

## **SUPPORTING SMALLHOLDER COMMERCIALISATION BY ENHANCING INTEGRATED COORDINATION IN AGRIFOOD VALUE CHAINS: EXPERIENCES WITH DAIRY HUBS IN KENYA**

By CATHERINE W. KILELU<sup>†‡</sup>, LAURENS KLERKX<sup>†</sup> and CEES LEEUWIS<sup>†</sup>

<sup>†</sup>*Knowledge, Technology and Innovation group, Wageningen University, Hollandsseweg 1,  
Wageningen, 6706 KN, The Netherlands*

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### SUMMARY

Recent literature suggests that to make value chains in changing agrifood systems in sub-Saharan Africa more inclusive, intermediary institutions should foster coordination. The hub concept has been applied as such an intermediary institution that coordinates advisory services, input supply and smallholder access to markets. This study unravels hub coordination in smallholder dairy in Kenya, conceptualising the hub as a mix between a broker of relationships, a one-stop-shop for services and a cluster of producers and service providers, enabling horizontal coordination (between smallholders) and vertical coordination (between smallholders and value chain actors and service providers). Findings indicate that, in resolving challenges that limit smallholders' integration in value chains, synergies emerged as the hub combined different types of horizontal and vertical coordination. This was done by simultaneously organising clusters of farmers and input and service providers (clustering role) and actively facilitating delivery (broker and one-stop-shop role), where the hub structure stimulated the matching of demand (better articulation) to supply (better organised access). However, tensions emerged in the combination of horizontal and vertical coordination as farmer organisations as hub operators had to balance a role as an honest broker between farmers with the intent of enhancing collective action and as a business-oriented entity which resulted in the exclusion of some farmers who cannot deliver the quantity and quality required to minimise coordination costs. Given these tensions and capacity problems of farmers' organisations, complementary intermediary arrangements may be necessary to fulfil some coordination roles.

### INTRODUCTION

Agri-food systems in sub-Saharan African (SSA) countries are rapidly changing, driven by several factors including urbanisation, evolving dietary needs and consumer preferences, liberalised and expanding markets for agricultural commodities and sustainability concerns. This change presents opportunities for smallholders to become integrated into a growing diversity of agrifood value chains (Reardon *et al.*, 2003; Swinnen and Maertens, 2007; World Bank, 2007). However, a majority of smallholders are unable to transition from subsistence to commercialised production. This is due to a number of factors including high transaction costs and other bottlenecks in accessing input and services (e.g. technologies, extension and advisory services, transportation, finance) and their constrained participation in output markets. It is further exacerbated

<sup>‡</sup>Corresponding author. Email: [catherine.kilelu@wur.nl](mailto:catherine.kilelu@wur.nl) and [ckilelu@gmail.com](mailto:ckilelu@gmail.com)

by smallholders' limited political voice in influencing agricultural policies and by other institutional biases that disadvantage their participation in markets, thereby broadly affecting sustainable agricultural development (Biggs, 2008; Hounkonnou *et al.*, 2012; Markelova *et al.*, 2009; Poulton *et al.*, 2010).

An extensive body of literature on smallholder commercialisation indicates the importance of mobilising and effectuating collective action amongst smallholder producers to overcome the above-noted challenges and enhance the producers' capacities (e.g. technological upgrading, entrepreneurial capabilities) (Bingen *et al.*, 2003; Markelova *et al.*, 2009; Poulton *et al.*, 2010; Shiferaw *et al.*, 2011; Snapp *et al.*, 2003). However, enabling smallholder commercialisation goes beyond organising collective action: there is also need to address the major challenge of facilitating and coordinating linkages between smallholders and other actors in the increasingly complex and fragmented networks underlying agrifood value chains (Bijman *et al.*, 2011; Poulton *et al.*, 2010). As these authors argue, coordinating these networks – which include smallholders, input and service providers, government agencies, researchers and buyers and processors amongst others – and fostering cooperation, goodwill, trust and interdependence amongst them is important for innovation and governance in agrifood value chains. The absence of these factors can threaten the sustainability and competitiveness of value chains or may lead to inequitable inclusion for smallholders (Gereffi *et al.*, 2005; Poole *et al.*, 2013; Poulton *et al.*, 2010). Coordination, occurs at various levels in value chains, broadly distinguished in the literature as horizontal and vertical. Horizontal coordination occurs between actors at one level in the value chain (farmers in this case), with the aim of fostering beneficial collaboration to address shared constraints and exploit opportunities associated with scale. Vertical coordination occurs between different actors at different levels in the value chain (e.g. farmers, traders, input services) in order to better align activities between them (Bijman *et al.*, 2011; Poulton *et al.*, 2010).

It is argued that enabling combined horizontal and vertical value chain coordination in order to better integrate and upgrade smallholders in value chains requires effective intermediary institutional forms (Hounkonnou *et al.*, 2012; Mmari, 2015; Poulton *et al.*, 2010; Trienekens, 2011; Yang *et al.*, 2014). Recently, the hub concept has been applied to denote such an intermediary arrangement in various development interventions supporting smallholder commercialisation in various developing countries (Jaleta *et al.*, 2013; Kilelu *et al.*, 2013; Kruse, 2012). These hubs are characterised as focal points in value chains, coordinating various multi-actor networks that link smallholders to inputs, innovation support services and output markets. The hubs are seen as enhancing relationships and enabling co-learning between actors in order to improve smallholder participation in agrifood value chains, but there have been few studies on their actual functioning. Hence, there is a knowledge gap on how hubs enable combined horizontal and vertical coordination and contribute to addressing the issues that keep many smallholders from participating gainfully and inclusively in agrifood value chains. This article seeks to fill this knowledge gap by analysing a case study of a project that used a hub model to support smallholder dairy development in Kenya. The main questions addressed are: (i) how do hubs enable

value chain coordination and (ii) what is achieved in value chain coordination through hubs?

The remainder of the article is structured as follows. Section 2 provides theoretical reflections that inform the analytical framework by reviewing literature on coordination issues relating to smallholders and the conceptualisation of hubs. Section 3 describes the case study and outlines the research methods. Section 4 presents the findings and discussions on the extent to which the hub, as a coordinating mechanism, contributes to enhancing linkages and building the relationships that strengthen smallholders' position in agrifood value chains. From our main findings, we conclude with reflections on the concept of hub as a coordination mechanism and on smallholder commercialisation efforts.

#### CONCEPTUAL FRAMEWORK

##### *Horizontal coordination issues and smallholder participation in agrifood value chains*

The small scale and high costs of transacting individually constrain many smallholder farmers from participating competitively in rapidly changing markets. Horizontal coordination amongst farmers is characterised by a shift from patchy interactions amongst them towards collective action. Several studies report that collective action amongst smallholders through the formation of producer groups and farmer cooperatives creates economies of scale, reduces transaction costs and improves farmers' bargaining capacity (Bingen *et al.*, 2003; Shiferaw *et al.*, 2011; Yang *et al.*, 2014). Despite mixed results on the effectiveness of these farmer organisations, there is wide consensus that coordinating collective action is important to enhance smallholders' position and promote inclusive agrifood value chains. The above studies note that coordinated efforts amongst smallholders are effectuated with the aim of addressing various challenges, including:

- limited collaboration and entrepreneurial capacities amongst farmers, which hampers the mobilisation of economies of scale for participation in markets;
- lack of mutual trust, loyalty and reciprocity amongst farmers who are informally collaborating, which can result in opportunistic behaviour (e.g. free-riding, defaulting, side-selling);
- diversity of interests amongst members, which limits effective organising;
- exclusion of some farmers from participation in markets; and
- market actors' opportunistic behaviour, inconsistency and unpredictability, which undermine smallholder farmers.

##### *Vertical coordination issues and smallholders' participation in agrifood value chains*

The vertical coordination challenges faced by smallholders reflect gaps in the governance of relationships between farmers and the various actors in the agrifood value chain (Biggs, 2008; Hounkonnou *et al.*, 2012; Poulton *et al.*, 2010). Most insights on vertical coordination issues linked to smallholder agricultural development (Bijman *et al.*, 2011; Dorward *et al.*, 2005; Poulton *et al.*, 2010; Swinnen and Maertens, 2007) theoretically build on the transaction cost economics perspective (Williamson,

1985), which identifies three typical coordination mechanisms in value chains – spot market, hybrid and hierarchical. The spot market denotes loosely linked market-based structures with price as the coordinating mechanism. Hierarchical coordination is characterised by vertical integration where one lead firm tightly controls the production and marketing stages in a value chain, e.g. when multinational companies supplying a commodity such as bananas operate their own plantations. In between spot and hierarchical is the hybrid model, differentiated further by Gereffi *et al.* (2005) into three models (modular, relational and captive) that encompass a diversity of organisational arrangements in markets that reflect the various interdependencies that exist between actors and their activities along agrifood value chains. Some notable examples of hybrid arrangements through which smallholder farmers have been integrated into agricultural markets include contracts, outgrowing schemes and partnerships (Barrett *et al.*, 2012; Mmari, 2015; Vellema *et al.*, 2013). These arrangements are orchestrated and coordinated through a ‘lead firm’ or what also has been called a ‘lead farm’ (Goedegebuure *et al.*, 2014).

The choice of vertical coordination mechanism is influenced by the nature and complexity of transaction. In the agricultural context, it is linked to product characteristics (e.g. perishability, bulkiness, quality) and the nature of the market (Abdulai and Birachi, 2009; Hobbs and Young, 2000; Swinnen and Maertens, 2007). From the literature (Hounkonnou *et al.*, 2012; Poulton *et al.*, 2010; Snapp *et al.*, 2003), it can be distilled that improving vertical coordination in the smallholder context aims to address various challenges, including:

- unreliable access to agri-input supplies and extension service systems (linked to delivery, affordability, information flow, etc.);
- unequal power relationships between farmers and output market actors (e.g. in negotiating prices or enforcing contracts, information asymmetry on quality standards);
- uncoordinated delivery of complementary services (e.g. finance) to enable smallholders to access agri-inputs in a timely fashion;
- lack of transparency and trust between farmers and input and output market actors due to various opportunistic practices (e.g. traders ‘fixing’ measures, farmers adulterating the quality of products, lack of regulatory guidelines on weights);
- input service providers’ disconnected understanding of the resource constraints faced by farmers and how this is linked to adoption and use of inputs;
- power imbalances between supply and demand sides of input markets if some service providers hold monopolistic positions;
- market and policy push for intensive input use in smallholder or peasant agricultural systems. This push does not always adequately take into account the effect of such a model on smallholders’ resilience, return on investment and sustainability concerns.

#### *Hubs as emerging institutional arrangements in agricultural value chain coordination*

The multi-actor networks in agrifood chains can be coordinated in several ways as discussed before, in which coordination can be more centralised or can be more

distributed or shared amongst value chain participants (Poulton *et al.*, 2010; Provan and Kenis, 2008). The term ‘hub’ is used to denote an intermediary arrangement that can enable such multi-actor network coordination of value chains. Several authors have indicated a need for such an intermediary arrangement that can enhance simultaneously horizontal and vertical coordination to address the challenges facing smallholders (Poulton *et al.*, 2010; Yang *et al.*, 2014) and ensure that value chains are inclusive as opposed to exclusive.

Recent work examining the application of the hub in smallholder-focussed agrifood chain development views the hub as an emerging intermediary business model for strengthening input and services delivery and output market access (Jaleta *et al.*, 2013; Kilelu *et al.*, 2013; Kruse, 2012). At the centre of hubs are lead firms, which in the context of smallholder development are farmer organisation-based enterprises or other firms engaged in the value chain. Broadly speaking, three conceptualisations of hub reflect its intermediary role (building on Tesfazghi, 2013):

- (1) The hub as a one-stop shop. Here, the hub is viewed as a mechanism for collective marketing and improving accessibility to services. The hub is a cost-effective way of realising business transactions by offering a suite of services in one central location. This entails integrated input and service delivery systems (e.g. business development, technology delivery, financial services), geared towards particular economic activities. For example, in India, Agricultural Technology Information Centres (ATICs) (Sulaiman *et al.*, 2012) and rural business platforms (Reardon *et al.*, 2012) have been set up at different administrative as one-stop shops for the delivery of relevant technologies and services to farmers.
- (2) The hub as a cluster. Here, a hub is conceptualised as a clustering of firms to stimulate and optimise the flow of knowledge, technology and support services for innovation (Chan *et al.*, 2010). In the Information and Communications Technology (ICT) sector particularly, the notion of high-tech hub is used to denote specific regional industrial districts (e.g. Seattle and Silicon Valley) where various suppliers cluster around one or several core firms (Gray *et al.*, 1996). An agricultural cluster comprises a concentration of producers and other actors engaged in the same agricultural or agri-industrial subsector that interconnect and build value networks, either formally or informally, when addressing common challenges and pursuing common opportunities (Ha *et al.*, 2013; Perez-Aleman, 2005; Reardon *et al.*, 2012). These hubs are socio-economic entities characterised by a group of economic agents located in close proximity in a specific geographical region. This literature suggests that, by using clustering as a strategy, local firms can strengthen their competitiveness by attracting investments, capital and strategic collaboration and joint learning.
- (3) The hub as a broker. Here, the hub is considered a node that connects various collaborating actors, as often within hubs some actors take on coordinating and facilitative roles (Chan *et al.*, 2010; Dhanaraj and Parkhe, 2006). Dhanaraj and Parkhe (2006) talk about ‘hub firms’ that occupy a central position within innovation networks and use this prominent role to orchestrate interactions

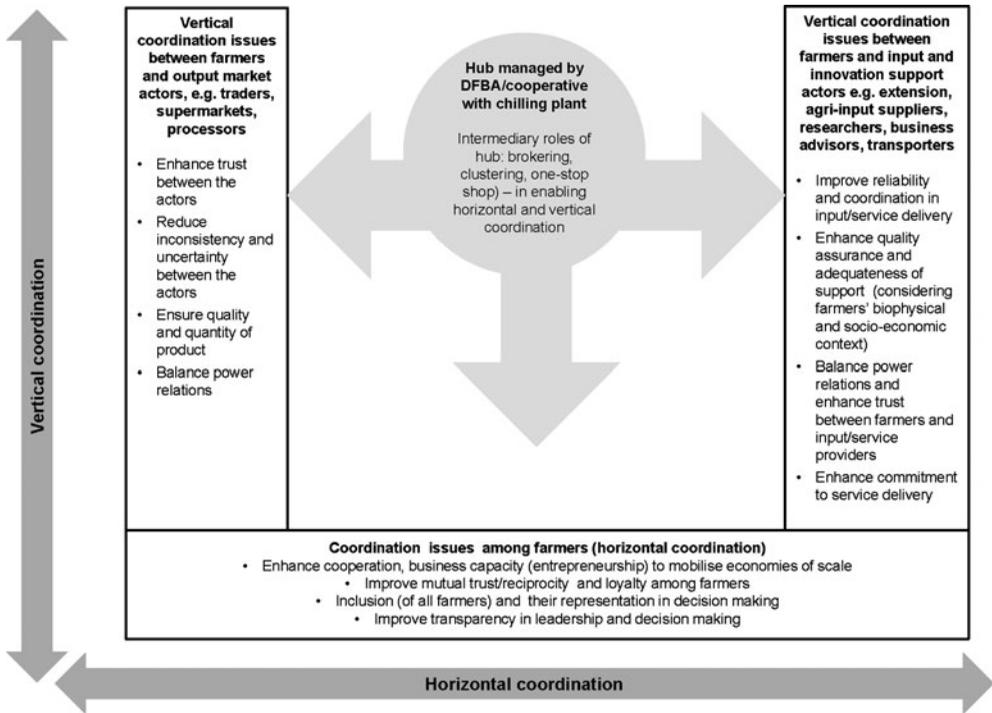


Figure 1. Analytical framework (Source: own elaboration).

amongst various actors in the network, pulling together the dispersed resources and capabilities of network members. This connects to the concept of lead firms in captive value chains that have an economic interest in orchestrating the value chain in a particular way (see Gereffi *et al.*, 2005). Alternatively, the broker role can be fulfilled by an independent intermediary organisation. In the agricultural sector, Klerkx *et al.* (2009) describe such intermediaries that fulfil brokering roles in the Dutch context. However, farmer organisations, which are not neutral actors, have been seen to take on brokering role (Kilelu *et al.*, 2011; Yang *et al.*, 2014). Such brokering entails undertaking a number of functions, including demand articulation (e.g. for technology, knowledge and funding needs), matchmaking and network building between farmers and other actors and enhancing relationships (e.g. conflict resolution, building trust, mediation).

Figure 1 illustrates the analytical framework derived from the theoretical exploration, showing the hub as an intermediary arrangement that enables linkages between a network of actors at horizontal and vertical level in agrifood value chains. To enable this simultaneous coordination, the hub fulfils one or a combination of the roles noted above. In a sense, the hub enhances value-chain governance through various market and non-market mechanisms.

## CASE INTRODUCTION – THE ESTABLISHMENT OF DAIRY HUBS THROUGH EADD

The East Africa Dairy Development (EADD) programme was a 4-year pilot project working in selected regions of three East African countries, Kenya, Rwanda and Uganda. It aimed to enhance smallholder dairy farming and profitability through integrated interventions in dairy production, market access and knowledge application. A consortium of five development and research organisations, including Heifer International as the lead partner, with TechnoServe, the International Livestock Research Institute, the World Agro-forestry Centre and African Breeders Services – Total Cattle Management, implemented the programme (EADD, 2011). The case study was conducted in Kenya.

The entry point of the EADD programme was first to support the establishment of new local dairy producer enterprises called Dairy Farmers Business Associations (DFBAs). The DFBAs are viewed as an alternative to dairy cooperatives, which had faced many operational and governance challenges in Kenya in the past. These challenges contributed to a fragmented dairy value chain dominated by highly volatile spot markets. The DFBAs are farmer-owned and managed enterprises expected to enhance farmers' collective action and strengthen their linkages with other dairy value chain actors. Each DFBA draws membership from farmers within a defined catchment area covering a radius of about 10 km from where they have installed a chilling plant (CP) for bulking and collective marketing of milk. The EADD provided initial partial financing<sup>1</sup> and technical support to DFBAs for purchasing and installing CPs. Each DFBA is run by a board of directors who are member farmers selected from the various administrative locations within its catchment. In addition, a team of professional staff has been hired in each DFBA to provide operational management. DFBAs are legally registered entities with the Kenyan government.

The CP is the operational platform for the DFBA, providing a physical location that forms the dairy hub for carrying out day-to-day activities. This includes collection and bulking of milk supplied by farmers. Through an interlinked 'check-off' credit system, farmers are able to access inputs and services directly and indirectly offered by the DFBA and pay from the proceeds of the milk supplied. Thus, the hub forms the DFBA business model that integrates collective output marketing with input and service delivery systems. The EADD programme provided technical support to DFBAs in structuring the hub and facilitating linkages with various inputs and service providers. EADD also provided credit support to some emerging service providers (artificial insemination [AI] services and animal health assistants [AHAs]) as start-up capital to purchase equipment (e.g. semen tanks, diagnostic kits, motorbikes). A centralised information management system installed at the CP is used to track and manage hub transactions and improve business management. The formation and maturing of hubs is a gradual step wise process (referred to as stage gating in EADD). There were 12

<sup>1</sup>Each DFBA was to raise 10% of initial capital from members to purchase or upgrade CP. An additional 30% of the financing came from Heifer International and the Bill & Melinda Gates Foundation as an interest-free loan (The remaining 60% was to be financed by a commercial loan.

DFBAs with established hubs in Kenya at the time of data collection (Kruse, 2012; TANGO International 2010 for details of the hub model).

## RESEARCH METHODS

### *Methods of data collection and analysis*

We conducted a case study in order to gain in-depth insights on how hub coordination enhances multi-actor relationships between smallholders and inputs, services and output market actors and resulting outcomes. We selected the EADD programme as a case from an exploratory study (see Kilelu *et al.*, 2011). The case can be considered revelatory (Yin, 2003) as the EADD programme explicitly applied a hub model in supporting smallholder innovation and market integration processes. The unit of analysis of the case is the DFBAs comprising a hub. Because of the breadth of the programme, we selected two sites for the study: Tanykina (Kipkaren) Dairy Company Limited and Metkei Multipurpose Dairy Company Limited. The risk of bias in such a sampling strategy was minimised by selecting sites that were sufficiently advanced in the process of hub establishment, thus providing adequate depth of diverse experiences in hub processes. Tanykina was operational at the time of engaging with the EADD programme and had an existing CP. Metkei, characterised as a new site, was an amalgamation of four existing small dairy societies. It had no CP when it first engaged in the EADD programme. The two sites have different histories and contexts with dairy farming; thus, it was possible to glean a variety of insights on hub dynamics.

We collected data between August 2010 and December 2011, using multiple methods in order to triangulate the information and enhance the validity and reliability of the study (Flyvbjerg, 2006; Yin, 2003). We conducted semi-structured interviews with seven service providers (three in Metkei and four in Tanykina) and key informant interviews with two DFBA managers, five District Ministry of Livestock officers and five EADD Kenya team members. We also conducted farmer focus group discussions in 15 farmer dairy management groups (DMGs) and two with non-DMG farmers. In addition, we had informal discussions with some board members and transporters and conducted participant observations during visits to the study sites. All the interviews and discussions were taped and fully transcribed for analysis conducted in two steps. In the first step, drawing from data, we identified how the different actor groups at horizontal and vertical level were coordinated through the hub. In the second step, we analysed how relationships between these different actors changed, and outcomes in addressing the challenges noted in the analytical framework (Figure 1). In the analysis, we use exemplary quotes to illustrate the findings.

## RESULTS

The CP provided the location for hub coordination. Figure 2 illustrates how different actors were coordinated in the hub (shown by different shapes). The hubs operate within a broad social and institutional context where other actors not directly linked

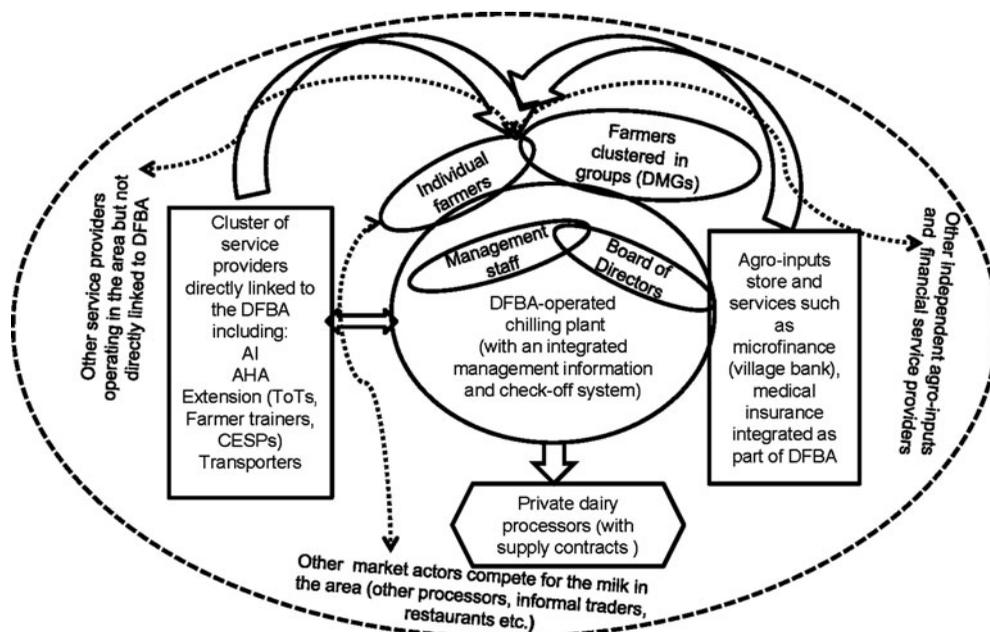


Figure 2. The DFBA-managed hub as a configuration of various actors and their interaction.

to the hubs also operate. Thus, these actors are part of the dynamics (represented by the dotted arrows) of the dairy value chain in each location.

### *The hub and horizontal coordination*

*Mobilising farmers through horizontal coordination.* The interviews and farmer discussions revealed that horizontal level coordination enabled new linkages between farmers, resulting in new configurations and collaboration at DFBA level (see Figure 2). The establishment of the hub attracted many farmers seeking to cooperate in milk marketing, as indicated by the increase in the number of farmers who registered as members of the DFBA and started delivering milk for collective marketing. In Tanykina, the number of farmers increased from about 2760 in 2009 to about 4430 in 2010, and in Metkei the number increased from 1188 to about 4928 farmers in the same timeframe (EADD internal report). Following DFBA membership guidelines, some milk suppliers opted to buy shares in the DFBA, not only supply milk and earn dividends but also be able to participate in the DFBA governance (e.g. voting for directors, investment decisions), whereas others remained only suppliers which required paying a minimum membership fee. In addition, the DFBA promoted the setting up of DMG clusters (membership of about 15 farmers each), which are platform through which the farmers could access services (especially extension) and engage in peer-to-peer exchanges. Some of the DMGs were newly established, whereas others had existed in other forms, mainly as self-help welfare groups. However, some farmers did not join DMGs for various reasons.

*Effect of hub coordination on horizontal relationships.* The discussions and interviews indicate that the new actor constellations triggered new patterns of horizontal interactions. At DFBA level, interviews revealed that the new governance structure with elected board members and a professionally recruited management team contributed to attracting farmers to the DFBA. Further, DMG formation facilitated collaboration between farmers, as most of them indicated that they had previously worked individually. These groups participated in joint training but began to meet regularly to share their experiences on dairy farming practices. Furthermore, some groups engaged in other joint enterprises such as vegetable, fruit and poultry production and marketing. As respondents indicated, the clustering of farmers through the hub fostered their relationships and increased cooperation, reciprocity and trust amongst farmers.

Nonetheless, other issues remained unresolved, and new tensions emerged. One issue was that the DMG structure inadvertently excluded non-participating farmers from accessing some services (i.e. extension and training), although they were DFBA members. Some DMGs became dormant; this highlights the issue of long-term commitment and sustainability of such externally induced collaborations, even amongst farmers. Some farmers were still wary of the DFBA leadership and questioned their intentions, as illustrated by the comments below:

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

Thus, relations between some farmers and the DFBA were still marked with distrust. This caution can be linked to the chequered history that led to the collapse of many dairy cooperatives in Kenya. In addition, some farmers who were struggling to improve productivity questioned whether they benefitted from being part of the collective enterprise. Interviews with board members revealed another emerging tension: that of the board trying to balance interest in growing a profitable enterprise and being inclusive and supportive of all farmers. This relates particularly to the poorer dairy households whose productivity was generally lower and who required considerably more support.

#### *The hub and enhancing vertical coordination*

*The role and effect of the hub in linking farmers to output markets.* The interviews revealed that DFBA establishment was important for linking farmers to the output market, especially private dairy processing companies. By installing CPs, the DFBA were bulking and cooling milk, thus offering processors high volumes of quality milk daily, albeit with some seasonal fluctuations. The increased milk volumes attracted some of the leading private processors such as Brookside in Tanykina and the new Kenya Cooperative Creameries (KCC) in Metkei. Informal milk traders within the DFBA catchment areas also increased operations, especially with local restaurants.

With increased milk volumes, farmers were assured of a market because of increased competition between different output market actors. According to data in project

reports, in 2009, the average daily volume delivered in Tanykina was 15,300 l; this had increased to an average of 21,700 l at the time of the study in 2011. In Metkei, the average daily volume increased from 5000 l to about 14,700 l. The data show that, prior to the DFBA, farmers sold their milk for an average of about 0.15 USD l<sup>-1</sup> in both locations. This rose to an average of USD 0.35 l<sup>-1</sup> paid by the DFBA at the time of the study (EADD internal reports). The DFBA's ability to supply high milk volumes enabled them to sign supply contracts with the leading private dairy companies and to negotiate higher prices for their milk. Tanykina's contract with Brookside and Metkei's with new KCC meant that the hubs enhanced vertical coordination that facilitated a stable market for the farmers. This also indicates efforts to balance power between farmers (DFBAs) and private processors.

However, other dynamics and tensions were noted that indicate continuing challenges of coordination with output markets. For instance, some farmer members in both DFBAs were side-selling some of their milk to alternative markets (such as the other processors operating in the area and informal milk traders) in order to maximise the various benefits offered by the different market channels. As one farmer noted:

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

Because the DFBA had insufficient transport services, farmers located in remote areas opted to sell to market players that collected the milk at the farm gate. Others farmers noted that, during the wet season, processors decreased milk prices and increased milk rejection rates, claiming poor milk quality. This discouraged farmers from selling through the DFBA. In addition, processors' tardy payments to the DFBA caused dissatisfaction amongst farmers. All these factors affected farmers' loyalty to the DFBA but also affected the DFBA's relations with the processors.

#### *The role and effect of the hub in linking farmers with input market actors*

Interviews with DFBA managers revealed that both hubs had set up an agri-input shop (for feeds, tools, veterinary drugs, etc.) and provided extension services directly to its members. The hubs further linked farmers to a cluster of private service providers that included AI and AHAs. There were four AI and two AHA service providers directly attached through service agreements to the Metkei hub and three AI and two AHAs in Tanykina. These service providers received short-term training and support in acquiring some equipment (e.g. motorbikes, AI tanks, diagnostic kits for AHAs) through the EADD programme. In addition, other independent services operated in both locations (see Figure 2). Also, many milk transporters, mainly local young men with motorbikes, emerged to offer services in the hub linked to the check-off system. In addition, the Tanykina hub integrated other services including a microfinance institution (village bank) and entered into a partnership with a medical insurance company. Furthermore, in both sites, we observed and confirmed through the interviews that the hubs had a spill-over effect in stimulating other types of services and businesses (e.g. retail shops, restaurants, other independent agridealers) locally.

As noted in interviews, although the hubs increased farmers' access to inputs and support services through the interlinked check-off credit system, this was not without challenges. For example, there was increased demand for AI services, but there were concerns about the quality of delivery. Some farmers expressed dissatisfaction with the responsiveness of service providers, as noted below:

We are not completely happy with the AI services . . . You call them when the cow is in heat and they will tell you to wait and don't come on time . . . so they constrain our progress. (Metkei farmers' discussion)

Some farmers felt that they could not rely on the service providers to guide them in making right decisions, e.g. regarding the selection of the most appropriate semen to improve their breeds. As one farmer explained:

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

Similarly, the programme envisaged that providing extension services through DMGs using farmer trainers and trainer of trainers (ToTs) would effectively meet farmers' requirements. These trainers would get back-stopping support from the local Ministry of Agriculture extension office and EADD consortium partners. However, in the early stages of the programme, problems emerged linked to opportunistic behaviour by some TOTs, as explained by a DFBA manager:

We initially used the TOTs as a link between the CP and farmers but their performance was dismal. They would sit under a tree and give us a list of those trained and invoice for the service. The EADD realised this practice and decide to terminate them. (Metkei manager interview)

To address this issue, a new model of community extension service provider (CESP), contracted directly by the DFBA, was introduced later. Additional challenges included scarcity of fodder crop seeds, quality of concentrate feeds and high cost of some inputs at the DFBA agri-input store. Thus, hub coordination did not address some underlying issues that affected relations (e.g. trust, reliability, quality assurance) between farmers and other actors.

## DISCUSSION

### *Role of hubs in enhancing combined horizontal and vertical coordination in dairy value chains*

Our findings confirm the importance of novel intermediary coordination mechanisms, such as hubs, for enhancing smallholder access to inputs and innovation support services and participation in remunerative output markets (Poulton *et al.*, 2010). They deepen earlier findings by showing how the many coordinating roles come together. As the summary analysis in Table S1 (in supplementary material) shows, hub coordination-enhanced linkages for input and service delivery and with output markets, supporting earlier findings (Jaleta *et al.*, 2013; Kilelu *et al.*, 2013).

Through the hub, the DFBA's are able to integrate horizontal and vertical coordination of the value chain.

As some scholars have noted, however, the characteristics of the agrifood value chain determine the choice of coordination mechanism (Hobbs and Young, 2000; Swinnen and Maertens, 2007). The application of the hub model has been documented mainly in cases of dairy development in East Africa ((Jaleta *et al.*, 2013; Kilelu *et al.*, 2013; Kruse, 2012). The characteristics of milk as a commodity (e.g. bulky, produced daily, perishable) that needs a CP in a physical location and the types of services and inputs required in milk production lend themselves to specific coordination mechanisms (Abdulai and Birachi, 2009). Also, the growing formal dairy market in Kenya, which has seen growing demand for quality milk and dairy products especially in urban areas, has likely played a role in supporting an integrated value chain coordination model. Thus, one could argue that the hub model embedded in a dairy farmers' organisation is suitable in a formal dairy value chain. However, there are similar observations of a shift towards more integrated coordination models, especially for other high-value commodities for domestic and export markets in Asia and SSA (Ha *et al.*, 2013; Mmari, 2015; Reardon *et al.*, 2012; Vellema *et al.*, 2013).

#### *Synergies of different roles of hubs in enhancing combined horizontal and vertical coordination*

An additional insight from this study, beyond analysing a hub model in a specific agrifood value chain, is the synergic coordination of the hub that results from its multiple intermediary roles. Most studies on farmer organisations emphasise their horizontal coordination role, which contributes to collective action in an effort to reduce the transaction costs of accessing inputs and output markets (Ha *et al.*, 2013; Markelova *et al.*, 2009; Shiferaw *et al.*, 2011). They do not, however, look at how these organisations actively facilitate access to such inputs and output markets by taking simultaneous horizontal and vertical coordination roles. The synergistic role of the hub in enabling such coordination provides interesting insights (see Table S1 in supplementary material). One synergy is that, by organising clusters of farmers and input and service providers (clustering role) and actively facilitating delivery (broker role), the hub structure stimulated the matching of demand (better articulation) to supply (better organised access). This outcome is important because, as other scholars have shown (Kelly *et al.*, 2003; Poulton *et al.*, 2010; Ton *et al.*, 2015), absent or dispersed farmer demand is a disincentive for private sector service providers to invest in service delivery to smallholders, and several programmes have aimed at remedying this, for example, through voucher schemes. An additional value of a hub model may lie in the fact that it does not provide a monetary incentive to create a temporary market for inputs and services, but contributes to creating a more mature and self-supporting market.

Another synergy is alignment of complementary services and bundling these: for example, offering AI services with farmer training (extension services) on heat detection, that inputs are readily available at the agri-input store, and that all these are offered jointly with the check-off credit service where the cost is deducted from

the monthly final payment to farmers (see Kilelu *et al.*, 2013). Additionally, cluster of farmers suppliers through the hub with adequate access to inputs and services ensures a steady supply of quality milk, and this gives buying companies sufficient confidence to have contracts with DFBA, which then begin to grow as enterprises. Here, the hub's role in enabling clusters (horizontal coordination) is synergic with its roles as broker and one-stop shop (vertical coordination). These synergies address the notable challenges (e.g. transaction costs, risk, profitability) of integrating smallholders in high value agrifood value chains (Poulton *et al.*, 2010; Trienekens, 2011). However, alignment and complementarity through the interlocking model did not necessarily mean that there was a lack of competition, as in several hubs there was a choice of service provider. However, competition was still restricted, and this may affect effective delivery, as others have also noted (Poulton *et al.*, 2010). In addition to the services provided through the hub, there was a spill-over effect, as the hub presence led to the emergence of other businesses (e.g. motorbike repair shops, restaurants, agri-input dealers) as there was a growing market in the hub catchments. But more research is needed to explore this issue in-depth.

#### *The downside of hubs: tensions and dilemmas*

Although the intrinsic link between horizontal and vertical coordination in hubs can provide synergies, it may also trigger tensions. These relate mainly to its intertwining with farmer organisations as part of the underlying institutional structure and the operational interface of the hub. As our study shows, farmer organisations can take the lead in value chain coordination at different levels. Some authors are wary of farmer organisations taking on such broader roles (Chirwa *et al.*, 2005), but our results indicate that the hub as part of the farmer organisations' business model shows potential in enhancing coordination that can catalyse the stronger positioning of farmer organisations in value chains (Bijman *et al.*, 2011; Shiferaw *et al.*, 2011; Yang *et al.*, 2014). However, this comes with some tensions and dilemmas.

In terms of exercising horizontal coordination through the hub, a dilemma is presented by the double identity of a farmer organisation as an honest broker between farmers with the intent of enhancing collective action and as a business-oriented entity. Studies of smallholder collective action assume some shared interests amongst farmers (Markelova *et al.*, 2009; Shiferaw *et al.*, 2011). However, similar to others studies, our results point to a dilemma of collective action that does not always benefit poorer and socially marginalised farmers (Biggs, 2008; Chirwa *et al.*, 2005) and hence has implications for inclusiveness. Aligning individual farmers' goals with the DFBA overall goals as part of the farmer organisation's business-oriented model may sometimes require the exclusion of some farmers who cannot deliver the quantity and quality required to minimise coordination costs (Bijman *et al.*, 2011). This contradicts the farmer organisation's goal of expanding its farmer membership to achieve economies of scale base by being inclusive. On the one hand, a policy of inclusion (e.g. both shareholders and farmers who only supply milk) opens a window for opportunistic behaviour such as some farmers side-selling their milk, which is a typical problem for

farmer organisations in the context of divided loyalties, as others have observed (Bingen *et al.*, 2003; Chirwa *et al.*, 2005; Yang *et al.*, 2014). On the other hand, some of the clustering structures (i.e. DMGs) inadvertently exclude some farmers from accessing some hub services. These tensions point to broader debates surrounding efforts to commercialise smallholder farming, whereby some scholars note the need to pay more attention to rural differentiation, in terms of assets, capabilities and aspirations, which determines how households engage and benefit from such interventions (Dawson *et al.*, 2016; Poole *et al.*, 2013).

In terms of undertaking vertical coordination, the findings also suggest some tensions relating to unresolved power imbalances in the value chain. One tension concerns the relationship between milk processors and the farmers represented by the DFBA, for example, with regard to determining milk prices. Despite farmers' increased bargaining power from their collective effort, they still have to contend with milk prices determined by the processors. This tension coupled with other emergent issues like tardy payments from the processors are some of the drivers of side-selling by farmers and thus affect farmers' loyalty to the DFBA. These findings suggest that, to resolve such tensions, coordination by the hub should not just be about establishing the linkages but also about continuous relationship management by means of conflict resolution and establishing effective mechanisms for countering opportunistic behaviour (Poulton *et al.*, 2010). Furthermore, as van der Ploeg (2008) argues, the push towards more entrepreneurial farming is problematic to the extent that it creates new dependency relations between farmers and external actors that prescribe and condition farm production processes.

These dilemmas raise questions about the effectiveness of farmer organisations in taking on broad coordination functions through hubs and the extent to which such hubs effectively enable the value-chain-wide learning needed to address the constraints that limit smallholders' participation in markets. This relates mainly to their suitability as an intermediary in relation to the combined roles of brokering, clustering and one-stop shop, despite the observed synergies (see Section 6.2). The DFBA take on a lead firm role (Goedegebuure *et al.*, 2014) partly to use their centrality to pull together the dispersed resources that are part of the value chain network. In this way, they aim to extract value in relationships amongst actors in the networks that they orchestrate. However, this raises questions about the extent to which farmer organisations can play an honest broker role (Klerkx *et al.*, 2009) through which strong business and social relations are cultivated to overcome the various constraints along the value chain and ensure equity and inclusion. For this reason, other actors that can complement the coordination role of farmer organisations can be explored further. For example, orchestrating and brokering agribusiness networks has been indicated as a new role that reformed public extension can take up (Klerkx *et al.*, 2009; Namdar-Irani and Sotomayor, 2011; Rivera and Sulaiman, 2009).

A final issue concerns the sustainability of hubs. As some studies have suggested, farmer organisations lack some capacities to adequately coordinate and monitor hub-induced linkages, and thus cannot manage some of the relationship changes over time (Bingen *et al.*, 2003; Chirwa *et al.*, 2005). This is particularly because of the power

issues at play in the governance of agricultural development efforts (Dawson *et al.*, 2016; Hounkonnou *et al.*, 2012; Ilukor *et al.*, 2014). As the findings show, the DFBA take on their coordination roles with external support of the EADD programme (which acts as a ‘meta facilitator’ in orchestrating many DFBA). A key question then is how farmer organisations and their respective hubs mature and can do without external support and be sustainable. In this context, farmers’ and value chain actors’ strategic behaviour must also be taken into account. On the other hand, as Klerkx and Leeuwis (2008) argue, if some of the coordination challenges are resolved through self-organisation amongst actors and transaction costs decrease, some intermediary functions may become obsolete – i.e. if the hubs become effective clusters with well-developed and autonomously functioning relationships, some of their broker functions may no longer be necessary. In this regards, programmes such EADD in sense fill a temporary ‘institutional void’ and will be expected to exit through the stage-gating process as hubs advance towards maturity.

#### CONCLUSION

This article has examined the emergence of hubs as an institutional innovation in terms of shaping coordination mechanisms for enhancing smallholders’ participation in markets. The study demonstrates the importance of such novel intermediary arrangements that enable simultaneous horizontal and vertical coordination in evolving agrifood value chains. Although the combined coordination roles of hubs enable useful synergies, tensions and emergent issues in the coordination process raise questions about the extent to which hub models are a panacea for solving problems facing smallholder farmers in their quest for more integration into agricultural markets.

Our results show that, although farmer organisations as the main actors within hubs may seem best positioned to shape relationships in favour of smallholders in terms of horizontal coordination, they may not have the ideal position and the necessary capacities to enhance vertical coordination amongst the other actors. This is particularly relevant with regard to relationship management, as they struggle with dilemmas such as inclusion, loyalty, trust and imbalanced power relations both amongst farmers and with other value chain actors. These findings call for reflection on policies that are pushing for farmer organisations to take on these broader coordination and managerial roles that seem to make more demands on their capacities. The findings indicate that coordination and governance of agrifood chains in ways that ensure equity and inclusion of smallholders will require other intermediary arrangements that build on alliances between farmer organisations and other public or private organisations. For example, public extension, which remains a key player in developing and emerging economies, if re-tooled can take over some roles regarding vertical coordination. We also note the need for differentiated development programmes that ensure smallholders that opt out of commercialisation trajectories are still included in rural and agricultural development.

A limitation of our study (a revelatory case study) is that our findings are based on qualitative results from a limited number of hubs. Hence, further research is required

in a larger sample of dairy hubs in Kenya and similar hubs elsewhere. The research could more systematically and comparatively assess the type of value chains for which hubs are suitable. Such future work could also assess how hubs influence changes in the value chain configuration into which the initial configuration transforms (e.g. market based, relational, captive) (following analytical frameworks provided by Gereffi *et al.*, 2005; Trienekens, 2011) and unravel in more detail the impact pathways of this type of intervention to corroborate the findings yielded by our study (see e.g. Pamuk *et al.*, 2014; Ton *et al.*, 2015). Lastly, as our study was not longitudinal, and researching hub development over time was outside its scope, future studies could look at maturation of hubs and how that influences the range of coordination functions that hubs perform.

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#### SUPPLEMENTARY MATERIALS

For supplementary material for this article, please visit <http://dx.doi.org/10.1017/S0014479716000375>

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