Draft paper for the Africa Knows! Conference; panel F39

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How do farm advisory businesses innovate to support inclusive chain-wide innovations? Innovation ecosystem experiences from selected private models emerging in Kenyan agrifood sector:

Abstract

Recently, private agricultural extension and advisory services (AEAS) models have emerged, owing to growing demand for knowledge and innovation support among entrepreneurial farmers and other value chain actors, linked to the unfolding agrifood sector transformation in Kenya. At the same time, a new strand of studies on AEAS, inspired by the concept of agricultural innovation system (AIS), have emerged focusing on the roles and contribution of AEAS in brokering multi-actor networks to create shared value for farmers and other actors. However, the value that these different actors bring into the innovation processes and how this is enabled has not been well interrogated empirically. This paper addresses this gap by applying the innovation ecosystem concept as a new perspective for analyzing value co-creation and value capture. Through qualitative fieldwork and review of secondary documents, we explore how two nascent private AEAS models in Kenyan agrifood sector build their innovation ecosystems. Findings show that the ecosystem lens evokes a more compelling conceptualization of AEAS as entailing a complex value proposition that is dependent on other complementary services and requiring focal actors to take the lead in mobilizing and aligning multi-actor contributions with key complements of the value proposition. We find pre-entry capabilities of founder directors and articulation and popularization of the business concept as main resources and roles, respectively, of the focal actors in building their ecosystems. Main contributions of ecosystem actors are in financial, technical, network support; content development and validation, and skilling of advisors; and linkages for complementary inputs and services. Value capture mechanisms are both monetary and non-monetary, and direct and indirect. We show that in seeking alignment, the models manipulate both the multi-actor network composition and/or the components of the value proposition by design or through learning from real life experiences. We conclude that the ecosystem perspective offers a systematic approach for visualising the outlook for an inclusive and productive multi-actor network. However, actor level inclusiveness in ecosystem lens should be evaluated from value addition perspective of end users and not normatively. This points to the need for private firms venturing into AEAS to apply the ecosystem perspective to guide their business strategy processes.

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1. Introduction

Privatization, linked to structural adjustment policies of the late 1980s, has been a key feature of debate on reforms of agricultural extension and advisory services (AEAS) (Rivera & Sulaiman, 2009; Zhou & Babu, 2015). It has entailed full or partial withdrawal of state funding and the entry of more efficient private sector and market mechanisms where farmers as end users bear some of the costs (Feder, Birner, & Anderson, 2011). Yet, the operationalization of the privatization agenda has been slow in Sub-Saharan Africa (SSA), including Kenya (Blum, Sulaiman, & Coffini, 2020). The public-good nature of the traditional types of agricultural information services (Rivera & Sulaiman, 2009), coupled with low willingness and capacity of farmers to pay (Christoplos, 2010) , along with the reliance on collective procedures in the production of agricultural knowledge and information (Labarthe, 2008) are some of the key challenges to privatization.

However, the agrifood system transformation unfolding in SSA is stimulating unprecedented demand for private-good type of agricultural information and advice (McCullough, Pingali, & Stamoulis, 2008; Kabasa, Kirsten, & Minde, 2015). Driven by changing dietary patterns associated with growing population, incomes, urbanization, and related demand for more and nutritious foods, the transformation of agrifood sector is turning food production and processing into knowledge intensive and technologically dynamic businesses (McCullough, Pingali, & Stamoulis, 2008; Kabasa, Kirsten, & Minde, 2015). To exploit the growing demand for nutritious foods, entrepreneurial producers – small as well as the growing cadre of medium-scale farms (Jayne, et al., 2019) - and downstream value chain actors are compelled to continually engage requisite technical and managerial (innovation) support services to enable sustainable and competitive agri-enterprises development (Kabasa, Kirsten, & Minde, 2015; Haggblade, 2011; McCullough, Pingali, & Stamoulis, 2008; FAO, CTA, and IFAD 2014). Food systems transformation links with the ambitious global sustainable development goals (SDGs) to end poverty and achieve food nutrition security (SDGs 1 and 2) especially in SSA.

Other emerging dynamics raising the viability of privatizing AEAS include the opportunities in advances made in digital technologies (Anderson, 2020), and the new understanding of AEAS as playing innovation support roles that require multi-actor processes and partnerships within a pluralistic system (Kilelu, Klerkx, & Leeuwis, 2013; Rivera & Sulaiman, 2009). Advances in digital agriculture are likely to stimulate demand for extension support among producers wishing to adopt digital tools on farm on one hand (Klerkx, Jakku, & Larbarthe, 2019). On the other hand, digital extension tools offer opportunities for reducing costs of delivery and improving quality and outreach (Anderson 2020). Also, digitalization influences the evolution of agricultural knowledge production and innovation systems (Klerkx, Jakku, & Larbarthe, 2019).

In the Kenyan agrifood sector, for-profit private sector actors are increasingly emerging as part of a pluralistic landscape of service providers that include public actors, non-profit NGOs, and producer organizations and cooperatives (Muyanga & Jayne, 2008; Kilelu, Klerkx, Leeuwis, & Hall, 2011; DLECP, 2019). They include chain-embed and independent models. The former embed agricultural information and advice in the sale of inputs or purchase of produce, while the latter provide specialized and individualized information and advice that is not directly linked to input sale or purchase of produce (Anderson, 2020; Feder, Birner, & Anderson, 2011). That way, these models carve information and advisory services relationships that endear private good characteristics (Blum, Sulaiman, & Coffini, 2020; Anderson, 2020; Feder, Birner, & Anderson, 2011). As argued by Sulaiman *et al.* (2005) and Feder *et al.* (2011), successful private AEAS enterprises emerge through a process of experimentation and learning in search of business model configurations that work. However, not much empirical attention has been paid to understanding how private firms innovate their business models in venturing into production and commercialization of agricultural knowledge and information (Labarthe, 2008; Faure et al., 2012).

Most studies on private AEAS have tended to focus on effectiveness, relevance, and exclusion risks of privatization (Sulaiman, Hall, & Suresh, 2005; Feder, Birner, & Anderson, 2011; Labarthe & Laurent, 2013; Bebe, Mwangi, & Ozor, 2016; Prager, Labarthe, Caggiago, & Arrias-Lorenzo, 2016; Faure et al., 2017). However, a relatively new strand of literature has emerged that see AEAS as moving beyond knowledge brokering to play broader and catalytic role of fostering farm-level and value chain-wide innovations (Rivera & Sulaiman 2009; Klerkx, Schut, Leeuwis, & Kilelu, 2012; Faure et al. 2018). Inspired by the agricultural innovation system (AIS) thinking, these studies focus on the roles and contribution of AEAS in brokering or intermediating multi-actor networks and their interactions to create shared value for farmers and other actors in the agricultural system and value chains (Klerkx and Leeuwis, 2009; Kilelu, Klerkx, Leeuwis, & Hall, 2011; Hellin, 2012).

While AIS literature has emphasized the innovation emergent nature of innovation through multi-actor interactions, the value that these different actors bring into the innovation processes and how this is enabled has not been well interrogated empirically. In the context of private AEAS, it is not well understood how for-profit private firms reconfigure their business models. To address this gap, we apply the innovation ecosystem perspective, as a new analytical framework for researching value co-creation and capture. The aim of the study is to explore how for-profit private firms build innovation ecosystems that contribute to the development and commercialization of agricultural information and advisory as an innovation support service within the context of a pluralistic system. Through two case studies of nascent private AEAS models emerging in the Kenyan agrifood sector, we answer the following research questions. Which types of actors are enlisted in the ecosystems and how do they contribute to value creation and capture? What are the activities and approaches of the case study firms in building their respective ecosystems? Is there a likelihood that applying the innovation ecosystem perspective influences the inclusiveness potential of private AEAS models?

The rest of the paper is organized as follows. The next section provides an overview of the innovation ecosystem concept and develops an analytical framework for exploring our case studies. Section 3 outlines the methodology of the study. Section 4 presents the results, followed by the discussion and conclusions in section 5 and 6 respectively.

2. Innovation ecosystems and private agricultural advisory services models

Recently, the concept of innovation ecosystems has gained popularity in academia and industry contexts, as a new analytical approach of understanding value co-creation and value capture (Granstrand & Holgersson, 2020; Oh et al., 2016; Gomes et al., 2016; Adner, 2017). This is triggered by an increasing specialization that in today's business world, a single firm does not typically possess the resources to develop and commercialize a new complex value proposition or enter a new industry (Adner, 2006, 2017; Kapoor and Furr 2015; Talmar et al., 2018). Thus, an innovating firm, also refered as focal actor or venture (Adner and Kapoor, 2010), has to rely on contributions from other actors in an ecosystem-setting to develop and achieve an ecosystem-wide or focal value proposition (EVP) (Hannah and Eisenhardt, 2017; Adner 2017). It has been argued that the concept offers new lens for operationalizing practice and research on collective dimensions of value creation (Gomes et al., 2016; Adner, 2017), and that it provides a more inclusive conceptualization of multi-actors networks that are required to drive innovations (Pigford, Hickey, & Klerkx, 2018; Ander, 2017; Talmar et al., 2018). Inclusive networks are thought to possess higher innovative potential, especially in agrifood systems whose transformation require interactions between farmers and diverse actors (Blum, Sulaiman, & Coffini, 2020; Zhou & Babu, 2015).

Adner (2017) defines innovation ecosystem as 'the alignment structure of the multilateral set of partners that need to interact for a focal value proposition to materialize'. Under this 'ecosystem as structure'

approach, the unit and focus of analysis is the structure of interdependent activities or complements or modules that are required for an EVP to materialize. In constrast to the broader 'ecosystem as affiliation' (actor-centric) approach, this structurist (activity-centric) view of interdependences identify the EVP and end users (rather than actors) as the building blocks of an ecosystem structure or model (Adner, 2017; Talmar et al., 2018; Walrave et al., 2017). The EVP, as the system level goal that articulates the overarching benefit to the targeted end users, forms the foundation of an innovation ecosystem. This notion of the EVP as the most defining component of an innovation ecosystem has several implications.

Firstly, is that the boundaries of an ecosystem should be derived from those complements or modules of the system whose interaction is a requisite for the materialization of the EVP (Adner, 2017; Walrave et al., 2017). Secondly, these complements or modules are best identified from the viewpoint of the targeted end users. Consequently and thirdly, the end user perspective on requisite complements broadens the scope and set of actors whose specialized contribution is critical for the EVP to come to fruition beyond those in direct transactional links with the focal actor (Walrave et al., 2017). Also, end users may constitute separate actors in an ecosystem like when they generate transactable value, such as data, that other actors can use in creating value within or in other ecosystems (Talmar et al., 2018). Therefore, understanding the EVP and user segment is critical in ecosystem modelling and strategy (Adner 2006).

According to the structurist approach, in building an innovation ecosystem, the focal actor can influence the structure of how the ecosystem as a network creates and delivers value, and appropriates value – also refered as the ecosystem model (EM) (Thomas et al., 2014; Walrave et al., 2017). Therefore, the focal actor lens provide an empirical setting for operationalizing research and practice on innovation ecosystems (Adner & Kapoor, 2010; Clarysse et al., 2014; Talmar, 2018; Walrave et al., 2017). Conceivably, the two most key elements of an EM are the activities requisite for acomplishing the EVP and the actors performing these activities (Adner, 2017). Talmar et al's (2018) ecosystem pie model (EPM) provides an appropriate strategy tool for analysing actor level contributions. In this case, the EPM operationalizes four key actor-level building blocks: Resources, Activities, Value addition, and Value capture:

- ***Resources*** **–** includes all tangible and intangible assets, capabilities, firm's processes and attributes, information and knowledge that are available to an actor for performing value-creating activities.
- ***Activities*** **–** the sets of activities and mechanisms by which an actor generates value addition and ensures value capture.
- ***Value addition*** **–** incorporates the outcome of activities each actor contributes to the ecosystem in the form of a product, service or support (for which they likely possess a comparative advantage relative to the other actors).
- ***Value capture*** **-** In exchange for their resources and activities to contribute to an EVP, actors are interested in receiving a gain: financial or non-financial; direct or indirect.

In taking an ecosystem building role, a focal actor's efforts aim at increasing internal alignment between the EVP and the EM or structure. Accordingly, the main objects of manipulation are the EVP, the EM, and/or both (Walrave et al., 2017). Several strategies have been suggested that a focal actor can employ in influencing the design and innovativeness of an associated ecosystem. They include developing awareness, defining the respective modularity, setting standards and rules, gaining insights on what or who could be the right complementary actors to include, and coordinating alignment of activities contributed by actors involved (Walrave et al., 2017; Adner, 2017). However, developing an ecosystem is challenging and focal actors must experiment in choosing different approaches and strategies (Autio & Thomas, 2014). This is especially so for ecosystems around path-breaking value propositions or innovation niches as they are nested in broader socio-technical context that influences how change happens (Pigford, Hickey, & Klerkx, 2018; Walrave et al., 2017). As set out in the introduction section, we conceive private AEAS models as

offering complex value propositions and fostering innovation niches. Integrating these insights drawn from literature on innovation ecosystem we construct an analytical framework, presented in figure 1, to explore how for-profit private firms build innovation ecosystems that contribute to development and commercialization of agricultural information and advisory services as an innovation support within the context of a plurlistic system.

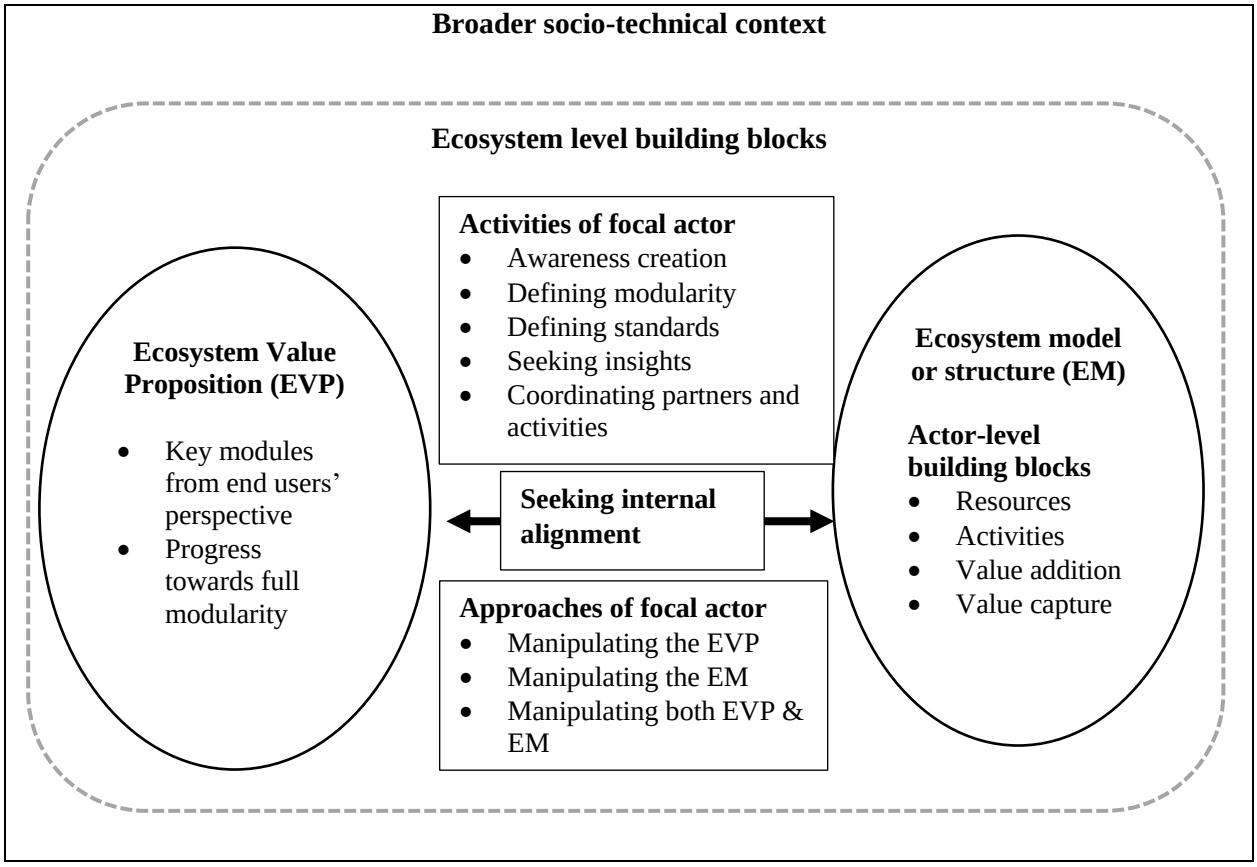

Figure 1: Analytical framework. Source: Own elaboration based on Adner, 2017; Talmar et al., 2018; Walrave et al., 2017.

3. Study methodology

The study used a multiple case-study method (Yin, 2009) with a focus on two private AEAS models that have recently emerged in the Kenyan dairy and horticulture sub-sectors. The two cases were purposefully selected based on the innovative character of their emerging AEAS business models and spread across two agricultural sub-sectors of focus for 3R Kenya project under which the study was undertaken (Katothya et al., 2020). The cases are Perfometer Agribusiness Limited (PAL) focusing on the dairy advisory, and Mazao Safi (MS) focusing on the broader horticultural sector. In both cases, the entity is considered as the focal actor in its respective innovation ecosystem (Adner & Kapoor, 2010). The study applied the 'ecosystem as structure' approach that has been suggested as an effective and efficient approach for modelling innovation ecosystems (Adner, 2017; Talmar et al., 2018; Walrave et al., 2017). Data gathering focused on understanding the overarching value proposition of each case study; types of farmer clients or end users targeted; main service products and delivery arrangements; key partners, their contributions (resources, activities, and value addition) and value capture; and feedback from farmer clients on service gaps.

Data were collected through a combination of a fieldwork and literature review. Fieldwork was conducted between February and May 2019. For PAL, in-depth interviews were conducted with four out of the eleven advisors (including the founder director) while secondary documents reviewed included annual reports, company profile, and an independent assessment report conducted in 2017. In addition, a sample of seventeen farms out of a total 205 client farms under the model's commercial segment were interviewed. For MS, In-depth interviews were held with all seven advisors (including the founder director) while secondary documents reviewed were a company profile and baseline report. In addition, a sample of 34 farmers were interviewed out of a total 600 farmer clients that were assigned to advisors by time of survey.

All the data from the interviews and documents collected were transcribed and analysed qualitatively, guided by the analytical framework explained above. First, a descriptive analysis characterizes the EVPs, outlines the main modules or complements, and profiles the end user segments under each case study. Second, the main partners or actors were mapped, and their contribution analysed using the EPM tool - in terms of resources and activities that they contribute to the ecosystem and the resultant value addition and capture[1]. Third, a comparison of the resultant ecosystems was undertaken to characterize their structure, explore activities and approaches of the focal actors in building and aligning their ecosystems, and reflect on inclusion and exclusion issues at end users and actor network levels.

[1] In this case the actor mapping approach applied was actor-centric rather than activity centric. This is because the case studies provide a retrospective context to draw theoretical and practical insights from existing and evolving ecosystems, as argued by (Talmar et al., 2018). This provides an opportunity to evaluate the analytical and strategic value of the ecosystem perspective.

4. Results: Case studies overview and ecosystem maps

Perfometer Agribusiness limited

Perfometer Agribusiness Limited (PAL) is an independent dairy advisory firm registered in 2013 in Kenya. The firm was set up to offer knowledge and advisory services to medium-scale farms (MSFs) as a potential niche market for private dairy advisory business. The MSFs were recognized as an emerging segment of entrepreneurial farmers seeking trusted sources of knowledge and innovation support to grow their dairy farm enterprises and that would be willing to pay for such support (KMDP, 2015; SNV, 2015). Start-up was supported by SNV's Kenya Market-led Dairy Programme (KMDP), which at the time was keen to stimulate market-led mechanisms in delivery of dairy commercialization support services including AEAS. PAL's value proposition is to improve professionalism and profitability of dairy farms. An MSF is defined as a dairy farm targeting a threshold of 100 liters or ten lactating cows per day.

To deliver this value proposition, PAL has developed a suite of connected advisory service products. The products have evolved informed by interactions with MSFs and benchmarked against international dairy standards from advanced industries such as the Dutch. Although the original design embraced a neutral approach to links for complementary dairy inputs and services, it was later modified, in response to clients demands, to include products that seek to directly link clients to quality inputs, fodder, farm managers, dairy stock, supervision of cow barn construction, and most recently financing. Each service product is priced separately based on its cost structure and a mark of 25 to 45%. By time of survey, prices were ranging from KES 30,000 to KES 400,000. By end of 2018, PAL had developed over ten service products (see table 1 for details) and served a cumulative total of 205 MSFs spread across 14 counties in Kenya. The model had a team of 12 regular advisors (58% females), mostly degree holders across a range of fields: livestock, agronomy, economics/finance, ICT, and architecture. The product approach does not allow for a specific formula for assigning advisor: clients ratio.

According to founder director, majority of MSFs are family farms while a minority are institutional farms such as private training institutions. For most family MSFs, owners are aged 46-60 years, do not reside in the farm, and the female spouses tend to be the key contacts for PAL. As a result, the MSFs rely on hired farm workers supervised by a manager. Most farm clients interviewed (n=17) had a positive attitude towards PAL's support. The main services gaps cited were delays in providing results of on-farm collected and lack direct linkages for breeding, veterinary, and milk marketing services.

Table 1: Main service products and delivery arrangements - PAL

Main service products	Delivery arrangements
a) Dairy Farm Benchmarking (DFB) b) Dairy Farm Benchmarking (DFB) c) Dairy Investment Plan (DIP) d) On-Farm Coaching (OFC) e) Dairy Farm Accounts (DFA) f) Cow-Barn Design (CBD)	Are farm specific, require on-farm visits, and offer opportunities for individualized long-term decision support. Approach has shifted gradually from qualitative and 'ideal farm' focus towards the integration of quantifiable key performance indicators (KPIs) and farm specific contextual factors in decision support.
g) CowPro: Herd data management application	A smart phone or computer enabled digital application.
h) Academy of Dairy Investors (ADI) i) Academy of Dairy Managers (ADM) j) Dairy Investors' Forums	Are non-farm-based products (but practical sessions are hosted in client's farm), are group based and offer platforms for clients to network with peers and other actors.
k) Dairy World Magazine	Print and electronic; links clients with peers and other actors.
l) Dairy World Market Place	An online platform that links clients and suppliers of inputs.

Table 2 below presents the ecosystem map/structure based on the main actors that were identified.

Table 2. Ecosystem map: Perfometer Agribusiness Limited case study

Main actors	Resources	Activities	Value addition	Value capture
1. PAL Founder director	Knowledge of, and experience in Kenyan dairy sector, including key networks (as an ex-staff of SNV Kenya). Awareness and recognition of business potential for private advisory models (entrepreneurial orientation).	Conceptualize the business model. Participating in sector studies by SNV. Profiling and mobilizing medium farms (MSFs) into study groups. Scouting and inducting advisors. Mobilize a network of potential partners. Spearhead product and business development.	Articulation of the model's concept and the overarching value proposition to potential partners. Coordination of activities and partners.	Gain recognition as a network/ ecosystem champion. Attract financial and technical investment into the business. Gain insights from experimentation experiences.
2. NGO programs (SNV Kenya Market-led Dairy Program-KMDP & The Technical Centre for Agricultural and Rural Cooperation-CTA)	SNV-KMDP: Financial and network resources. Expertise in local and Dutch dairy sector. Experience promoting market led models Prior relationship with some MSFs.	Provide PAL acceleration grants. Provide technical support and mentorship. Link PAL to Dutch knowledge networks. Subsidizing advisory services (in some cases) to activate demand or pilot new products.	Financial and technical support. Linkages with Dutch knowledge networks and MSFs in Kenya. Platform for experimentation.	Contribution to program goals related to promotion of market led dairy services models as a pathway to industry competitiveness/sustainability.
	CTA: Financial & technical resources Interests in digital agriculture technologies.	Development and piloting of digital advisory technologies	Financial & technical support (for CowPro as a new (digital) product)	" " "
3. Dutch/International dairy industry actors (PUM, Vetvice, Cow Signal/CS, Pro-Dairy ltd, UniformAgri/UA)	PUM: Expertise in husbandry & fodder. Vetvice: Cow barn design/comfort. CS: Cow handling, safety checks/signals. Pro-Dairy: Data and performance led advice UA: Herd management software.	In-country missions to coach PAL advisors. In-country missions to develop and pilot PAL's advisory products and tools. Organize exchange visits to Netherlands. Promote Dutch inputs and technologies.	Adapted and expanded range of advisory products & tools. Validity of content enhanced. Capacity & competences of PAL advisors accelerated.	Promotion of Dutch dairy knowledge and technologies. Access to grants from Dutch sources. Business linkages prospects.
4. Varsities (University of Nairobi/UoN; Strathmore University/SU)	UoN: Knowledge and expertise in dairy nutrition. SU: Expertise in Agribusiness and entrepreneurship education.	Contribute to curriculum for Academies of Dairy Managers and Investors (ADM/I) and serve in the team of trainers Co-organize the ADM/Is.	Enhanced validity and relevance of content, especially on fodder/feeds, and agribusiness entrepreneurship training and research.	Contribution to varsity mission on outreach and industry linkages and enrich curricula and research in agribusiness.
5. Local dairy industry experts	Localised expertise in areas of specialization that PAL may be overstretched.	Outsourced as advisors on ad hoc basis (e.g. Financial analytics in DIPs and for on-farm coaching-requires a veteran farm manager).	Specialized and localised expertise. Opportunity for building in-house capacity.	Revenue from fees paid. Prospects for business linkages in knowledge or technologies.
6. Medium scale dairy farms-MSFs (end users)	Dairy farms as facilities for practical trainings and exposure visits.	Co-host practical training sessions with PAL (e.g. Oloosian, Joy, Kalia farms). Host other exchange visits.	Practical orientation of PALs service products enhanced. Referrals for PAL services.	Added source of income. Pride in recognition as a source of dairy knowledge.
	Source of tacit on-farm data and experiences	Share data and insights on dairy production enterprise with PAL advisors.	Source of transactable data. Co-creation of dairy knowledge.	Improved relevance of advice (revised or new products)
7. Perfometer team of 11 in-house advisors.	A team equipped with advanced professional knowledge & skills specializing in dairy husbandry, fodder, nutrition, cow barn/cow comfort, dairy economics/financials, and ICT.	Packaging services into distinct service products (pricing, marketing them). Delivering products as per area of expertise. Engaging is self-directed skills development. Revising and expanding product range.	Last mile delivery of advisory. Interface for gathering feedback. Profiling PAL's reputation. Continuous improvement in skills and service products.	Revenue from fees paid by clients (charged per product). Advisors paid on fee basis. Opportunity to grow products and market segments.
8. Local suppliers of dairy inputs and services (e.g. fodder producers, banks)	Fodder suppliers: Potential sources of quality and reliable supply of fodder.	Establish partnership with PAL. Engage in coordinated production of fodder.	Fodder supply meeting set standards-quality, supply reliability.	Sales Business linkages.
	Family Bank: Source of financing working capital & related investments	Establish partnership with PAL Design a financing model	A tailored package with a focus on financing fodder production.	Growing revenues Growing product portfolio

Mazao Safi

Mazao Safi (MS) is a subsidiary of TradeCare Africa, (https://www.tradecareafrica.com) a social enterprise founded in 2008. The founder-director has a background in the management of outgrower schemes in Africa. Established in 2017, MS offers to provide neutral and reliable AEAS to entrepreneurial small-scale farmers engaged in mixed commercial crops and link them to sources of quality (curated) complementary inputs and services for improved yields, quality, an access to markets. By time of fieldwork, the model's pilot hub in Embu County was focusing on four perennial commercial crops but with plans to expand the range to include seasonal horticultural crops such as tomatoes. Farmer client eligibility criteria were: i) a minimum of 100 trees in case of coffee or 50 trees in the cases of macadamia or avocado or banana; ii) accessibility of the farm by motor bike; iii) proof of access to labour and key farm structures, including irrigation water; and iv) farmers' positive attitude to implementing advice.

Delivery arrangements are characterized by a hub and spoke model, with a field hub in Runyenjes sub-county - resourced with an agro-input store, a mini soil lab and a field office from where advisors are dispatched to cover assigned villages/zones within a radius of about 5–7 km (i.e. the spokes). The main products were: i) private extension services (PES); ii) soil testing and amendment advisory; iii) linkages for sources of quality crop protection and nutrition inputs; iv) and plans to mobilize clients for collective marketing (See table 3 for details). The PES package is delivered through a methodology called RASTA (Mazao Safi, 2019), borrowed from the founder director's previous background. RASTA is a data-driven approach that involves five steps: **R**egistering farmer client baseline and progress data; **A**nalysing data; **S**hare results and assisting farmer set targets; **T**raining farmers in groups for common needs; and **A**djust/Action-supporting clients implement advice via regular farm visits and phone calls or messaging.

Though still at start-up phase by time of fieldwork, the field hub had registered a total of 731 clients by end of 2018 (37% of whom were female) against a target of 600 clients. Main challenges were; recovering PES fees, meeting sales targets for complementary inputs, and ambitiously high KPIs for advisors. The farmer survey (n=34), shows MS as the main source for advice and information and reports high rates of implementation of advice. Main challenges cited are; limited access to prompt financing for inputs, effects of erratic weather, and delays in operationalizing the produce aggregation services. Further details about the case study can be accessed (Katothya et al., 2020; Kilelu, Katothya, & Van der lee, 2020).

Table 3: Main service products, delivery arrangements, and financing - MS

Main Products	Delivery arrangements	Financing
Private extension services (PES)	Each advisor is assigned 150 farmers to offer individualised advice via regular farm visits. Advisors (six by time of study, of whom two were females) are young and holders of diploma or degree in agricultural fields, are kitted with motorcycles, smartphones, and customised crop calendars.	Break even fee is estimated as a standard monthly fee of KES 300 per client, but a 50% discount is extended for the first 12 months.
Soil testing services	PES clients are recommended to test soil upon registering and after every three years.	Charged KES 1,200 per test.
Inputs package (crop protection products-CPPs)	MS provides PES clients with a shortlist of quality (curated) inputs that they should use. Clients are at liberty to source from MS hub store or other dealers.	MS factors a 10% profit margin onto the sale of inputs, plus a free delivery for PES clients.

Table 4 below presents the ecosystem map/structure based on the main actors that were identified.

Table 4: Ecosystem map: Mazao Safi case study

Main actors	Resources	Activities	Value addition	Value capture
1. Founder and director at TradeCare Ltd (TC) the parent organization to Mazao Safi-MS	Expertise in out-grower supply chains. Prior service experience in MS pilot County. Knowledge of RASTA extension approach. Prior relationships: chain actors and enablers. Existence of key physical and human resources by TC - the parent business.	Conceptualize the business model. Enlist support of local leaders in pilot site. Scout and induct advisors. Spearhead farmer recruitment & baseline. Explore partnerships with county government of Embu.	Gain approval by local leaders. Popularize the service model. Setting-up of a field hub in Embu. Coordination of activities and partners.	Develop recognition as an ecosystem champion. Attract grants & technical support. Prospects for growing TC's business portfolio.
2. Local leaders (Chiefs, Religious) and County government officials in charge of agriculture and cooperatives in Embu.	Chiefs and religious leaders: Trusted community mobilizers (gate keepers). Existing platforms for reaching farmers.	Introduce MS to the community. Facilitate medium for MS to create awareness about the model concept.	Endorse MS to the community. Platforms to market the services to potential farmer clients.	Achieve roles related to linking community to external partners (social capital).
	County officials: Overall public mandate on agriculture and cooperative development.	Facilitate meetings with MS to share the model concept, farm data and analytics.	Good will and prospects for partnerships.	Achieve objectives of attracting and regulating partnerships.
3. Collaborating NGOs (e.g. IDH, AFD Christian Aid, 3R Kenya project)	Financial and network resources. Expertise in services models for smallholders. Interests in research on innovative service models.	Documenting insights from service models. Providing financial and technical support.	Insights on innovative design & enactment of AEAS models. Start-up and acceleration grants. Platforms for experience sharing.	Contribute to program goals related to improving access to commercialization services, and knowledge products.
4. Private firms (Agrochemical Companies/AC; processors; Plantation Management Firms/PMF; Software development firms/ICT; Soil Cares limited/SC).	AC: Expertise in crop husbandry-nutrition and health. Suppliers of crop protection products (CPPs)	Contribute to MS's AEAS content/tools. Contribute to skilling MS advisors. Promote CPPs via MS networks/events.	Enhance and validate MS content. Accelerate skills of MS advisors. Offer links for curated CPPs.	Professional fees for tailoring capacity building inputs. Prospects for sales of CPPs.
	Processors: Knowledge on market conditions. Source of market opportunities-Macadamia.	Explore supply chain partnerships with MS for macadamia nuts.	Market linkages for producers. Tacit knowledge on markets.	Prospects for securing a reliable supply of nuts.
	PMF: Expertise in professional management of large scale commercial horticultural farms.	Contribute to MS's AEAS content/tools. Contribute to skilling MS's advisors.	Enhance and validate MS content. Accelerate skills of MS advisors	Professional fees for tailoring capacity building events.
	ICT: Expertise in Management Information Systems (MIS).	Developing a MIS tailored to data and information needs of MS's model.	A digital solution for integrated data/information management.	Professional fees Prospects for support services.
	SC: Expertise in soil testing services.	Partnership to set-up a mini soil lab.	Equip MS hub: soil testing skills.	Prospects: Business and grants.
5. Local Agricultural institutes/TVETs (Rwika, Meru); Varsities (Chuka)	Human resources development centres (for agricultural graduates) that are near the pilot site.	Screen students/graduates suitable for internship or employment by MS.	Improve effectiveness and efficiency of MS's advisor selection process.	Achieve training mission of matching manpower to industry needs.
6. Public research institutes (CRI, KALRO)	Experience in research on target crops.	Contribute to MS's AEAS content/tools. Contribute to skilling MS's advisors.	Enhance and validate MS content. Accelerate skills of MS advisors	Contribute to mandate on disseminating research outputs.
7. Local Coffee cooperatives (Kirurumwe, Murue)	Experience in organizing coffee farmers (social capital) in the pilot site. Interest in partnerships.	Explore opportunities for collaborating with MS to support coffee farmers improve yields and quality.	Enhance coordination & outreach for MS model (including a check-off arrangement for AEAS fees).	Contribute to goals of linking farmers to coffee yield and quality enhancing services.
8. Farmer clients	Sources of first-hand farm data and experiences (tacit knowledge) in target crops. Rooted norm of sharing data among farmers.	Consent to sharing farm data. Adopt MS's farm data capture tools. Participate in information sharing sessions.	Generate transactable data and insights related to MS's value proposition.	Better articulation/aggregation of needs, leading to improving relevance of MS' services.
9. MS's field hub in Runyenjes Sub County, Embu	A village-based service delivery field hub equipped with a team of 7 advisors, AEAS program and resources (content, tools), an input store, mini soil lab, and other related physical assets.	Engage in continuous skills development. Operationalize the RASTA methodology. Collect AEAS fees from assigned farmers. Promote complementary services and inputs offered under the model.	A last mile delivery mechanism of individualized AEAS, curated inputs, and soil testing services.	Standard usage fee for AEAS. Advisors payed wages. Sales from inputs and soil tests.

*Note: IDH: The sustainable trade initiative; AFD: Africa Development Fund; CRI: Coffee Research Institute; KALRO: Kenya Agricultural and Livestock Research Organization; TVET: Technical and Vocational Education and Training Institutes.

5. Discussion

Ecosystem structure

Actor networks and brokerage activities of focal actors

The two private AEAS models assessed offer emerging experiences on efforts to privatize agricultural information and knowledge in the context of small and medium scale commercial farming in Kenya. Overall, the value propositions of the two business models relate to farm level outcomes for clients in terms of yields, quality, and profitability. Further, findings of this study show that the focal actors are compelled, either at design stage or during operationalization (e.g., as is the case for PAL), to take up broader roles beyond knowledge brokerage to facilitate linkages for farmers' access to complementary inputs and services. As argued by Babu & Zhou (2015), this implies that the models' viability is premised on creating a shared value for the farmer clients and other actors whose contribution is key to the materialization of the value propositions. These broadening roles have been referred to as systemic intermediation or innovation brokerage in a new strand of literature that sees AEAS as part of the broader agricultural innovation system (e.g., see Rivera & Sulaiman, 2009; Kilelu, Klerkx, Leeuwis, & Hall, 2011; Klerkx, Schut, Leeuwis, & Kilelu, 2012; Hellin, 2012; Faure, et al., 2018).

However, by applying the innovation ecosystem perspective, this study contributes new insights into the debates about privatization of AEAS and the broadening roles of AEAS. Firstly, it reveals a more compelling persuasion that private AEAS models entail complex value propositions, and that the focal actors must rely on contribution of other actors. Secondly, the results show that, in both cases, the focal actors take up ecosystem building roles envisaged in innovation ecosystem literature (Walrave et al., 2017; Talmar., 2018). In this case, the founder directors take the lead in conceptualizing and articulating their AEAS model concepts; mobilizing financial and technical support from donor funded programs; enlisting support from community leaders (for the case of MS); creating awareness among potential end users and their agents; undertaking thematic studies (e.g., profiling of MSFs for the case of PAL and farm baseline studies for MS); setting standards (e.g., client eligibility and engagement rules, advisor profiles, and modalities for engaging other actors). Thirdly, the network of actors mobilized is broader than the research-extension-farmer linkages envisioned in the traditional linear knowledge transfer paradigm of AEAS. They include local universities and technical colleges; local research institutions; local and international private suppliers of agricultural inputs and services; farmers as sources of transactable data; and donor funded programs. The MS case further enlists local community leaders, administrators, and cooperatives. In both cases, the engagement with produce buyers, financial services providers, the public frontline extension system, and digital technologies has been slow and/or weak.

Resources and activities

The case studies provide some insights on the distributed nature of resources for value co-creation in an ecosystem setting. As argued (Kapoor & Furr, 2015) the pre-entry capabilities of the founder directors, including professional background and networks, seem to be an underlying resource in the impetus to venture into the AEAS business. Mobilized actors contribute a set of other critical resources. For donor funded programs, the key resources include financial, technical, and networking resources aimed at accelerating the viability of the start-ups. The bulk of actors are enlisted because of their expertise that is seen a source of farming knowledge. For the case of PAL, actors drawn from the advanced Dutch industry are leveraged as source of new and international knowledge on dairy farming. In both cases, clients' farms are a source of transactable farm data and knowledge. Further, some client farms are enlisted as facilities

for practical dairy training sessions under the PAL case study. Another set of actors are assembled as sources of complementary farming inputs and services or as providers of specialized services to the focal actors such as digital tools. For the village-based MS model, coffee cooperatives and community leaders and administrators are enlisted as sources of social capital.

Given that both cases are nascent pathbreaking businesses still experimenting their model reconfigurations, the specific activities of each enlisted actor and the relationship with the focal actor can be viewed as non-generic (Talmar, 2018). As such, the characterization and assessment of the major activity flows requires an ecosystem perspective (Talmar, 2018; Adner, 2017). The findings show that the founder directors take lead role in ochestrating ecosystem building activities. In doing so, the founder directors leverage partnerships with donor funded programs that promote market-based mechanisms for agricultural commercialization services. Other key activities that require major customization include development of AEAS products and tools; modalities for complementary inputs and services linkages; a cadre of advisors meeting models' competence requirements; digital tools (initially for managing farm data); and modalities for recovering AEAS fees in the case of the MS model.

Value addition and value capture

As ecosystem champions the unique contribution of the focal actors is the articulation and popularization of the model concept, and coordination of activities and partners. Partnerships with donor funded programs contribute financial, technical, and networking support key for start-up and experimentation. Financial support is in forms of innovation acceleration grants and business subsidies while technical support include studies to generate insights and lessons, capacity development and learning events, product development and piloting, and linkages with potential actors and MSFs clients (in the case of PAL). The bulk of the private and public actors contribute to the development and validation of AEAS products (content and tools) and skilling of advisors. In some other cases they contribute specific products such as digital tools, curated inputs and support services, and farm facilities for practical training sessions (for the case of PAL). Farmer clients contribute transactable farm level data and experiences that inform the relevance of AEAS products and opportunities for improving or widening the range of service products. For the MS model, local administrators and community leaders serve as an entry point to the targeted farming community while local coffee cooperatives are potential actors in enhancing client coordination and scaling/outreach.

In both ecosystems, monetary and non-monetary motives co-exist. The monetary motives are in both direct and indirect forms. Direct forms are as fees, grants or direct sales for complementary inputs and services. Fees are paid by farmer clients or fees to professionals who contribute to product development or delivery. Indirect monetary motives are in form of prospects for sales from complementary inputs and services via B2B or B2C linkages. Others are in form of prospects for securing reliable supply of quality produce at minimal coordination costs like the case for Macadamia nut processors and coffee cooperatives under the MS model. Non-monetary motives are in forms of achieving organizational mandates and program goals.

Alignment approaches

Applying the innovation ecosystem perspective provides new lens for unravelling how private AEAS businesses, as focal actors, build their ecosystem of actors that contribute to the materialization of the value proposition. Findings from the two cases suggest that the focal actors manipulate both the ecosystem structure and the complements required for value proposition to materialize. In the case of MS, the key complements (save for financial linkages) of the value proposition were elaborated at design stage, although with an understanding that implementation will be gradual whereby some complements or sub-complements get high priority at start-up stages. For instance, engaging in produce aggregation and marketing was scheduled to begin at a later stage once client and production base has been mobilized. In

other instances, the introduction of newer actors has been associated with the recognition of their potential to address a crucial gap in value addition (e.g., the case of coffee cooperatives) or to substitute an actors with a more promising one (e.g., the search for suitable digital tools). According to the farmer survey, failure to facilitate financing and market linkages were the main service gaps cited.

For the PAL case, the original design was not to engage in facilitating direct linkages for other complementary inputs and services that are key for client farms to realize the promised value proposition. However, uptake of professional dairy farming advice and information stimulated demand for sources of quality and reliable dairy inputs and services. In response, the model has kept on adjusting the scope of complements and sub-complements to include quality inputs, reliable supply of quality fodder, search and selection of farm managers and dairy stock, cow barn construction or supervision, and most recently in arrangements to facilitate financing. These modifications have entailed development of new products (value additions) and mobilization of new actors into the ecosystem. According to the farm client survey, the main service gaps are weaknesses in generating and sharing analytics of farm data collected periodically, and not facilitating breeding, veterinary and milk marketing services.

Inclusiveness

We look at inclusiveness from two perspectives: targeted end users and the actor networks mobilized in the respective ecosystems. From end users' perspective, there has been concerns that private sector models that seek to stimulate market based mechanisms to deliver AEAS risk excluding marginal (i.e., women and youth) and poor farmers (Feder, Birner, & Anderson, 2011; Birner, et al., 2009). Our findings show that the case studies make a strategic choice not to target all producers, rather, they target both small or medium-scale commercial and entrepreneurial farmers who meet set resource endowment thresholds. However, women representation in the client base of the two case studies is reported to be above 30%, this suggests the need for a more nuanced debate on inclusion and exclusion in private AEAS.

From actor network standpoint, it has been argued that the innovation ecosystem perspective yields a more inclusive conceptualization of multi-actor networks (Adner, 2017; Pigford, Hickey, & Klerkx, 2018). Within the context of broadening role of AEAS towards innovation support, it is argued that inclusive networks may help farmers enhance their productivity more effectively than traditional linear models of research-extension-farmer linkages (Zhou & Babu, 2015; Klerkx, Schut, Leeuwis, & Kilelu, 2012). The ecosystem maps (Tables 3 and 4) show that the two AEAS models have mobilized a more inclusive network of actors compared to the traditional linear paradigm of AEAS. However, rigorous farm level outcome data to evaluate the effectiveness and productivity performance of the models was not available. Further, applying the end user perspective has led to identification of other key complements (e.g., linkages for financing farm operations and produce markets) that require specialized linkages to accelerate the materialization of the value propositions. Addressing these value gaps entail new activities and inevitably new actors into the ecosystems. These findings suggest that a deliberate application of the ecosystem perspective in charting the business strategy of a focal actor can contribute to a systematic visualization of the outlook of a more inclusive and productive multi-actor network required.

6. Conclusions

This paper has demonstrated the potential for the application of the innovation ecosystem perspective in research and practice in the agribusiness services subsector within a context of increasing demand for

knowledge and innovation support linked to transforming agrifood systems in Kenya. A main implication of our study for theory is that the application of the ecosystem perspective to AEAS business models evokes a more compelling conceptualization of AEAS as entailing a complex value proposition: whose materialization is dependent on other complementary inputs and services, and that typically a firm does not have the resources to offer single-handedly. Our study therefore suggests a stronger case for AEAS to take up systemic intermediation roles. Secondly, our study shows that understanding the key complementarities from end users' perspective broadens the boundaries of activities, value additions, and actors required for inclusive and productive multi-actor networks. The main nuances it adds to the innovation system concept is that inclusiveness in multi-actor networks should be evaluated from a productivity or value addition point of view rather than from a normative sense. Further, the value addition should be determined from end users' perspective.

A key implication for practice is that the ecosystem perspective can deliver value to ecosystem insiders (focal actors, and their collaborators) and external experts. It can guide the strategy process of a focal firm, as a single actor or in an inclusive process that brings on board other collaborators to explore opportunities for joint innovations and discuss topics prone to tensions such as value capture and risks. For external experts, the innovation ecosystem perspective can be a new tool for mapping and analyzing market-led models embedded in the agribusiness services subsector for purposes of evaluating investment opportunities or advising development agencies and policy makers. For policy makers, a key implication from the analytical framework of this study is that the private AEAS models are emerging within a broader socio-technical context whose influence needs to be evaluated and mitigated to ensure a favourable enabling environment. For instance, our study shows that the public sector is yet to take up key roles in regulating AEAS in terms of content and professional standards for advisors, financing start-ups and in enacting a responsive policy and institutional framework.

A major gap in the study is that it provides a static snapshot of what the actors bring to the innovation ecosystem. A more dynamic perspective of how actors came into the process, how they change their behaviour and how and whether their value addition and - capture changed overtime could further our understanding of innovation processes. Another area for further research is in the interaction between ecosystems and the broader socio-technical context or the external environment. A starting question is to examine how actors from comparable ecosystems influence external alignment of their ecosystems.

Acknowledgements

The study was conducted under the 3R Kenya (Resilient, Robust, Reliable-From Aid to Trade) Project. The 3R is a learning initiative implemented by Wageningen University and African Centre for Technology Studies (ACTS).

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