development project on smallholder commercialization of bulb onions in Kenya. The main research question the paper addresses is: how did the project support the matching of farmers' innovation support demands to innovation support service provisioning within an evolving learning process? In section 2 we briefly review literature and build a conceptual framework for the study. We then present the case study design and the findings in the subsequent sections, and end with a discussion on the theoretical and policy implications of our findings in connection to the debate on demand-driven advisory services and their role in enhancing innovation processes.

Conceptual Framework: Dynamic Learning Agenda and the Matching of Demand and Supply of Innovation Support Services

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

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

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

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

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

As Figure 1 conceptually outlines, the dynamic learning agenda entails continuously (re-) articulating needs and demands and consequently matching them to action, often supported by various innovation support services. This requires that the intermediary actors facilitate reflexive monitoring and capture feedback, to identify emerging demands and match these demands with innovation support services. This learning process is to guide the continuous adaptation of goals and plans in order to ensure the support is not mismatched thus enhancing the interventions (Leeuwis and van den Ban 2004; Regeer 2009; van Mierlo et al. 2010).

Case Description

We apply the conceptual framework outlined in the previous section to analyze an on-going project implemented by Farm Concern International (FCI), a non-governmental organization that is supporting the commercialization of onions by smallholders in Kieni east and west districts, in central Kenya (Farm Concern International 2010). Despite favourable conditions for bulb onion farming in various regions in Kenya, a deficit in supply of locally produced onions has necessitated the importation of the produce, mainly from Tanzania. Studies have shown that onion

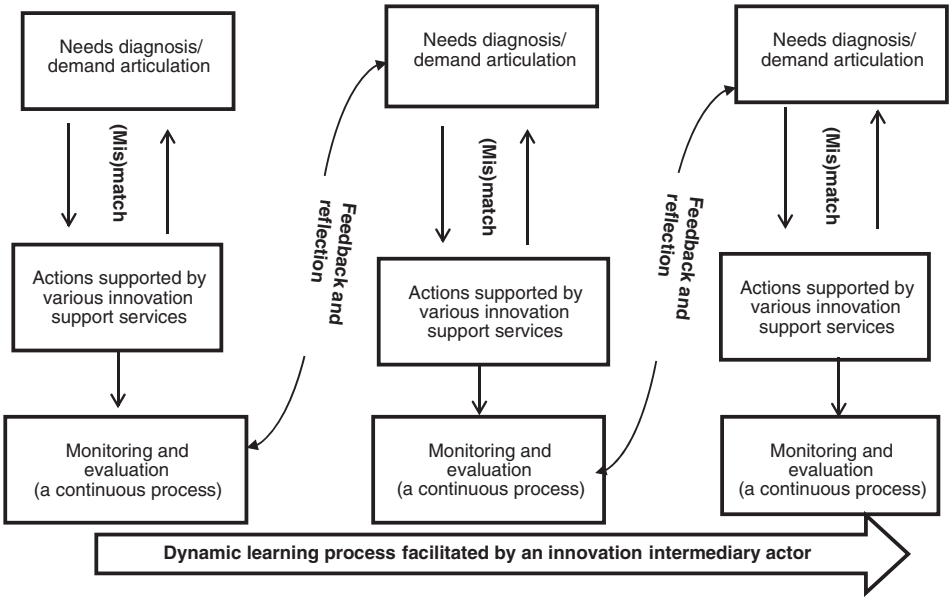

Figure 1. Conceptualization of a dynamic learning agenda.
Sources: Authors; Regeer, 2009; Klerkx and Leeuwis 2009.

yields in Kenya are considerably low and of lower market quality (for example, storability and visual appearance) than those from Tanzania. This poor performance has been linked to the predominant use of low yielding open pollinated varieties (OPV) coupled with challenges in weed and pest management, poor post-harvest practices and marketing (Koenig et al. 2008; Muendo and Tschirley 2004; Waiganjo et al. 2009). These challenges and the identified market opportunity provided the impetus for supporting the onion commercialization project.

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

Research Methods

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

case was identified from an exploratory study that mapped various multi-stakeholder agricultural development projects in Kenya (see Kilelu et al. 2011). The project was selected for further in-depth research as it had a clear goal for facilitating innovation processes through matching demand with supply of different types of innovation support services. It thus fitted our research objective and moreover, because it was on-going, it allowed us to follow the process in real time.

Data were gathered between August 2011 and February 2012 to coincide with the main onion production season in the project areas. This enabled us to follow the interventions of the project and gather data at various points in order to observe and understand how the process evolved over time. We used various data collection methods and sources to enable triangulation and enhance the validity of the study (Yin 2003). Data from farmers were collected from four CV sites to enable us to get a broader view of this process. Two sites were part of the pilot project (Embaringo and Kinyaite CVs) and two were new areas (Kiaragana and Tanyai CVs). Table 1 below provides a summary of the methods and data collected.

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

Findings

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

Setting the Agenda: Identifying Innovation Needs and Demands

The project's goal to enhance onion commercialization in Kieni district was guided by a diagnostic and market opportunity analysis conducted by FCI prior to the pilot project. According to the project field manager, the current project aimed to scale up onion commercialization and targeted to reach 10,000 farmers in Kieni east and west districts. Below is a list of the innovation needs identified at the outset of the project that relate to challenges in the technical and socio-institutional domains (Farm Concern International 2010; Roothaert and Muhanji 2009).

1. Technical domain:

(1) Improved production of quality bulb onions;
(2) Improved agronomic practices and use of other production technologies; and
(3) Improved post-harvest handling and storage of onions.

Table 1. Summary of methods and data collected.

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

Source: Authors' data.

2. Social-institutional domain:

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

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

Matching Demand and Supply of Innovation Support Services in an Evolving Learning Agenda in the Technical Domain

The main technical issues pertained to improving yield and quality of onions grown in the project area. According to the field manager, farmers used cheap OPVs before the project interventions and had an average yield of between 0.5 to 1 tonne per acre (the project used acre as unit for measuring farm size (1 acre = 0.4 hectare)), whereas the expected yield from hybrid varieties in optimal local conditions was estimated to be about 10–14 tonnes per acre. On average farmers in the project sites grew onions on about 0.4 acres. The project interventions started with organizing farmer mobilization meetings to promote hybrid onion seed varieties (for example, Tropicana F1, Red Pinoy F1, Red Passion F1, and Rouge FI) just before the beginning of the growing season (in August). We participated in two of these meetings where seed companies and agri-input suppliers were invited to promote their hybrid onion seed varieties and the related agro-chemicals. During these sessions, the input suppliers also provided information on improved onion production practices. The data we collected from individual farmers in the discussion groups indicated that in the older sites—Embaringo and Kinyaite CVs—about 80% (n = 31) of the farmers had planted hybrid varieties and a minority still grew OPVs. In the two newer CVs—Kiaragana and Tanyai—only 28% (n = 28) of farmers grew hybrid varieties while about 62% indicated growing OPVs while another 12% mixed both hybrid and OPVs. Thus in the older sites there was a higher adoption of hybrid varieties.

During one of the mobilization meetings, some farmers noted that while such forums were a useful source of knowledge on onion production, they felt that they still did not have adequate information to enable them make decisions on which varieties to grow. As one of the farmers explained: 'We have tried onion farming but were not happy with the productivity. An experiment should be conducted to understand if the seeds promoted are suitable in our area' (Farmer meeting, Endarasha, September 2011).

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

Farmers were linked to other various support services for improving crop management practices to coincide with the peak onion growing season (October to January). First, the project facilitated farmer-to-farmer visits, where lead farmers (identified mainly in the older CVs) would share their experiences with the 'new' farmers on various technical issues. During discussions farmers indicated that these visits were important avenues for acquiring information on improved production practice. Second, the project organized crop management training forums in various locations. We attended some of these forums where various agro-chemical company agents were again invited to disseminate information on standard procedures on applying fertilizer, pesticides and herbicides at different stages of onion production. While farmers were able to ask questions during these sessions about specific issues they faced, their feedback after these sessions indicated the need for more practical training on application of agro-chemicals but also concerns with the effects of using them. These forums were also meant to create direct links between farmers and the agro-chemical suppliers as a way of stimulating demand for the agro-chemical products but to also ensure farmers accessed quality products. But as farmers indicated, the investment costs also remained a constraint to the adequate use of quality inputs as illustrated by a comment of one of the farmers: 'We have so many chemicals available so when you use chemical X for thrips, it doesn't work although it is cheap and everyone can afford it, but when you tell someone to buy another chemical Y, that costs 600 shillings (about 6.9 USD [1 USD is equivalent to 87 Kenya shillings]), while X goes for 150 shillings (about 1.7 USD). But some of these chemicals are not working' (Farmers group discussion, Tanyai, December 2011).

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

Table 2 provides a summary of the needs and demands in the technical domain and how these were supported and monitored based on a review of the monitoring process. We collected estimates of yield data from a small sample of farmers (n = 43), in three CVs in February (Embaringo, Tanyai and Kinyaite) and found that the average production was about 3.4 tonnes per acre, with some variation in the different sites. While a more detailed study with a larger sample size would be needed to get more conclusive results, our findings indicate that there was improved production in the project areas, although the volumes are still below the expected yield of between 10-14 tonnes. Furthermore, from observations at harvest time, we noted that some of the onions were small in size and not properly cured indicating problems of quality. Thus, the main technical challenges were not resolved, pointing to the need for continuous support to farmers.

Matching Demand and Supply of Innovation Support Services in an Evolving Learning Agenda in the Socio-institutional Domain

Following the diagnosis assessment at the onset, support for innovation in the socio-institutional domain focused on two broad areas: (1) enhancing collective action

Table 2. Summary of demands in the technical domain identified at the onset of the project and the matched innovation support services.

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

Source: Authors' data.

of farmers in the value chain; and (2) strengthening entrepreneurial capacity of individual farmers. Table 3 provides a summary of how the innovation demands in in this domain were matched to innovation support services.

Enhancing collective action was anchored on FCI's commercial village (CV) model that brings together many farmers within an administrative village to engage in commercialized production of identified crops. The CV model is operationalized first through the formation of commercial producer groups (CPGs) made up of about 20–30 households. The CPGs within a village are then clustered to form the larger commercial village (Farm Concern International 2011 provides details of the model). According to the project manager, getting the CVs as new institutions operational was hinged on establishing elaborate structures, comprising several committees at the CPG and CV level. All CPG members were expected to be actively involved in at least one of

Table 3. Summary of demands in the socio-institutional domain identified at the onset of the project and the matched innovation support services.

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

Source: Authors' data.

the committees. It is through these structures that farmers would be able to engage in collective action through aggregating their demands for various innovation support services such as bulk purchase of inputs, advisory and extension support, financial credit, and would also enable them to leverage better prices through collective marketing.

To support the establishment of CVs, the field manager periodically consulted with the CV leaders and provided them with guidance as needed. In addition, a number of individuals from the different projects sites were trained as community level CV facilitators and were expected to offer further support in operationalizing the CV as this was considered a continuous learning process. But from the interviews we gathered that these CV facilitators provided little support in strengthening the CVs because in practice, they had to spend most of their time collecting various

monitoring data for the project. Furthermore, from discussions with farmers we established that the older CVs had set up most committees while the new CVs only had a few committees set up (production and marketing). However, many farmers indicated that they were not actively involved in the committees as envisaged. Others mentioned the issue of conflict within groups and a lack of collaboration between different CPGs, which affected the operation of the CVs. The field manager considered such conflict as part of internal dynamics of CVs, which the project avoided being drawn into. These findings suggest that there are some gaps with the support needed for strengthening farmer organizations where the demands for such institutional support are not well articulated.

The demand for streamlining farmers' participation in the onion value chain was supported by linking farmers directly to the market (traders) and other innovation support services that were referred to as business development services (BDS). On marketing, the project organized a number of farmer-trader forums in order to facilitate direct market links so as to by-pass the middlemen who many farmers considered exploiters. In addition, the field manager visited various markets in different parts of the country to scout potential untapped market opportunities. Farmers noted that the direct linkages resulted in substantive increase in prices from approximately 10Ksh (0.1USD) before the project to about 50Ksh (0.57 USD per kilogram) during the season when the study was conducted. For the traders, the sourcing became better coordinated as they could order large volumes through the CVs. Thus brokering such linkages as an innovation support service enhanced the farmers' position in the high value market.

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

Support related to enhancing individual entrepreneurship aimed to change farmers' attitude and practices of farming as a business. According to comments from the Ministry of Agriculture (MOA) officers and MFI representatives, this need for entrepreneurial capacity of smallholder farmers seemed to be a latent demand that needed to be stimulated. To address this demand, the project facilitated forums where representatives of the MFI and the MOA agri-business officers trained farmers on basic farm records and financial management, calculating profitability combined with general discussions on what it means to do farming as a business. However, the project did not follow up to see if the farmers had incorporated some of these ideas and skills into their practices. Interestingly, the discussions with farmers showed that they associated entrepreneurial support more with facilitating access to credit and markets rather than displaying a demand for specific skills, competences and attitudes. Thus, we see that in the case of such latent demands related to

entrepreneurship there was an apparent mismatch with the support provided. This highlights the importance of having a better understanding of such latent demands, and detecting these demands and supporting them requires adequate monitoring and feedback. In the following section we analyze how the monitoring and feedback process contributed to a dynamic learning agenda.

The Role of Monitoring and Feedback Processes in a Dynamic Learning Agenda

As indicated in the conceptual framework, monitoring and feedback are important components for guiding the matching of demand for and supply of innovation support as part of dynamic learning processes. From the interviews with the field manager and a review of monitoring reports, we noted that the information gathered through the formal monitoring system was mainly geared toward reporting on project progress. The project monitoring system comprised mainly a series of forms that were used to periodically collect data for tracking project progress. As shown in Tables 2 and 3, this formal monitoring system was used to capture pre-defined outcomes of the project (for example, using indicators such as number of farmers that were growing hybrid varieties, yields attained, amount of inputs purchased collectively etc.). These indicators were linked to the demands identified at the onset of the project through the diagnostic study. However, the data was not systematically analyzed and reflected upon, particularly not in relation to whether the innovation support provided adequately met farmers' demands. Thus, the formal monitoring system did not adequately guide learning and the re-orienting of innovation support based on (re)emerging demands. In addition, we observed some informal feedback processes within the project, as shown in Table 4. Farmers mainly expressed this feedback during various meetings. For example, the demonstration plots were set up in response to farmers' demand for further guidance on seed variety selection. Such informal feedback provided avenues for demand (re)articulation. While in some instances the feedback was used to re-orient activities to match the demands, most of the emerging demands were not addressed (see Table 4). For example, during a meeting farmers indicated some concerns with the effect of intensive use of agro-chemicals on soils and indicated that they wanted research to look into this matter but there was no follow-up on this issue. Thus, the emerging needs from such informal feedback and the responses to the demands for support were somewhat arbitrary. These findings indicate a gap with the intermediary role of the project in terms of being a broker between demand and supply of services and the extent to which it organized to support a dynamic learning agenda.

Discussion

Matching Demand and Supply of Innovation Support Services is Part of a Continuous Learning and Negotiated Process

Our results show that supporting learning in agricultural innovation processes is tied to linking the needs of actors, particularly farmers, to various resources and services that contribute to dynamic innovation processes. Importantly, the study showed that in the context of demand-driven pluralistic innovation support, the requisite for learning that underlies innovation processes trigger the mobilization of a network of

Table 4. Summary of the emerging demands in the two domains and how these were matched to innovation support services.

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

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

different innovation support service providers who bring in different complementary knowledge, skills and resources necessary for innovation. This confirms recent findings of Chowa et al. (2013) that pluralistic advisory support systems are better

tailored to support learning, and using the words of Birner et al. (2009) they hence do provide a menu of options. Our findings also support other studies which have shown that brokering roles (in this case fulfilled by FCI) are important in facilitating linkages among various actors, as they try to optimize a demand and supply match for innovation support services (Crawford et al. 2007; Klerkx & Leeuwis 2008).

What our study adds to earlier work on demand-driven innovation support services (Birner et al. 2009; Christoplos 2010; Klerkx et al. 2006; Parkinson 2009) is to show that there are continually emerging demands in innovation processes, triggered by new problems, uncertainties and challenges or new opportunities. Because of the many interacting socio-technical factors that determine the outcome of agricultural innovation processes (cf. Hall and Clark 2010), these emerging problems, uncertainties, challenges and opportunities are not fully predictable. Therefore supporting learning requires a fine-grained understanding of the various demands for services that emerge in the process and which require to be matched to a combined supply of innovation support services (Crawford et al. 2007; Klerkx and Proctor 2013). It also requires an adequate monitoring system for capturing these demands, as shown in the conceptual framework (Figure 1). This is where the challenge lies with regard to supporting a dynamic learning agenda. While our results show that the FCI project mobilized different innovation support services, the process was not always effective in addressing emerging issues and adapting the agenda accordingly (a demand for research to understand the effect of intensive input use in onion production on soils was not incorporated into the agenda as no research partners were mobilized as collaborators in the project). This ties to arguments against generic knowledge transfer models in innovation support interventions, which are not geared towards addressing everyday farmers' concerns and practices which are diverse and evolve over time (Hall and Clark 2010; Parkinson 2009).

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

Monitoring and Feedback Processes and the Learning Agenda

As the findings indicate, the project continually gathered data in order to monitor progress of the interventions in relation to the pre-defined project goal, such as tracking the adoption of hybrid seed varieties by farmers and the linked yield outcomes. However, the inadequate match with appropriate support for most of the emerging demands shows the limitations of this monitoring approach. Considering

that the monitoring system had a focus on tracking pre-set goals, it was not able to adequately capture useful feedback on emerging demands of farmers as the process unfolded, and hence it reproduced a linear view of innovation processes. Our findings thus confirm that an indicator driven monitoring system is limited in its ability to systematically capture feedback and enable evolving demand (re)articulation, and hence improve the efficacy of action by linking to appropriate innovation support services. This builds on the argument that a dynamic learning agenda should be linked to reflexive learning-oriented monitoring systems (Regeer 2009; Ringsing and Leeuwis 2008; van Mierlo et al. 2010; Woodhill 2007).

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

Furthermore, the results also show that demands emerging from feedback in the socio-institutional domain (building entrepreneurship capacity) were more latent than the technical demands (access to hybrid seeds) and thus were largely not addressed (see Table 4). The limitation of supporting farmers to incorporate generic business skills and entrepreneurial attitudes points to a mismatch as regards the appropriateness of the support provided to agricultural enterprises. As some scholars have noted (Klerkx and Leeuwis 2009b; Phillipson et al. 2004), part of the difficulty in providing support related to enhancing business skills in agriculture has been a lack of familiarity of non-agricultural innovation support service providers with farmers (and vice versa), but also a limited understanding by 'traditional' agricultural innovation support providers of entrepreneurial learning processes that are more tacit and contextual (Cope 2005). While most of the studies on support of entrepreneurship of farmers have been undertaken in the context of developed countries, our findings indicate this is also a concern in developing countries. Studies emerging from other developing and emerging countries indicate that dedicated entrepreneurship support programs are highly relevant to stimulate smallholders to become more entrepreneurial and market-oriented (Berdegué 2001; Kaganzi et al. 2009; Namdar-Irani and Sotomayor 2011).

Given the above problems related to demand articulation, our article re-emphasizes the message from earlier work (Klerkx and Leeuwis 2009b; Parkinson 2009) that adequate effort should be put in optimizing the quality of demand articulation processes, including capturing the latent needs. When not putting sufficient attention to the quality of demand articulation, interventions may miss out on the broad range of farmers' needs and demands. This means that monitoring the process through continuous capture of information from both formal and informal feedback process is needed (Ringsing and Leeuwis 2008). This is a key task of the intermediary actors involved in these interventions as brokers, which in this case was the role of the project staff. In order to enhance a dynamic learning agenda,

the emphasis of such intermediaries should not be on controlling the process and monitoring predefined outcomes. Such a focus reduces the learning potential, as it tends to overlook feedback. Rather, emphasis should be on steering the process to enable optimal interactions between the demand and supply sides of the innovation processes, guided by a learning agenda. This indicates that the three principal functions of such intermediaries (demand articulation, network formation, and innovation process monitoring; see Klerkx and Leeuwis 2009b) should be performed in tandem. As has become clear from the previous section, while executing these functions, power dynamics between actors at the demand side (farmers) and the supply side (input suppliers) need to receive sufficient attention.

Conclusion

By applying the concept of a dynamic learning agenda we bring in a new perspective to understanding how to enhance demand-driven innovation support service delivery. Our findings have shown that there is a need for a more nuanced understanding of the concept of 'best fit' in increasingly pluralistic agricultural innovation support service systems (Birner et al. 2009). As the findings show, it is crucial that farmers are assisted to navigate these systems to enable better targeted and context-specific support, especially in a context in which there are contrasting private and public interests, and power differences between farmers and innovation support service providers. As our analysis reveals, in fact several 'best-fits' should emerge through a continuous process of articulating of demands that are then linked to an adequate network of service providers with attention to the appropriateness of service modalities. Sufficient attention needs to be paid to evolving demands, and the quality of demand articulation needs to be high to be able to inform the choice for appropriate type of innovation support. Also, there may be a need to build capacity to be able to provide certain types of innovation support services when these are not available (for example, entrepreneurship support). Hence, following Regeer (2009), intermediaries that act as brokers between demand for and supply of innovation support services within such innovation processes should put more attention to 'making the invisible visible'. This means incorporating learning oriented monitoring systems that integrate a learning agenda that enables optimally matching demand and supply of innovation support services.

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

In terms of future research, looking at the development of dynamic learning agendas over a longer timeframe is needed, as our study was only able to capture some of the dynamism. Following Klerkx and Proctor's (2013) recent findings on how 'alliances of advisors' form to provide an integrated palette of innovation support services, more research on how technical and socio–institutional advice

(entrepreneurship support) can be optimally combined is needed. This is especially relevant in the context of complex systems of public and private pluralistic innovation support services which have emerged in many developing countries.

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