

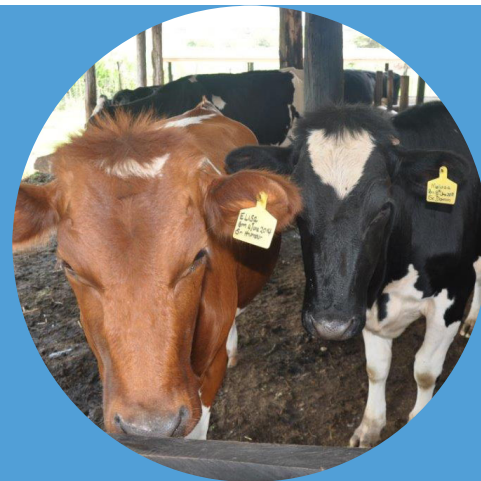
Resilient, robust and reliable agro-food sectors in Kenya

From aid to sustainable trade: driving competitive dairy sector development

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Dairy in Kenya

Kenya has a vibrant dairy industry with an estimated value of 3.5% to 4.5% of the gross domestic product (GDP) or 40% of the livestock sector GDP. It provides employment to over 1.2 million citizens. In 2014, the value of exported milk and dairy products was worth KES 1 billion. There are over 1.8 million smallholder milk producing households who own one to three cows, which in aggregate is over 80% of the national dairy herd (4.2 to 6.7 million cattle) (KDB, 2015; ILRI, 2008). Kenya has the highest per capita milk consumption (110 litres) in sub-Saharan Africa, the equivalent of 5.2 billion litres a year. The bulk of milk (ca. 70%) is unchilled raw fresh milk and sold to consumers through informal market channels (KDB 2015). There is growing demand for milk owing to expanding urbanisation, a rising middle class and export opportunities in the region.

This brief provides an overview of the supply chain, institutional governance and innovation support system in the dairy sector based on a literature review and stakeholder interviews. These are evaluated by means of a strengths, weaknesses, opportunities and threats (SWOT) framework to identify existing opportunities as well as challenges that could potentially impede growth in the sector. It is a first step towards documenting and sharing insights that support the move towards a more resilient, reliable and robust sector.

The formal milk market has witnessed steady growth with 616 million litres processed in 2015 (KDB website). This growth is attracting both domestic and international private investors seeking to seize business opportunities in the domestic and export markets (Business Daily, 2015).

The increasing demand is being met by more smallholder farmers taking up dairy. Consequently, the geographical spread of milk production in the country across agro-ecosystems is widening. The economic vi-

3R Kenya

As part of the Dutch transition strategy from aid to trade in Kenya, Wageningen UR will implement a project that assesses and validates lessons learnt from the Netherlands Embassy's Agriculture and Food and Nutrition Security programme and other related programmes that support competitive market-led agricultural development. The 3R (Resilient, Robust and Reliable) Kenya from Aid to Sustainable Trade project investigates whether the lessons from the aid era can be transferred and scaled up in the coming trade era. 3R Kenya focuses on the aquaculture, dairy and horticulture sectors. The overall aim of the 3R Kenya project is to have well-informed stakeholder actions supporting the transition from aid to sustainable trade (people, planet and profit) in the selected sectors.

brancy of the sector is shown in the growth of domestic milk production (at an average of 5.3% per year), processing capacity (at an average of 7% per year), per capita milk consumption, and exports (KDB, 2015). The expanding sector is characterized by an increasingly sophisticated supply chain involving a diverse range of actors, as depicted in figure 2. The actors include input suppliers, who may be small agro-vet stockists, companies or international firms, and various service providers, including private consultants offering a range of support services in veterinary, animal health, training and extension.

The feed sector has various manufacturing firms selling feed of variable quality. The producers consist of small, medium and large-scale dairy farmers. Aggregators in the chain include milk bulking and chilling facility operators, who may be farmer groups, cooperatives, or processors. At the marketing node, there are traders who procure milk from farmers to sell in the raw milk chain or act as intermediaries for processors. Transportation within the chain may be provided by farmer cooperatives, processors or by contracted transporters.

At the milk processing level, there are currently 27 active processors, four of which control 85% of the milk procurement. The scale of retailers' operations vary from small shops to large supermarkets, and consumers can be divided into buyers of raw unchilled, chilled or processed milk.

Additionally, various public research organizations, universities, training institutes and NGOs support the development of the sector. KDB has the mandate to regulate, develop and promote the dairy industry (KDB website). The Ministry of Agriculture, Livestock Development and Fisheries also plays a role in regulation and policy direction.

The Kenyan dairy value chain is broadly divided into informal and formal channels, based on compliance with regulatory frameworks for quality and safety standards and payment of statutory revenues (levies, taxes, VAT or PAYE).

At the production-technical level there are three distinct dairy chains: (a) unchilled, raw; (b) chilled, raw and (c) chilled, processed chains. The transformation towards a bigger formal channel is possible via the chilled, processed chain by targeting capacity building and enabling policies. The national dairy master plan defines strategic actions to enable a shift from informal to formal value chain channels (RoK, 2010). The strategies include reducing the market share of low-quality liquid milk, encouraging progressive investments for developing the dairy industry, and ensuring consumers' public health, and in the process creating skilled jobs and earning revenue for public expenditures (RoK, 2010).

Issues in the dairy sector

The dairy sector faces a myriad of issues in terms of challenges and opportunities that characterize the sustainability of the supply chain, institutional governance and the innovation support systems along the value chain. Combined, these three themes help us to understand the robustness, reliability and resilience of the dairy sector.

Table 1: Opportunities vs. challenges of threats in terms of sector sustainability

Opportunities	Challenges/threats
Economic sustainability	
Large domestic and regional markets with a rising demand for milk and in-calf heifers	High cost of production Poor milk quality and high losses High consumer prices
Expanding middle class leading to increased demand and value addition possibilities	Low overall value addition due to 2/3 of milk marketed in raw milk chain
Dairy attractive due to decreasing profitability of cash crops like cereals, sugar, coffee and tea production	Seasonality affects fodder availability and milk supply Decreasing farm size limits opportunities to scale up
Emergence of young entrepreneurial farmers	Poor farmer bargaining power and processor oligopoly
Commercial fodder production; land for fodder production available in some areas	Poor rural roads and lack of access to electricity in some rural areas
Contracting services for fodder production emerging	Chain fragmentation - little loyalty and side-selling to formal and informal chain actors
Introduction of feed rationing at farm level	
Use of sexed semen; vaccines	Poor access to fodder seed; equipment & spare parts; maintenance services
Provision of embedded services by coops to reduce side-selling	
Cooperatives as integration point for input supply, service delivery and marketing (= business hub)	Solution needed to address farmers' short-term cash needs
Combining insurance with credit; encouraging borrowing as collectives to reduce risks for banks	Poor price/quality ratio of feed, fodder, AI, vet services; training and extension
Identification of less bankable parts of the supply chain to concentrate support	Few appropriate financial products due to rigid credit conditions, high interest rates
Consolidation of processing and growing interest of multinationals, county governments prioritizing dairy	Investments in AI, dairy equipment by county governments and donors present danger of market distortion
Good climatic conditions for dairy farming in high potential areas	Risk of food scare – aflatoxin, antibiotics, microbial
Strong dairy consumption practices	Animal disease and zoonosis incidence (ECF, FMD, TB, brucellosis)
Use in tea does not require processing	Cheap Ugandan milk imports threaten domestic milk market
Environmental sustainability	
Carbon credit / financing opportunities	Environmental degradation and vulnerability to climate-change impacts
Uptake of agro forestry and feeding of multipurpose leguminous tree fodder	Limited awareness of environmental impact of dairy production and processing
Uptake of manure recycling to support soil fertility for crop and fodder production	Limited attention to reduction of GHG emissions in the sector Increasing manure management issues in landless farms
Uptake of climate-smart agricultural practices in smallholder and other size farms	Environmental degradation and climate-change impacts: erosion by grazing; increased soil acidity from perennial cereal growing
Social sustainability	
Substantial contribution to smallholder livelihood - 80% of milk from 700,000 smallholders	Little appeal of agriculture among youth and role of women not well integrated
DFCS development contributes to sense of ownership, trust and broader community development	Poor negotiation position of smallholder producers and inclusive business models not critically assessed
New employment and business opportunities along the growing formal supply chain	Smallholder production costs remain uncompetitive, except for those transitioning to commercial farming or changing to other ventures
Higher living standards and revitalization of rural areas by entrepreneurial farming	High zoonosis incidence and poor milk quality a threat to public health
Sensitization of the public about nutritional value of milk	Limited attention to animal welfare
	Loss of indigenous breeds

Robustness of the dairy- supply chain

Robust supply chain integration refers to efficient and trusted interactions between supply chain partners that reduce transaction costs and the risks involved in enhancing product quality and safety and reinforcing sustainability. In this brief, the robustness will be approached from the perspective of sustainability; this we means we will highlight the robustness of the sector in terms economic, social and environmental sustainability. An efficient and effective supply chain is key to the success of the dairy industry in Kenya. The dairy supply chain is complex, as reflected in the diversity of actors and transactions involved and a proliferation of varied inputs, services and dairy products.

The growth of the Kenyan dairy industry is driven by the private sector, but there are challenging demands affecting the different nodes along the supply chain – from the farm to the consumer (see table 1). These nodes include production, inputs and services, and marketing. Addressing these challenges relates to ceasing opportunities to exploit the potential of the Kenyan dairy sector to become globally competitive as envisaged in the national dairy master plan.

Strengths, opportunities, weaknesses and threats

Addressing low production and productivity – The vision of becoming a globally competitive dairy industry will be difficult to attain as long as smallholder milk producers dominate the industry. Most of these producers lack economies of scale in production and have low productivity (average of 9 litres a day) coupled with seasonal fluctuations. They also lack the necessary resources to modernize and expanding their enterprises.

The majority of smallholders meet the growing demand for milk demand by increasing their herd size, without increasing productivity. This production system not only results in high production costs, but also presents ecological threats, as the required feed resources are produced by expanding rather than sustainably intensifying land use. It consequently degrades land, soil, water and farm animal biodiversity.

Recent estimates of farm-level milk production costs in Kenya show an average of KES 16 to KES 18 per litre as compared to KES 10 in Uganda, and consequently higher milk retail prices of KES 103 per litre in Nairobi relative to KES 80 – KES 84 in major South African cities and KES 101 in Cairo (Daily Nation, 2016; Makoni et al., 2014). The demands at the production level are for leveraging economies of scale and producing safe milk. Enhancing production requires support for entrepreneurial farmers skilled in good dairy farming practices, including consistent record keeping for planning and

strategic decisions, quality feeding, and access to financial services.

Innovative business models are required that offer quality inputs and services competitively to lower the milk production costs that restrict export market opportunities.

Turning around the fodder challenge: improving production and exploring business models

Access to quality fodder and feed remains a systemic issue hampering the growth of a sustainable and competitive dairy sector in Kenya. SNV/S Kenya Market-led Dairy Program (KMDP) is implementing a range of interventions related to fodder development and preservation, including catalysing commercial fodder production models that meet the needs of dairy farmers. Hay and maize are the main fodder products preserved by dairy farmers, and production and handling can be improved significantly through management and mechanization.

Some outcomes of KMDP's Feed & Fodder program include:

- Improved farm-management skills in production, mechanization and preservation, introduction of new fodder seed varieties, especially high-protein fodder.
- Piloting innovative technologies and business concepts for the marketing of preserved fodders (commercial fodder producers).
- Improved land preparation, with farmers understanding the pros and cons of using certain farm implements.
- Fertilization programmes for maize and grasses have improved fodder production in terms of both quantity and quality.
- Over 2,000 acres of maize were ensilaged in 2014 and silage preparation has improved, reducing previous huge losses due to poor silage preparation.
- Farmers have improved paddocking and rotational grazing to reduce the cost of milk production.

Source: Ettema, 2015

Growing reliable and quality markets - At the processing level, the challenges include the high cost of milk processing, an unstable milk supply with cycles of abundance and scarcity, poor milk quality, and the risk of expanding unhealthy competition from oligopolists in milk processing. Processors who have invested in expanding processing infrastructures for long-life dairy products face occasional cash-flow challenges to the tune of KES 4 billion when stuck with long-life dairy products – butter, ghee, cheese, milk powder and UHT – related to limited domestic demand for these products (Business Daily, 2016).

Despite the challenges, the growth trends, including the demand for high-quality milk and diverse dairy products in both the domestic and regional markets, are opening investment opportunities for entrepreneurs along the chain. Opportunities in dairy farming are at-

tractive for medium and large-scale farms, and entrepreneurial smallholders can benefit from the viability of dairy enterprises delivering milk to expanding and diverse formal markets. There is a growing market demand for equipment and facilities for milk handling, bulking, chilling, processing and dispensing by various enterprises. Indeed, various county governments are investing in local milk chilling and processors plants.

Reliability - institutional governance

Reliable institutional governance refers to public-private cooperation, co-innovation and a public economic policy framework that supports private investment and enhances opportunities for (inter)national trade (ToR, 2015). This brief focuses on how policies, standards and markets are being supportive from a trade perspective: i.e. the degree in which they support private investment and enhance trade opportunities.

Dairy business hubs and strengthening supply chain - The EADD experience

While the growth of the dairy sector in Kenya presents many opportunities along the value chain, most smallholder dairy producers are unable to transition from subsistence to commercialised production. Key limiting factors include high transaction costs and other bottlenecks in accessing inputs and services (Kilelu et al., 2016). The dairy hub model is one innovative approach developed to address this challenge. The dairy hub entails a farmer-owned and managed milk stock and chilling centres established in various rural areas. These centres become agribusiness centres that support and attract a network of businesses delivering inputs and services to the farmers who supply milk to the farmer-owned enterprise (Kruse, 2012). The East African Dairy Development (EADD) project in Kenya aimed to support the development and scaling up of dairy hubs in the Rift Valley and Central Kenya regions (Mutinda et al., 2015)

The dairy hub aims to build robust dairy supply chains through a variety of business strategies and social relationships that are formed with the interests of all value chain actors in mind. Hubs can transform and create opportunities for increased private sector participation in the dairy sector. They have been proven to be potentially strong platforms for improving access to markets, inputs and services for men and women smallholder dairy farmers alike. Indeed, they are transforming rural regions (Kilelu et al., 2016; Mutinda et al., 2015).

Source: Various authors

The role of the government is critical in guiding the evolution of a common vision and in coordinating sector players to address common objectives by providing a reliable institutional governance framework. Institutional challenges facing the sector co-exist with emerging opportunities, which can be harnessed to grow the sector. Since 2010, the development of appropriate policy

frameworks for the dairy sector in Kenya has been the responsibility of the national government, while the development of the sector – including facilitating veterinary, AI, and training and extension services – has been devolved to the county governments (Makoni et al., 2014).

Strengths, opportunities, weaknesses and threats

Harmonizing regulatory instruments

The general impression of the regulatory policy instruments employed by the Kenyan government is that there is little direct encouragement to gain knowledge or engage in innovative activities. Policy that directly targets dairy research, extension and training seems to yield few innovations in the field, as there is reportedly little interaction between KALRO, the Dairy Training Institute, farmers and input suppliers because of the limited end-user relevance of on-going research, extension and training.

Generally, the enforcement of standards and regulations is limited, which does not particularly induce anyone to gain indirect knowledge, engage in innovative activities, or change established practices – for instance, the use of antibiotic drugs, the residue of which contaminates milk, continues with impunity .

Additionally, dairy-specific policy documents are numerous and scattered, which raises questions about coherence. This is also an important issue if policy is to be enforced. The new Kenyan veterinary policy contains several opportunities to facilitate the development of a robust dairy value chain. This policy will need to be implemented with great care to capitalize on these opportunities.

Providing economic incentives

County government interventions- Various counties are embarking on ‘one cow initiatives’ that promote the inclusion of resource-poor households, the youth and the disabled (e.g. in Busia County). However, these counties seem to forego constraints that are more inhibitive to those groups than access to stock. Various counties also provide subsidies for AI services to tackle the issue of farmers’ access to affordable AI services and quality stock (e.g. in Muranga and Nyamira County). To tackle the same issue, the Kenyan government is also investing in sexed semen and embryos. Milk cooling tanks have been or will be provided to many cooperatives (e.g. in Nyandarua County). These initiatives reflect a wider orientation of government and development partners to promote of ‘hardware’, while the development of ‘software’ solutions, targeted training and advisory services, data recording, collection and

analysis, is by and large neglected. A market distortion effect is the likely result of these skewed approaches.

Funding options for dairy enterprise development – Several parastatal funds attempt to improve access to financial services for farmers, specifically women, youth and disabled people. In the case of the Women Enterprise Fund (WEF) an evaluation showed that women were able to purchase dairy cows with loans obtained from WEF, but that loans in general were considered too small to make viable new business start-ups possible (Kiraka et al., 2013). The recommendation is to create business incubators.

Application of cess, levies, and taxes – KDB is able to raise funds through cess, levies, penalties and licensing (Kurwijila and Bennett, 2011). With such revenues KDB is expected to regulate and promote the dairy value chain, yet many value chain actors do not see benefits accruing from the payment of cess and levies to governmental entities. In fact, they believe it is constraining the growth of their business. An increasingly unpredictable environment for investors is present as the county governments propose to impose new taxes on many items. Currently the 60% import tariff on dairy products from outside the EAC protects the Kenyan domestic milk industry. Some people consider the high import tariff as the main reason why consumer milk prices remain high. Unrealized tax opportunities for the Kenyan dairy sector include the removal of value-added tax (VAT) on dairy equipment and liquid processed milk.

Table 2: Opportunities vs. challenges or threats in terms of institutional governance

Opportunities	Challenges/threats
Regulations	
Enactment of regulations on environmental quality, public health, drug use, Dairy Industry Act	Policy and legal framework has not kept pace with changes in the operational environment (milk marketing, feed)
*EADRAC established to promote intraregional trade and the development of shared quality standards	Increasing regulation of unprocessed milk chain may drive up milk prices
QA systems for feed, fodder, milk being established	Uncoordinated and inefficient quality assurance systems for feed, fodder, and milk; poor compliance with quality/safety requirements
Formalization of milk traders that may enable better regulatory monitoring	Poor compliance of supply contracts
Regulation and QA of private investments	Uncontrolled drug prescription, concentrated processor segment
Supply contracts between farmers' coops and processors and enforcement mechanisms	Weak governance systems in cooperative sector
Restructuring of the role of KDB to regulation and compliance	
Economic incentives	
Regional trade – free movement of most goods within EAC	Sector support interventions by national and county governments subject to political opportunism
Tripartite regional arrangements involving EAC, COMESA and SADC facilitating regional trade	
Reduction of 60% import levy on dairy products likely to reduce consumer milk price	Reduction of import levy on milk powder – market distortion by subsidized inputs from county governments

Opportunities	Challenges/threats
Economic incentives	
Beneficial tax situation for investment in processing facilities proposed	
Experimentation with processor-established incentives for milk suppliers	Subsidized exports from Europe threaten Kenyan exports to North Africa
County governments investing in AI services and dairy equipment	
Soft instruments	
KeBS has developed a Code of Practice for hygienic milk production	Insufficiently articulated and shared vision for the sector
County platforms offer opportunity for consultation between sector actors	Lack of effective and sustainable sector platforms to drive the vision and agenda
Public-private partnerships to address sector challenges e.g. extension and service delivery, marketing	
Sensitization of the public about the nutritive value of milk through workshops and advertisements	

* East Africa Dairy Regulatory Authorities Council

Innovation platforms - In theory, KDB provides a platform for dairy sector players to come together to collaborate and discuss urgent matters like milk quality problems and the high import tariff. A number of issues prevent KDB from becoming such a platform facilitator. Counties do provide platforms for dairy sector stakeholders to synchronize dairy development activities and prevent a duplication of efforts. Such platforms could be used to create innovation platforms that not only provide an opportunity to synchronize dairy activities, but also discuss creative solutions for sector problems. Stakeholder involvement varies over the counties. Finally, donor innovation platforms like the EADD, KMDP and KAVES programmes work extensively with Kenyan dairy value chain actors to enable innovation.

Code of conduct - A Code of Practice for dairy value chain actors was developed by KeBS in 2000, to improve milk quality along the value chain. It is meant to be a code of conduct to guide dairy sector stakeholders in the hygienic production, bulking, handling, processing and distribution of milk and milk products. Importantly, the Code contains directions on mycotoxin contents of feed and veterinary drug residues in milk, which are major issues in the Kenyan dairy value chain. Yet, because of low capacity of the KDB this document has found limited operationalization at farm level (ACET 2013).

Resilient - innovation support systems

Addressing the challenges and exploiting the growing opportunities in the Kenyan dairy sector hinges on actors continually exchanging knowledge, mobilizing resources and coordinating co-innovation networks that support development of capacities like entrepreneurship for social-technical, institutional innovation (Kilelu et al. 2016). Recognising that innovation is a collaborative

learning process, this study analysed the ways in which the diverse actors in the sector coordinate and work together as innovation system. In this brief we focus on how these agents and systems support technical, institutional, and social innovations (the enabling conditions) or take away barriers that prevent these innovations from happening.

Strengthening innovation support systems – the role of emerging practical dairy training centres

The practical skill gap among dairy farmers and farm managers is a critical obstacle to the development of a competitive sector. KMDP supports three dairy farms that have gone into training as a business, to become practical dairy training centres (PDTCs). By collaborating with various actors, including Dutch experts, the PDTCs can offer farmers market-driven one-day and one-week practical short courses

(pdtc.cowsoko.com). PDTCs have proven to be an important innovation in the KMDP T & E approach, although it is a bit early to evaluate their impact. They are meeting and creating demand for practical skills in dairy production across a diverse clientele of dairy entrepreneurs.

A recent project review indicates a number of positive outcomes attributed to PDTCs (Kathothya and Van der Lee, 2016). Interviewed lead farmers were unanimous that their participation in a 5-day practical skills training at a PDTC triggered changes in their dairy farms. Second, six youths (all males) running the Bidii dairy promoter's enterprise interviewed in Meru attributed the successful start-up of their silage business to the 5-day training at the Mawingu PDTC. They also reported that the exposure has also triggered them to establish and/or improve their own dairy farming enterprises. Third, the DFCS T & E staff interviewed also spoke highly of the effects of the 5-day PDTC trainings on their role as facilitators of practical trainings to DFCS farmers. Fourth, the PDTC manager interviewed highlighted three indicators that signal the increasing realization of the relevance of PDTCs. These are: i) an increase in the number of enquiries and visitors to the PDTC, ii) the interests that technical training institutes (TTIs) have been expressing for partnerships, and iii) the high turnover of PDTC staff as a result of being poached by farmers and input supplier companies following contact made during visits to the PDTCs. Besides the practical skills orientation of the trainings at PDTCs, other positive factors identified were the incorporation of new knowledge and innovations through international experts from Netherlands (ToTs).

Despite this positive feedback about the relevance and impact of PDTCs, managers of PDTCs highlighted the inability to operate optimally as a major challenge to the new concept. This manifests itself in the inability to attract a quorum of clients in an evenly spread schedule throughout the year. Reasons mentioned included the inadequate marketing of PDTC services and little willingness to pay for T & E services among potential clients.

Strengths, opportunities, weaknesses and threats

Challenges in the innovation support system

Limited collaboration among various actors – Generally linkages between the various actors in the sector are weak and limit the coordinated action that is necessary to solve problems. This is underlined by the weak organizational capacity of industry associations, which prevents effective collaboration and business interaction, investment facilitation and lobbying. Moreover, there is a shortage of strong innovation networks that foster dialogue and exchange among stakeholders and create the conditions for catalysing innovation in the sector.

Smallholder support approaches – The majority of smallholders undertaking dairy farming do not approach it as a business. This has implications on how they seek support services and equally how support service providers can work with them. Targeting entrepreneurial smallholders that see dairy as a business rather than targeting all smallholders still is a point of contention. Promoting inclusive business models that target various smallholders are contending with balancing support of growing entrepreneurial smallholders through links with medium and large scale farms, but while not excluding other marginal producers.

Competencies of support service providers – There is a mismatch between the competences and skills of graduates and industry needs, especially when it comes to practical training. This is due to a limited focus of education institutes on practice and competence needs in the labour market.

Market driven innovation support systems – Most of the research conducted in the sector is viewed as insufficiently client-oriented to adequately address the pressing challenges of the sector and to support innovation. Linkages between research institutes and the dairy industry are weak. KDB, the agency with the mandate to promote the sector, is not involved in setting the research agenda that can guide policy decisions. Additionally, private and public extension and advisory services are just starting to be equipped to support entrepreneurial dairy farming.

Transition from public to private sector innovation support – This uncoordinated transition has resulted in gaps in extension, AI and veterinary services. Extension services are weak; service liberalization has not attracted substantial private sector participation, is not linked to private industry development, and is not well coordinated between private sector actors and farmers (Bebe et al., 2016). Moreover, there are challenges accrediting new actors that are emerging to offer training and advisory services. Proper mechanisms are lacking to proper-

ly evaluate the information and know-how that is being promoted. This leaves the sector vulnerable.

Incentives for innovation – There are poor incentives for innovation, for example to enhance productivity and maintain good-quality of milk, due to a lack of a coherent common vision that should be an important driver for building a competitive, sustainable and inclusive dairy sector.

Uncoordinated efforts in strengthening innovation support – There are a number of interventions to develop the sector, supported by various donor and government programmes. While these initiatives are structured to promote public-private partnerships, most of them are uncoordinated, resulting in a duplication of efforts and limited cross-learning and collaborative co-creation.

Opportunities in the innovation support system

Capacity building – There is space for sustained efforts to enhance the capacity of various innovation support services in the sectors. This includes (re-)training key players with relevant, practical skills and knowledge to better support training and extension services that help smallholder entrepreneurial farmers in dairy enterprise development and address some of the persistent challenges facing the industry (low production and productivity, profitability, poor milk quality). Such opportunities include collaborative public-private partnerships that are integrating universities, mid-level agricultural colleges, practical training dairy centres and private sector advisors to work with farmers and other industry actors.

Table 3: Opportunities vs. challenges of threats in terms of the innovation support system

Opportunities	Challenges/threats
Actor-related enablers and barriers	
Training of key players in the raw milk chain to improve sanitation and quality	Weak organizational capacity of industry associations prevents effective lobbying and investment facilitation
Tapping in to educated work force	Limited focus of research and education institutes on outputs/personnel needed in industry Donors focus too much on tackling hardware issues (equipment, inputs, etc.) and too little on soft skills such as data collection and dissemination
Institution-related enablers and barriers	
Private service provision for training and extension to farmers to improve current farming and milking practices	Lack of entrepreneurship/commercial approach to dairy farming No incentives on maintaining quality of milk
Training to chain actors on milk handling in combination with quality assurance system	Poor farmer skills leading to poor animal husbandry, breeding, disease control and feeding practices Record keeping not common practice among farmers (little incentive) Mismatch between competence of graduates and industry needs, especially on practical training No official accreditation for practical training through PDMCs, making trainees unrecognizable on the market

Opportunities	Challenges/threats
Interaction-related enablers and barriers	
Possibility to reclaim training costs for staff from the Ministry of Labour	Research hardly client-oriented, weak linkages between research institutes and dairy industry
Match-making role for county and national governments to link input suppliers to producers	Uncoordinated transition of service provision from public to private actors resulted in gaps in extension, AI & vet services
Experimentation with input & service delivery by private and third sector actors	Extension role of universities not systemically integrated into extension models Hard for foreign input suppliers to find qualified dealers in Kenya
Knowledge linkages with Dutch companies and institutions	
Infrastructure-related enablers and barriers	
Dep. for TVET provides a regulatory framework and gives guidelines to PDMCs for practical training	Weak dairy research, esp. for sector policy and productivity at production, processing and marketing level: no research agenda
Provide wide access to extension materials published by development projects and universities	Extension services are weak: services liberalization has not attracted substantial private sector participation, is not linked to private industry development, and has not attracted coordinated private sector and farmer group participation
Training on GMP to all value chain partners at DTI	Lack of valid and reliable dairy sector data
Awareness building of environmental issues through national education system	Lack of access to on-farm and cooperative management ICT

Opportunity of devolved government structures –

Devolving governance to the county governments presents opportunities for new partnership investments in regions with high dairy potential. Several county governments are positioning themselves as investment and development hubs for dairy development; they have the opportunity to leverage better coordinated interaction among the various stakeholders to drive innovation and dairy sector development.

New models for innovation support -

Experimentation is ongoing on new business models that deliver more market-led approaches to innovation and sector development. These efforts are tapping into the highly educated work force in the country.

Supporting innovation platforms to drive a common vision and agenda for the sector.

Previous efforts, such as the National Dairy Taskforce, KAPAP contracted extension service delivery (Bebe et al., 2016), and the value chain platforms promoted by the ASDSP, provide entry points to inject new momentum for collaborative and coordinated action among stakeholders in the sector, including county governments.

Conclusions - connecting the dots

Promising innovations in supply chain development and innovation support service provision have emerged over the past five years that offer hope for the future. The dairy chilling hubs and various supply chain financing models are good examples. Additionally, there are emerging new approaches to training, extension and advice, including the PDMCs, private advisory services

like Perfometer with international linkages to service providers such as PUM and DTC, extension committees, and service provider coordination by NewKCC agricultural contracting services such as Nunduroto and SPEN, training and extension units in cooperatives and cooperative unions, study groups among medium and large-scale farmers, to name a few. In addition, there is recognition of the need to strengthen and better coordinate the institutional governance framework, and leverage it to incentivize the effective, commercially oriented and sustainable growth of the sector.

Together these elements combine approaches driven by the private sector, but with appropriate connections to and support from public institutes. If strategically leveraged these approaches can support the development of entrepreneurial farmers across the board (from smallholders to medium and large scale), and enable co-innovation and joint learning among the diverse value chain and support actors in the sector and nurture an innovative and competitive sector.

This brief provided an overview of the sustainability, institutional governance and innovation support system in the dairy sector. Findings will be validated and fed into the next phase of the programme to provide and share solid, evidence-based knowledge that supports the transition from aid to sustainable trade.

The next challenge is not so much to come up with more new interventions for particular bottlenecks, but rather to bring these strengths together into a coherent support structure for the sector: connecting the dots and strengthening linkages and collaboration.

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