



Dairy component value chain analysis



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Feed the Future Accelerated Value Chain Development (AVCD) Program

Dairy component value chain analysis

Joseph Auma, Michael Kidoido and James Rao

International Livestock Research Institute (ILRI)


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Patron: Professor Peter C Doherty AC, FAA, FRS

Animal scientist, Nobel Prize Laureate for Physiology or Medicine—1996

Box 30709, Nairobi 00100 Kenya
Phone +254 20 422 3000
Fax +254 20 422 3001
Email ilri-kenya@cgiar.org

ilri.org
better lives through livestock

ILRI is a CGIAR research centre

Box 5689, Addis Ababa, Ethiopia
Phone +251 11 617 2000
Fax +251 11 667 6923
Email ilri-ethiopia@cgiar.org

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The Feed the Future Kenya Accelerated Value Chain Development (AVCD) program seeks to widely apply technologies and innovations for livestock, dairy and staple crop (root crops and drought-tolerant crops) value chains in order to competitively and sustainably increase productivity, contributing to inclusive agricultural growth, nutrition and food security in 23 counties in the country. Supported by the United States Agency for International Development as part of the US government's Feed the Future initiative, its main goal is to sustainably reduce poverty and hunger in the Feed the Future zones of influence in Kenya.

In partnership with the International Crops for Research Institute for Semi-Arid Arid Tropics (ICRISAT) and the International Potato Center (CIP), International Livestock Research Institute (ILRI) will lead the implementation of AVCD. The three CGIAR centres will work closely with partners—county governments, NGOs, CBOs, private sector actors and other USAID-funded projects/programs, as well as leverage knowledge and best practices from academic institutions and foundations.

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USAID/Kenya contact:

Mary Onsongo, activity manager,

Office of Economic Growth

Tel: (+254) 20 8622504

Email: monsongo@usaid.gov

ILRI contact:

Romano Kiome, program manager

Tel: (+254) 20 422 3207

Email: r.kiome@cgiar.org

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Acronyms

AVCD	Accelerated Value Chain Development
FtF	Feed the Future
ZOI	Zone of Influence
IGAD	Intergovernmental Authority on Development
FAO	Food and Agriculture Organization of the United Nations
USAID-KAVES	United States Agency for International Development (USAID)-Kenya Agricultural Value Chain Enterprises
KAGRC	Kenya Animal Genetic Resource Centre
KEVEVAPI	Kenya Veterinary Vaccines Production Institute
KARLO	Kenya Agricultural and Livestock Research Organization
SDOL	State Department of Livestock
KLBO	Kenya Livestock Breeders Organization
KLPA	Kenya Livestock Producers Association
AFC	Africa Finance Corporation
KWFT	Kenya Women Microfinance Bank
SMEP	Small and Micro Enterprise Program
KDB	Kenya Dairy Board

Executive summary

Introduction

The Accelerated Value Chain Development (AVCD) Program dairy component aims to benefit 40,000 households in nine target counties of Kenya through better dairy value chain technologies and innovations.

This dairy value chain analysis seeks to inform the AVCD program of the key challenges linked to the dairy value chain and provide potential interventions areas for the program.

Methodology and approach

This study was carried out in two parts (1) a review of secondary information associated with the dairy value chain in Kenya and, (2) a qualitative study to supplement and/or bridge the existing gaps in secondary data since most existing value chain literature in Kenya emphasizes the traditional dairy producing areas. Traditional value chains are formal and more developed than those in the project target sites. Field data was collected from eight of the nine target counties including Migori, Homa Bay, Vihiga, Siaya and Busia counties in HRI, and Kitui, Makueni and Taita-Taveta counties in SA2 zone of influence (ZOI). The selection of the sub-counties was purposive and based on initial differences in agro-ecological zones and dairy cattle density characteristics. Selected sub-counties in Migori and Busia counties have a mixture of both humid and semi-humid agro-ecological zones and represent high and low dairy cattle density areas. The Focus Group Discussions (FGDs) and the key informant interviews (KIIs) were the main approaches used for data collection.

Significance of the dairy sector to the Kenyan economy, milk supply and demand analysis

The dairy sector contributes close to 22% of livestock gross market value in Kenya. The sector provides livelihoods to about 1.8 million rural households, who produce about 80% of the total domestic milk. The sector has been growing at an estimated rate of between 3–4% annually. The contribution of cattle milk has been growing with increased total national milk production. Reliable statistics estimate that the country has close to 6.8 million dairy cattle, of which 3.2 million are lactating annually. This figure brings the total volume of milk produced in the country to over 5 billion litres per year. Meanwhile, consumption of dairy products has been growing faster than milk production and this growth is projected to continue at 6% per year. By 2022, the country will face a deficit of between 1.275 and 3.53 billion litres of milk per year. Potential drivers of demand include urbanization, increasing per capita consumption and high population growth. The rising demand presents several opportunities for sector-wide and project specific interventions. Unfortunately, production remains non-commercialized, heavily rain-dependent, and the market is still highly informal. The informality of the market sector is, therefore, holding back investment in processed dairy products.

Production systems and animal husbandry

Three main dairy production systems are found in Kenya; the intensive, semi-intensive and the extensive system. Whereas the intensive system requires higher investment in terms of fixed infrastructure and close management it offers more returns per unit compared to the other two systems. In all systems, variable costs constitute the largest proportion of production costs and, therefore, managing yield remains the most important driver of profits. Active management of production costs and reducing seasonality of feed availability are key strategies to achieving greater yield management in commercial dairy production.

Unfortunately, animal husbandry skills remain low resulting in low productivity. There exist significant gaps in feeding, breeding and animal health; with most farmers relying on inadequate and low quality feed and breeding materials. Moreover, since production is mostly done under rain-fed systems, milk production is low and depends on rain seasons. Furthermore, availability of quality feeds diminishes with the approach of dry seasons. Improving access to appropriate animal husbandry practices and breeds is likely to enable some producers to achieve yields closer to the global average.

Access to productivity improving technologies and services

Farmers' access to productivity enhancing technologies and services remains poor. Breeding services include access to semen through bulls or artificial insemination (AI). Although AI use is predicted to continue growing among dairy farmers, its use remains inaccessible to smallholder farmers. Bull service, which is more accessible to small-scale farmers, is also constrained by the lack of access to high-quality bulls. Other challenges to increased access to quality breeding services include lack of reliable infrastructure for managing breeding materials such as liquid nitrogen and semen, poor access to breeding materials, absence of technically competent practitioners, and low participation of the private sector in supplying semen due to unfair competition from government players, particularly Kenya Animal Genetic Resources Centre (KAGRC), that enjoy preferential treatment.

The key animal health service requirement for most dairy producer is access to vaccinations and vaccines. Similar to AI, supply of vaccines is monopolized by the Kenya Veterinary Vaccines Production Institute (KEVEVAPI) that does not adequately supply vaccines to farmers and private distributors. Their monopoly has further limited entry of private providers due to numerous market distortions. Farmers' use of vaccines is low due to unavailability of vaccines and farmers' low knowledge of vaccines use. With regard to animal feeds supply, most of the high density commercial dairy feeds are imported and expensive for most farmers.

Despite Kenya having access to some of Africa' best dairy research institutions, customization, promotion and adoption of better dairy technologies remains low. This is closely linked to farmers' lack of access to adequate and quality extension services. Although some financial institutions have been actively engaged in the value chain, providing some targeted products, there is still room for expanding access to financial services to farmers. Access has remained low due to the inherently high risk and lack of collateral associated with the livestock, and specifically the dairy sector. Moreover, there are huge knowledge gaps in terms of the available financial packages for dairy value chain actors.

Findings from AVCD dairy component target counties

Dairy management systems and breeds

Consistent with the national systems, open grazing, semi-intensive and intensive management systems are most prevalent in AVCD target locations. The former two systems are predominant and they host mostly local cattle breeds. But of late open grazing and semi-intensive systems are increasingly rare because of land scarcity, particularly in the western part of the country. The more intensive systems, although relatively expensive, are more productive and profitable. Milk production in project target counties is comparably lower than the national average, due to their low dairy potential.

Farmers in the eastern counties have more improved breeds compared to the western region. The key limitation to acquiring improved breeds is the risks associated with the feeding demands and high disease susceptibility of improved breeds.

Feeds, feeding and feed availability

With the exception of Taita-Taveta, use of concentrates is low across all project counties. Two important aspects of feeding were also noted; (1) whereas farmers in both regions feed animals with crop residues; in the west, crop residues are fed to animals directly from the fields while in the east they are harvested and preserved for future use, (2) this was also true with forages and grasses, the study found comparably more storage capacity and more feed conservation in the eastern counties, which have a higher dairy production potential.

Gender perspective in dairy production

The study revealed that most dairy activities at the household level are done by females. More so, where the monetary value of the proceeds or the level of commercialization turned out to be low, men tended to have less interest in the activities. This was noted in the sale of traditionally processed dairy products whose value remains low.

Support services and input supply

Support service provision (breeding, health and feeding) is to a large extent provided by private actors. The key challenges faced include; few service providers, lack of facilities (equipment and technologies) and skills to provide the services. Most input suppliers are formally registered. Since most agro-vet businesses are owned by animal health practitioners, they provide both clinical and input supply services and advice. Input suppliers are able to access credit but mainly from commercial banks. Even then, few of them actually use credit to finance and capitalize their businesses. In addition, service and input providers link directly with individual farmers and have not yet taken advantage of linking up with groups/ associations.

Credit services

Several sources of credit are available to both producers and service providers. However, credit use is still low due to perceived high risks from both users and providers.

Extensions services

Extension services are provided by both private and public actors including NGOs. Private extension provision comes from agro-vets, mostly owned by animal health practitioners. Information is largely provided through farm visits, over the counter, field demonstrations, exchange visits, trainings and through telephone.

Transport services

The low milk production levels in the project areas have contributed to the lack of organized milk transportation arrangements. The few examples of organized transportation are found among farmers who are contracted to organized processors and through producer cooperatives.

Information services

Information sources are varied and seem to be equitably accessed across genders. However, there are cases where access to inaccurate information has affected value chain actors' production and marketing decisions.

Marketing channels and relationships between channels

Farmers in low production areas sell milk directly to consumers whereas milk chains in high production areas tend to be longer. In some places, high milk producers bypass middlemen to sell directly to milk bars and kiosks for larger marketing margins. Producer prices vary with channels, volumes and transport costs. Ninety per cent of the milk is sold fresh. Producers who sell milk directly to consumers earn significantly larger profit compared to those that sell through other channels.

Milk collection is informal and milk collectors are often found engaging in several other income generating functions due to low milk volumes in most project areas. Milk collectors are responsible for maintaining milk quality since any loss incurred during milk marketing falls back on either them or farmers.

Milk trading and retailing involves three distinct groups—milk bars or kiosks, mobile traders and milk vendors. Most of them combine several marketing functions, especially in western Kenya. Most milk bars have small cooling facilities that handle limited but relatively larger volumes than those of vendors. Whereas some milk bars also do some value addition, most vendors engage in selling fresh milk. Cash transactions are the dominant mode of payments for milk delivered. A number of dairy cooperatives exist although most of them are weak and poorly managed. They have low membership which affects the level of business they engage in due to low milk volumes. As a result, many of them have underutilized installed cooling facilities.

Inputs and service providers are both public and private. However, several farmers still find the services costly. Services are more available and accessible where levels of dairy production are high. Few service providers offer similar services to those provided publicly e.g. extension systems.

Summary of challenges and opportunities for improving the value chain:

- 1• Open grazing is the prevalent dairy production system. Although less costly, it offers significantly less returns due to associated low productivity compared to other production systems. Most of the farmers keep local breeds and fear the risk in transitioning to improved breeds which are associated with higher productivity and better returns.
- 2• Due to low feed storage capacity in the west, farmers waste a lot of feeds during wet seasons, which contributes to feed shortages in dry seasons.
- 3• Animal health service provision is bundled with other services. However, farmers lack access to quality services due to the absence of qualified technical personnel. Specific to AI provision, the challenge also includes lack of proper equipment and technology to deliver the service.
- 4• Transport is mainly informal, uncoordinated and largely individually initiated. Numerous credit and financial services exist although few actors can access and use them due to lack of collateral.
- 5• Extension services are largely demand driven and most farmers only seek them when problems arise.

Identified value chain upgrading interventions include:

- 1• General animal husbandry: increasing farmers' business orientation through their producer groups and developing simple financial toolkits to enable them monitor and control farm production costs.
- 2• Breeding and animal health: promoting farmers' access to quality AI and other breeding materials, promoting practices that increase the success of breeding technologies and enhancing adoption of animal health and breeding practices.

- 3• Feeding: promoting feed planning practices to reduce seasonality of feed availability besides enhancing adoption of high-quality forages and promoting feed and forage preservation, especially in western Kenya.
- 4• Transportation: supporting enforcement of milk handling regulations and supporting the development of financial products targeting milk transporters. In addition, facilitating the development of organized milk transportation through promotion of transporters' associations/cooperatives.
- 5• Milk selling and retailing: supporting enforcement of recommended milk handling regulations and enhancing the technical knowledge of milk traders and retailers.
- 6• Milk collection and cooling: forward and backward linking of chilling plants as cost centres for producers and processors and supporting chilling plants to actively manage members' milk transportation costs.
- 7• Consumers: supporting enforcement of milk handling regulations and increasing access of consumers to milk quality assurance information/knowledge.
- 8• Inputs supply and service provision: supporting development and access to financial products targeting input suppliers and service providers, enhancing linkages between value chain actors and enhancing coordination and collaboration among inputs and service providers.

I. Background and methodology

The dairy value chain component is one of the projects of the USAID-Feed the Future (FtF) funded Accelerated Value Chains Development (AVCD) program. AVCD aims at applying technologies and innovations widely for selected value chains to competitively and sustainably increase productivity; and contribute to the FtF goals of inclusive agricultural growth, nutrition and food security in Kenya. The overall goal of the dairy value chain project is to improve diet diversity, food security and rural incomes among poor and vulnerable subsistence-oriented households. The project is implemented in nine counties across the HRI and SA2 zones of influence (ZOI) with the objectives of increasing farm-level milk productivity, expanding market opportunities for milk producers and enhancing capacity among value chain actors to co-create solutions and enhance nutrition-based behavioural change, benefiting 40,000 households.

The study was divided into two parts: (1) a review of secondary information associated with the dairy value chain in Kenya and, (2) a qualitative study to complement and/ or bridge the existing gap in secondary data since most existing value chain literature in Kenya emphasizes traditional dairy producing areas. Traditional value chains are more formal and more developed than the project target sites. The first part of the study, the literature review, sought to understand the key challenges facing the whole value chain and identify possible opportunities to inform program targeting of interventions in order to achieve improved productivity of the overall value chain. The study, especially the desk review, was based on secondary data from various recent studies and reports on the dairy sector in Kenya. The study also relied on data from the AVCD-dairy component value chain baseline study.

I.1 Description of the qualitative study area and sampling strategy

Field data was collected from eight of the nine target counties including Migori, Homa Bay, Vihiga, Siaya and Busia counties in HRI, and Kitui, Makueni and Taita-Taveta counties in SA2 ZOI (Figure 1). Kisumu County was left out of the study for the close similarity of its dairy system with Vihiga and Migori counties. The selection of the sub-counties was purposive besides the initial variation of agro-ecological zones and dairy cattle density characteristics. Selected sub-counties in Migori and Busia counties had a mixture of both humid and semi-humid agro-ecological zones, and also represented high and low dairy cattle density areas. Sub-counties in Vihiga mainly represented the humid agro-ecological zone and high dairy cattle density. Makueni, Kitui and Taita-Taveta counties, located in lower eastern region (SA2), were sampled differently.

In the second stage of sampling, wards were selected in consultations with the sub-county livestock production officers; considering both the agro-ecological zones and dairy cattle density. Existence of active dairy farmers' associations or cooperatives was also considered at this stage. In each selected sub-county, two wards, representing the peri-urban and rural areas, were sampled. The selection process avoided wards that were previously sampled for the baseline study so as to increase variation. In Table I is a list of sub-counties and wards sampled in each county.

Figure 1. AVCD dairy value chain component sites.



Table 1. Sampled counties, sub-counties and wards

County	Sub-county	Ward	Ward selected for value chain analysis
Migori	Rongo	Rongo Dairy	Peri-urban
	Kuria West	Masaba	Peri-urban
		Bukira Central	Rural
Homa Bay	Rangwe	East Gem	Peri-urban
		West Gem	Rural
Siaya	Alego Usonga	South East Alego	Peri-urban
		North Alego	Rural
Vihiga	Luanda	Wemilabi	Rural
		Mwibona	Peri-urban
	Hamisi	Shamakhokho	Peri-urban
Busia	Butula	Banja	Rural
		Elugulu	Rural
	Teso South	Marachi North	Peri-urban
		Angorom	Peri-urban
		Amukura Central	Rural
Kitui	Kitui Central	Kyagwithya East	Rural
		Kyagwithya West	Peri-urban
Makueni	Kilome	Kasikeu	Peri-urban
		Kiima Kiu/Kalanzoni	Rural
Taita-Taveta	Taita	Wumingu/Kishushe	Rural
		Weruga	Peri-urban
	Mwatate	Wusi Kishamba	Rural
		Bura Makitau	Peri-urban

1.2 Data collection and analysis of the qualitative study

Focus group discussions (FGDs) and key informant interviews (KIIs) were the main approaches used for data collection. The FGD guide was used to gather information from key primary producers (farmers) and KIIs checklists for dairy input service providers, milk transporters, and milk traders (including milk bars, vendors and cooperatives). A total of 23 FGDs, one in each ward, were conducted. Alongside the FGDs, 31, 17 and 20 key informant interviews of milk traders, milk transporters, and dairy input service providers were conducted, respectively in 12 sub-counties (Table 2). The data was processed and analyzed using Nvivo 11.

Table 2. Number of value chain actors interviewed in each county and sub-county

County	Sub-county	No. of transporters			No. of input service provider			No. of traders (including cooperatives)			No. of FGDs and participants (farmers)			
		M	F	T	M	F	T	M	F	T	No	M	F	T
Migori	Kuria West	0	0	0	1	0	1	2	1	3	2	22	10	32
	Rongo	5	0	5	0	0	0	1	1	2	1	19	11	30
Homa Bay	Rangwe	1	0	1	2	1	3	0	2	1	2	15	7	22
Vihiga	Hamisi	1	0	1	1	0	1	1	0	1	2	17	8	25
	Luanda	1	0	1	1	0	1	4	1	5	2	19	8	27
Siaya	Alego Usonga	2	0	2	2	0	2	1	0	1	2	8	16	24
Busia	Butula	1	0	1	2	0	2	1	1	2	2	14	17	31
	Teso South	0	0	0	2	0	2	2	0	2	2	19	18	37
Kitui	Kitui Central	1	0	1	2	1	3	3	1	4	2	13	20	33
Makueni	Kilome	2	0	2	1	0	1	3	0	3	2	11	10	21
Taita-Taveta	Mwatate	1	0	1	1	1	2	1	1	2	2	15	10	25
	Taita	2	0	2	1	1	2	3	1	4	2	14	12	26
Total		17	0	17	16	4	20	22	9	31	23	186	147	333

M=Male, F=Female, T=Total

2. The status of the dairy value chain in Kenya

2.1 Significance of the dairy sector to the Kenyan economy

Dairy products, including the sale of live animals alone, contribute about 30% of the livestock gross domestic product (GDP) and more than 22% of livestock gross market value (FAO 2011). The sector contributes to the livelihoods and food and nutritional security of many actors who are engaged along the value chain. It is estimated that smallholder farmers contribute over 80% of domestic milk production. Most commercial dairy production is concentrated in the central and Rift Valley regions leaving many other dairy potential areas under exploited (USAID KAVES 2015; USAID KAVES 2013; FAO, 2011). Recently, farmers in other parts of the country have been reported to be slowly taking up commercial dairy production as well. The industry supports an estimated 1.8 million rural households and it has been growing at between 3–4 % annually. Since a livestock census has not been conducted in Kenya for some time, it is difficult to estimate the current population of dairy cattle and the number of lactating cows. Nonetheless, several International Livestock Research Institute (ILRI) studies, among other sources, estimate that the country's dairy cattle population stands at 6.8 million with 3.2 million of them lactating every year (EADD 2008; USAID KAVES, 2015).

2.1.1 National milk supply analysis

The population of cattle that contributes to total national milk production is reported to have dropped to about 75–76% in 2012 from 89% in 2005. The drop has been associated with the growing contribution of other livestock species including camels and goats, and not necessarily a drop in the number of cattle. National milk production estimates from cows alone have been increasing at a slow rate of 3% per year, also reflecting a 4% increase in national dairy population reported between 2000 and 2010. Many other reasons have been advanced for the increase in milk supply including increased adoption of better animal husbandry practices by smallholders, improvement of breeds through increased use of artificial insemination (AI), increased access to markets leading to better producer prices, increased adoption of more intensive production systems (zero-grazing) and the use of concentrates and alternative feedstuffs that have enabled smallholders to slowly improve their dairy herd productivity. Total production estimates are based on a dairy population of about 3.2 million lactating cows per year. FAO STAT (2012) has recorded an annual increase of 2.8–3.6 billion litres whereas IGAD (2013) has recorded an increase of 5.79 billion litres per year.

Despite this modest growth in supply, several bottlenecks continue to limit efforts to increase milk production in the country. At the farm level, farmers' adoption of productivity improving technologies remains low, and producers poorly manage their dairy herds and continue to struggle with several biophysical and socio-economic constraints. Other factors at the farm level include over reliance on rain-fed dairy production, use of low quality agricultural by-products for feeds, lack of adequate quality feeds and forages, climate variability and changes and ownership of small herds. Market associated factors include losses due to spillage and spoilage, lack of ready and profitable markets and milk rejection due to poor quality eventually resulting in reduction in total milk supplied.

2.1.2 National demand and consumption analysis and trends

National per capita milk consumption is driven by total production trends, urbanization, income structures, and overall national demographic trends. Per capita milk consumption estimates in the previous decade have ranged between 80–125 kg per year. Several studies project that per capita milk demand will grow at an average of 3% per year to about 139 kg per person per year by 2022. At the same time, national milk consumption is projected to grow at a 6% rate per annum between 2012 and 2022, reaching 8 billion litres in total. At this growth rate, a demand deficit of between 1.275 and 3.52 billion litres per year is expected by 2022. This projected deficit underscores the

need to quickly increase dairy sector productivity. Several entry points exist. Investment in increasing productivity in traditional dairy potential areas and continuous tapping of the huge potential in non-traditional dairy areas, such as Nyanza, western and lower eastern, regions will address the deficit. Investment in increasing the demand for quality milk, and the transformation of the informal sector, through which 80% of marketed milk is sold, to a more formal one, is another excellent entry point to reducing the demand deficit.

2.1.3 Production systems

The three dairy production systems found in Kenya are intensive (also referred to as zero-grazing), semi-intensive (semi-grazing) and the extensive (open grazing). Large and medium-scale farmers practice any of the systems whereas small-scale farmers largely practice the semi-intensive and extensive systems. Much as the zero-grazing system requires higher investment, in terms of fixed infrastructure and close management, its unit returns are comparably more than those of the other two systems. It is estimated that feeding costs in the zero-grazing system account for the highest share of total costs, of over 70%. Although feeding and labour costs, under the open grazing system are significantly lower, unit productivity under this system is equally low. Generally, more than 90% of total costs of dairy production are variable costs meaning that yield management is an important focus area for improving dairy profitability. Unfortunately, taking advantage of economies of scale for improved profitability is untenable and ineffective since most costs are variable in nature, especially for the majority smallholder farmers. Under the relatively less intensive systems, profits can be increased by practicing balanced feeding i.e. efficient management of feeding costs and reduced over-reliance on seasonal feeds. Relying on open grazing is also responsible for the frequent seasonal milk supply with surplus production occurring in the wet season (April to August) and shortages during the dry season (January-March).

2.1.4 Housing and general management of dairy cattle

Most dairy farmers' animal husbandry skills are poor and inadequate resulting in long calving intervals, short lactation lengths, high mortality rates and, ultimately, low productivity. In addition, there exists significant gaps in the use of better feeding, breeding, and animal healthcare practices. Most farmers also rely on inadequate and low quality feeds and breeding materials. It has been established that poorly fed, unhealthy low-quality breeds eventually compromise productivity. Since dairy production is commonly practiced under rain-fed systems, variability in climatic conditions are an important cause of seasonal milk production and poor yields. Key program interventions in this area including innovative extension, education and training approaches should offer low-cost means of raising productivity and reducing milk losses through improved management practices.

2.2 Support services and input supply

Breeding services

The dairy sector is characterized by poor general animal condition, rapid erosion of genetic quality leading to low sector productivity and diminishing unit returns to smallholders. AI was, and continues to be, an important method for accelerating the upgrade of zebu breeds to better producing dairy animals. A literature review of the Kenyan dairy sector (Makoni et al. 2015), indicates that the country no longer enjoys the well organized and subsidized breeding system that existed up until the mid-1980s. The sector is now dominated by the private service sector, which has not developed fast enough to fill the vacuum created as a result of government's exit (FAO 2011). Fortunately, use of AI is projected to grow by up to five per cent among Kenyan herds by 2030. Aside from AI, contract mating and other recent methods of breeding, such as assisted reproductive technology (ART) (sexed semen and embryo transfer), are also emerging but most of them are under the control of the Kenya Animal Genetic Resources Centre (KAGRC) and some well-to-do farmers. The services are not yet widely accessible by most rural smallholder farmers. Bull scheme

services are the most common but again are also characterized by use of poor-quality bulls. AI is widely used in dairy production although semen is often acquired from bulls that have not been appropriately selected. Such bulls are also costly (to smallholders) and achieve low conception rates.

Although KAGRC has remained central to the supply of AI to private dealers, semen imports have been steadily increasing from 20% in the 1990s to the current estimate of 40% of the semen currently distributed through private dealers. Typical challenges to efficient delivery and expansion of AI services include: 1) lack of proper transportation and poor road network which limits accessibility, 2) non-availability and cost of AI delivery infrastructure such as nitrogen semen containers, 3) challenges in procurement of AI from the KAGRC and other private suppliers in Nairobi, due to high cost of acquiring information and transport costs, 4) insufficient knowledge among farmers of best practices for managing dairy cows' fertility cycles and 5) extreme shortages of technically competent and adequately trained inseminators. Other players in the semen industry are involved in importation and distribution of semen which is comparatively more expensive compared with semen from KAGRC hence its use is limited to a few large-scale commercial farms.

Animal health services

Provision of animal health services, especially vaccination, has also undergone significant transformation over the last two decades. These services were partially privatized and the central government is now focused on creating an enabling environment to facilitate increased participation of the private sector. But the animal health service provision by the private sector is disorganized and most of the services provided are substandard. Animal health services mostly focus on the delivery and use of vaccines. Similar to AI service provision, vaccine production and distribution is monopolized by the Kenya Veterinary Vaccines Production Institute (KEVEVAPI) a government parastatal that does not pay import levies and taxes and therefore offers subsidized prices that potentially cause market distortions and unfavourable conditions for private service providers. Significant supply-demand gaps continue to prevail due to the inability of parastatals to meet the demand for vaccines. Consequently, vaccine use among smallholders remains low due to unavailability, inefficient distribution and low farmers' knowledge of vaccine use. In addition, private sector participation in vaccine provision has been constrained by ill-defined/characterized and unpredictable vaccine markets. Vaccine use is heavily dependent on disease outbreaks and government departments responsible for animal health do not provide data on vaccine production, distribution and use in the country.

Access and availability of commercial dairy feeds

Feeding takes up the largest proportion of total dairy production costs especially for market-oriented dairy producers and underfeeding is the primary cause of low yields in smallholders' dairy farms. A majority of farmers feed their animals on natural forages, cultivated fodder and crop by-products. Maize is the predominant feed resource among commercially-orientated farmers. Commercial dairy feeds include dairy meal, dairy cubes, calf pellets, maize germ, maize bran, molasses, cotton cake, wheat pollards and wheat bran. Dairy cattle feeds constitute less than 20% of total value of animal feed manufactured annually in Kenya and is mostly sold by private dealers. Other sources of nutrients, especially proteins from sunflower/cotton seed cakes, are imported from within the East Africa region. Premixes mainly come from South Africa and outside Africa.

Extensions and information services

Research services are provided by well-developed public and private research institutions in and outside Africa. Despite Kenya hosting some of Africa's best and well-known dairy research institutions, including ILRI, KEVEVAPI, and KALRO, customization, promotion and adoption of dairy productivity enhancing technologies remain extremely low largely because of poor access to extension services. The key players in extension service provision include KALRO, the State Department of Livestock (SDOL), Kenya Livestock Breeders Organization (KLBO), and Kenya Livestock

Producers' Association (KLPA). Also, some large-scale milk processors such as Brookside Dairy Limited, have been reported to provide extension services to members of the dairy producer associations they support.

Access to financial services

Access to financial services among dairy value chain actors is poor. It is estimated that about 36% of rural households have no access to any form of financial services (USAID-KAVES 2015). Whereas several financial institutions are already engaging in provision of several forms of formal saving and credit schemes, there remains plenty of room for expansion. The value chain has also seen the increased use of buyer credit plans including: large-scale processors accessing equipment, feed suppliers and veterinary drug dealers offering credit to their agents and stockists and cooperatives extending credit to their members and recovering money from milk deliveries (using a check-off scheme). Credit facilities are also reported to be available through deposit taking microfinance institutions and commercial banks including Barclays and K-Rep banks, Agricultural Finance Cooperation (AFC), Kenya Women Finance Trust (KWFT), Faulu Kenya, Rafiki, and Small Micro Enterprise Programme (SMEP). Besides credit services, some microfinance institutions, including Juhudi Kilimo also offer insurance cover. Majority of these financial institutions also provide special and tailored services for small-scale farmers besides advising them on investment decisions. Increased participation of financial institutions in this value chain is constrained by the high risk levels often related to climate variability, the lack of collateral among small-scale dairy farmers and the general lack of information among key value chain actors.

3. Findings of the qualitative study in project target locations

3.1 Dairy production and livelihoods

Most focus group discussions (FDGs) begun with establishing the main purpose of keeping dairy cattle, whether farmers were achieving these objectives and how they perceived success in the enterprise. This was important because keeping dairy cattle has major implications on the kind of animal husbandry and general management practices adopted by farmers. The FDGs revealed that farmers keep dairy cattle largely to generate income and supplement food and nutritional requirement of their households. Income earned contributes to payment of school fees and purchase of food items. In addition, income from sale of milk is also used to meet dairy enterprise expenses such as feeding, animal health and to reduce pressure on other household sources of income. Though income from dairy has risen over the last five years some farmers have not fully realized the economic benefits of keeping dairy animals, due to a number challenges.

Most farmers in the project sites, except Taita-Taveta, keep dairy animals partially for commercial and for food security purposes. In Taita-Taveta and upper parts of Mwatate sub-counties majority of farmers keep dairy cattle more for commercial than food security purposes.

3.2 Management systems, housing and general husbandry

This section discusses dairy animal housing and general dairy management practices, breeds and breeding technologies, feeding and feed availability, animal health practices and milk production.

Management systems

The three main dairy management systems i.e. open grazing (including tethering), semi-zero grazing (semi-intensive), and zero-grazing (intensive) are all practiced in the target areas, and in that order of prevalence. The open grazing (extensive) system is characterized by dairy, beef or pastoralism production with *Bos indicus* cattle (the East Africa Zebu) being the main cattle breed. Open grazing is the most commonly practiced management system in most of the study areas, especially parts of Busia, Migori and Siaya (Teso South, Butula, Kuria west, and Alego Usonga), Makueni and Kitui (Kasikeu in Kilome and Kitui Central) and Taita-Taveta (Mwatate). In this system, cattle are grazed in an open land or along the road reserves often without supplementary feeding. This production system has been decreasing in prevalence and evolving to a tethering system where cattle are tied and constantly shifted and in some cases cut and carry forages are given to the animals in the morning and late evening. Water is provided where the cattle is tethered or the animal is released to the water source. Tethering system has been on the rise replacing open grazing in the past five years due to decreasing access to land, especially in Vihiga, Busia (Teso South), Siaya (Alego Usonga), Homa Bay (Rangwe), and Migori. Reducing herd sizes and competitive labour demands also explained the decreasing prevalence of open grazing. Nevertheless, observations have shown that in some instances the animals are tethered in places where there is minimal forage which leads to reduced productivity in terms of milk production. Generally, under open grazing (including tethering) milk yield is comparatively low. The system is cheap and easy to manage but has several challenges including low production due to excessive movement of the cows, high incidence of diseases and poor breeding practices e.g. inbreeding due to uncontrolled mating.

Semi-zero grazing (semi-intensive) involves partly confining the animals in a unit, especially during milking, from where feeds such as Napier grass and other forages are provided. Occasionally, the cows are given supplementary feeding

such as dairy meal and/or other available concentrates mainly by-products of maize, wheat or rice. However, in most instances, the feeding regime is not commensurate with the genetic potential of the animal hence productive performance are lower. The system is common among private dairy farms in the comparably high potential areas of the Coast including Taita-Taveta (Wundanyi and upper parts of Mwatate), Vihiga (Hamisi and Luanda), Nyanza (Rongo), and a few isolated areas in Kitui and Makueni (Kilome). The system presents several advantages including high cattle productivity, easier tick control, easier monitoring and control of cattle diseases, reduced conflicts with neighbours resulting from crop damage by animals, cattle energy saving leading to more milk production, easier cleaning, easier monitoring of cattle movement, provision of good cattle shelter and reduced feed wastage. In the last five years, use of the semi-intensive system of feeding has also been on the rise.

Zero-grazing (intensive) (Figure 2) is characterized by pure stall feeding and cows are fed on various feed types. There is continuous confinement of cattle in the stall where they are treated, watered, fed and milked. The system requires heavy investment in terms of housing, feeding (fodder production and feeds) and labour demands. However, milk yield per cow per day is much higher (ranges between 15–30 litres) in this system compared to the other two. Zero-grazing is common in Taita and upper parts of Mwatate in Taita-Taveta and a few farmers in other parts of the project area. According to producer group discussions, the system has been on the increase in the last five years.

Figure 2. A zero-grazing dairying unit with a hay barn on top in a smallholder farm in Wundanyi, Taita-Taveta.



Milk production

Milk production in Nyanza, western and lower eastern is far below the national average and therefore huge deficits exist in the project counties. This is reflected by common hikes in milk prices throughout the year compared to the traditional dairy areas in the highlands of Kenya (AVCD baseline report 2016). The deficit is bridged by importing milk from other counties; for example, traders in Kisumu and Vihiga source milk from Nandi; Kitui traders import milk from Kiambu, and Makueni traders import it from Narok during some periods of the year. The volume of milk produced, as indicated by the amount traded, further points to high volume of production in Makueni (Salama sub-county) and upper Mwatate and Taita sub-counties in Taita-Taveta. In these location, prices greatly fluctuate and gluts are common compared to western Kenya. Traders and transporters reported handling between 200 and 300 litres per day in Taita-Taveta and Makueni compared to 30-50 litres per day in Busia and Migori, respectively, during peak periods. While prices in western Kenya remained stable at KES 60 per litre almost all year round, in Kilome sub-county (Makueni), Upper Mwatate and Taita (Taita-Taveta) prices drop to as low as KES 25–30 during peak wet seasons. Again, this is an indication of high volume of production in lower eastern compared to most parts of western Kenya.

3.3 Dairy breeds and breeding technologies

Farmers across the project area keep local zebu, crosses and what they refer to as ‘pure breeds’ (which does not necessarily mean breeds of high genetic composition of the improved breed) (Figure 3). However, cows of local breed are steadily decreasing and improved cows acquired through purchase of pure breeds and crossing from other farmers, are increasing. The AVCD dairy component baseline survey reported that most of the cattle kept are local or a combination of local and improved breeds (AVCD 2016). The survey further reported that 33% of farmers keep at least one improved cow most likely of Friesian type. With the exception of Taita and Upper Mwatate in Taita-Taveta where most farmers have already transitioned (almost 20 years ago) to pure breeds of Friesian, Ayrshire, Jersey, and Brown Swiss, majority of farmers in the other areas surveyed keep local breeds.

Focus group discussions revealed that farmers fear of their inability to acquire enough feeds and managing diseases in improved cows keeps them from adopting better breeds. In the last five years, several organizations and initiatives have been involved in improving breeds in these areas including Heifer International’s ‘Send a cow’ program in Nyanza and western regions, the county governments of Makueni through subsidized AI, and the county governments of Migori, Kisumu, and Siaya through purchasing and distributing improved cows to farmers and farmer groups.

Figure 3. Crossbreeds kept at a smallholder farm in Rangwe, Homa Bay County.



3.4 Feeds, feeding and feed availability

Dairy feeding constitutes a major cost component of dairy production accounting for between 70-80% of total cost of production (EADD 2008). The main feed types according to the survey and based on producer group discussions are green forages, crop residues, concentrates and conserved feeds. Green forage is largely composed of grasses and pastures including Napier grass, which is grown by 84% of farmers (AVCD baseline report 2016), Mulato, Boma Rhodes and fodder legumes (particularly Desmodium and Lucerne). These are grown or sometimes purchased from other farmers and also gathered. Some of the green forages (Napier) are available throughout the year especially in parts of western Kenya, Nyanza and Taita-Taveta. Crop residues form an important source of dairy feed and 95% of the farmers use it. Maize stalks are the most widespread crop residues fed to cattle and 94% of the farmers were found to use (AVCD baseline report 2016). Banana stems and sweet potatoes vines are also fed to cattle, particularly during dry seasons. Farmers use crop residues from their own farms or buy from other farmers. Maize stalks are used immediately after the harvest seasons (June and July) and during the dry spells (December, January and February) in western Kenya where open grazing is common. In Taita-Taveta (Mwatate and Taita) in the dry season sweet potato vines are used between March and October.

While both regions (east and west) use crop residues, in western Kenya they are directly grazed on while in the field whereas in lower eastern regions they are harvested, stored in hay barns and fed to cattle over a period of time. This difference in management of crop residues as is necessary in the lower eastern regions where dry season feeding strategy is more critical unlike in Nyanza and western regions where dry spells are short.

Conserved feeds in the form of hay (Boma Rhodes) are mainly used during dry seasons or purchased from commercial hay producers (Figure 4). This is common in lower eastern Kenya (Kitui, Taita-Taveta and Makueni). Conserved feeds in the form of silage is used mostly in western Kenya (Vihiga, Busia, Migori and Homa Bay) during the drier periods.

Figure 4. Feeding a dairy cow on hay (Boma Rhodes) in a smallholder farm in Ugenya, Siaya county.



According to the AVCD baseline report (2016), 14% of farmers in the project area use commercial dairy meal. Concentrates such as dairy meal, wheat bran, maize bran and cotton seed cake and sunflower oil cake are only fed to cows that are highly productive. These are mostly purchased although a few cases of homemade rations were reported. Except in Taita-Taveta (upper parts of Mwatate) and Makueni (Kilome sub county) dairy meal feeding is not a widespread practice.

Availability of dairy feeds, particularly fodder and forages, also depends on weather patterns (wet and dry seasons). Some farmers conserve and store feeds during wet /harvest seasons when there is plenty of grass/ crop residues and use these during the dry spells. Majority of the respondents from western Kenya (Busia, Vihiga, Homa Bay, Migori and Siaya) lack feed storage capacity despite often experiencing excess production from both grown and naturally existing grasses, particularly during the wet/harvesting seasons. This often results in extreme wastage of feeds during this period. This was corroborated by the low ownership of stores amongst those in the focus group discussions. Many respondents from lower eastern (Kitui and Makueni) and Taita-Taveta (Mwatate and Wundanyi) own feed stores and strive to collect excess fodder/crop residues during times of plenty for use during prolonged dry spells. They also confirmed that conserved dry matter results in more milk than green forage when fed to dairy cattle.

Text box 1. Feed conservation and storage

Crop residues are conserved by cutting and storing in hay barns in lower eastern (Figure 5) but grazed directly in western Kenya soon after harvesting. The hay barn is a common farm structure in lower eastern regions especially in male-headed households but not in western Kenya, implying that dry feeding coping strategies are not uniform across the project area. This indicates a need for promotion of varied dry feeding strategies in project sites especially in western Kenya. Use of dry feeding strategies is also dependent on the number of animals, breeds and whether the animal is lactating or not. Feeding cows on dry matter (conserved feeds) was reported to result in more milk yield compared to green forages.

Overall, other factors affecting availability of feeds include prices and distance away from agro-vet input stores. Feed prices are high during the dry seasons and low during the wet seasons. Prices also vary between different agro-vets based on their distance and location from farmers.

Strategies that farmers use to cope with feed shortages during dry seasons were: use of crop residues, feed conservation during rainy season (silage/hay, buying hay/Napier grass), conservation of crop residues after harvesting (e.g. maize stalks), use of banana stems and sweet potato vines, use of cotton seed cake and open grazing where open fields or farms are still available. Farmers are not aware of any feed analysis services in the project area which could be used to test for feed quality and therefore only feed what is available without knowing its quality.

Figure 5. Conserved feed in a hay barn in a smallholder farm in Kilome, Makueni County.



3.5 Animal health practices

The most important animal health technologies demanded and used by most farmers according to the AVCD baseline report (2016), include tick control (89%), deworming (78%), vaccination (35%), clinical services (55%) and others such as dehorning (4%). According to FGDs in the project areas, these services are offered by both private and public (county government) service providers. Difficulties in access and cost of the services were reported in Taita-Taveta, probably due to low demand for the service in this county. Some farmers resort to traditional treatment (herbs) when conventional drugs are not effective or inaccessible:

‘In cases where the animal is sick and there are no drugs/ service provider, most famers use traditional herbs to treat the animals’— farmer in an FGD in Kasikeu, Makueni County.

Other services, such as livestock registration with Kenya Stud Book (found in Busia and Vihiga), pregnancy diagnosis and embryo transfer (in Taita-Taveta) and AI, are often bundled with animal health service provision. In Makueni and Busia, public service providers are comparably more active than private practitioners despite the long distances they have to cover to provide the services. To reduce the distance and increase coverage, farmers suggested increasing the number of service providers, especially AI inseminators and animal health practitioners.

In terms of cost of health services, vaccinations were reported to be unaffordable to most farmers in Makueni, Vihiga and Homa Bay counties. The majority of farmers, especially in Homa Bay and Vihiga, were not vaccinating animals and numerous cases of East Coast fever (ECF) were reported. Despite the generally low levels of adoption, there was an indication that use of vaccination has increased compared to five years ago, largely as a result of increased subsidization by the county government and other projects. No gender biases in service provision were reported except in Makueni (Kasikeu), where women complained of being charged exorbitantly.

3.6 Gender perspective in dairy production

3.6.1 Tasks and responsibilities

Findings indicated that both men and women are engaged in most of the dairy production and marketing activities. However, results showed that most dairy activities at the household level are largely performed by women. Although some tasks are shared, women still allocate relatively more time than men to dairy farming. Women mostly perform delivery of milk to the market (especially when transported on foot), cleaning milking equipment, animal collection, watering, fodder collection and feeding, and add value to milk through traditional milk processing. Men's tasks include cattle spraying, construction and maintenance of cattle pens, keeping general animal health and animal breeding. Some of the shared dairy tasks include cattle feeding, grazing, and milking. Girls and boys support women and men's tasks respectively. It was also evident that when feeding involves cut and carry of feeds, women were more likely to be involved and men were mostly involved in open grazing of animals.

The rapidly changing dairy feeding systems from open grazing to cut and carry, happening across most of the areas surveyed, are changing gender roles, tasks and workload in the household. Women's workload in dairying is increasing and that of men is reducing as revealed below by a group discussion:

'Now that we have moved from open grazing to zero-grazing, most of cattle keeping activities are left to us women to manage'—female FGD participant in Taita-Taveta County.

3.6.2 Decision-making

Decisions on use of proceeds from the sale of fresh milk vary by marketing channel, volume of milk sold and the breed type kept. In regions with many improved breeds, such as Taita-Taveta County, decisions over fresh milk proceeds are made jointly. In most counties in western Kenya region (Vihiga, Migori and Siaya), women control proceeds from fresh milk sold probably due to low volumes of production and little proceeds. However, the situation is changing as farmers shift from local breeds to improved breeds. Proceeds from traditionally processed milk are traditionally handled by women and discussions revealed that this is not likely to change in the near future until men get enlightened about the value of this milk. Similarly, the decisions of where to sell milk is dependent on volume of milk produced, breed type, price offered and available marketing channels. In counties where milk production is low (Vihiga, Busia, Migori, Siaya, Homa Bay and Kitui counties), decisions on where to sell are dominated by women whereas in Taita-Taveta county where there are more improved breeds, both men and women jointly make the decisions. These trends are likely to remain the same in the next five years.

Decisions over selling of heifers is mainly done by men, in areas where dairying is not well developed, otherwise it is a joint decision. The same was reported on breeding and bull selection, even though a few times women take such decisions.

3.7 Support services and input supply to the dairy value chain

3.7.1 Breeding services

The provision of AI services in the project area is largely done by government and private service providers. However, private service provision is poor, uncoordinated and ineffective. Providers operate individually, are few in number, lack the necessary facilities and skills to serve farmers more efficiently and effectively. The low capacity of these providers has resulted in high conception failure rates and discouraged farmers who resort to using privately-owned bull schemes (local breeds). Since the privatization of AI services and the devolution of agriculture, some counties have realized the weaknesses in the delivery of service by private providers, veterinary doctors and even government veterinary departments. Because of poor coordination, semen is sourced from poor-quality bulls and there are high

incidences of inbreeding, as commonly cited in Vihiga County. Some county governments have initiated programs to mobilize service providers, re-train and equip them with the necessary facilities and create central sources of semen, and deliver to farmers at subsidized costs. Such counties are already realizing a huge demand for these services.

3.7.2 Inputs support services

The AVCD dairy component project areas have numerous private agro-input dealers and agro-veterinary service providers. These range from small input stores in small market centres to large dealers located in major market centres and towns, supplying farmers with various animal feeds, drugs, veterinary services and technical advice. Out of the 18 interviewed agro-input suppliers across the project area only two, found in Rangwe, Homa Bay, were not formally registered. All agro-input suppliers deal in both crops and livestock inputs and supply dairy farmers with various animal feeds, animal drugs, acaricides, and extension services (Figures 6-8).

Figure 6. Agro-input shop dealing in both crop and livestock inputs.



Figure 7. Agro-input shop dealing in livestock feeds.



Figure 8. Feeds and forages in Luanda market, Vihiga County.



Most of the agro-vet shops are owned by animal health practitioners and therefore offer both clinical and input supply services. There are four main supply channels for inputs suppliers/service providers: manufactures, distributors, wholesalers and agro-vet stockists. These supply channels depend on the type and size of input supplied by the provider. For instance, the two largest input suppliers/service providers in Wundanyi town in Taita-Taveta are supplied directly with animal feeds from Mombasa Maize Millers and veterinary inputs from manufacturers such as Coopers, Twiga Chemicals, Unga, and Farm Chem.

Small-scale input suppliers/service providers receive most of their supplies from wholesalers and agro-vet stockists. The distance between dairy input main suppliers, manufacturers, distributors, wholesalers, agro-input stockist and farmers in project sites, and across the project areas, varies. Most manufacturers are located in Nairobi, Mombasa and Kisumu and distances between them and input suppliers ranges from 200–360 km, on average. Major distributors and wholesalers are located 100–200 km from input suppliers while producers (farmers) are located 5–30 km from the nearest agro-vet shops. In cases where farmers are located further away from input suppliers, communication through mobile phones and use of motorcycles alongside mobile money transfer services has significantly reduced the physical distance and transaction costs associated with access to dairy input services.

Agro-vets shops sell animal feeds directly to producers. However, veterinary drugs are mostly sold through animal health practitioners, except tick control and deworming products that are purchased directly from agro-vet shops. Sales volumes for feeds and drugs vary by season. Sales tend to drop during drier seasons for all channels even though none of the channels is eliminated at any time of the year. The most common mode of procurement by wholesalers from manufacturers/ distributors is by cheque and cash payments. In cases where input suppliers have long-term relationship with manufacturers, distributors and wholesalers, credit is advanced to the input supplier (agro-vets) and payment is made before the next batch of inputs is delivered. This arrangement guarantees supply of inputs to the agro-vets which enables them to maintain regular customers. The check-off mode of payment; where payment of farmers supplied with inputs is deducted from milk delivered, was reported by one agro-vet in Wundanyi (Taita-Taveta) but only members of the Taita-Taveta Dairy cooperatives and suppliers of Brookside Dairy Limited benefit from this arrangement.

Credit facilities targeting input suppliers are mainly provided by commercial banks. Most agro-input dealers have benefited from this service and are satisfied with the terms and conditions provided. To qualify for this credit, input suppliers need to provide evidence of continuous cash inflows, and have active bank account (indicated by the bank statement) or collateral. Some input suppliers have never benefited from bank credit but have received credit from distributors/wholesalers payable within 30 days of delivery.

Despite input suppliers being aware of the benefits of doing business with milk cooperatives rather than farmers, most of the suppliers interviewed opted to do business with individual farmers because most cooperatives societies in the project areas are weak, have low membership or are mismanaged.

3.7.3 Credit services

A number of formal credit services are available but only a few farmers access them because they view the terms for borrowing as unfavorable and are therefore unwilling to take the risk. The major sources of formal credit in the target counties include commercial banks, microfinance institutions, government financial institutions such as the Agricultural Finance Corporation (AFC), Agricultural Development Cooperation (ADC) and government programs such as the Uwezo and the Youth Enterprise Development funds, and NGOs including One Acre Fund. Informal credit institutions such as community financial services associations (CFSA), table/ village banking groups, informal farmers groups and milk dairy cooperative societies were also mentioned. Despite having a national coverage, AFC and ADC were only common in Busia and Vihiga counties. Table banking and KWFT are mostly accessible to women groups. Financial services associations (FSA) were reported mostly in Taita-Taveta county and Kuria West (Migori). It was also evident that in Busia the agricultural development fund by the county government was providing credit to farmers.

Credit access by milk traders (cooperatives, milk bars and shops, mobile traders and vendors) is poor despite the presence of various credit institutions across the project areas. The key challenges include lack of collateral, fear of losing properties in case of default and high interest rates. This is indicated by the small proportion of milk traders (6 out of 25) who confirmed ever benefiting from credit services. Milk traders mainly acquire credit from commercial banks, ADF, FSA, AFC, table banking groups, microfinance institutions and cooperatives.

The milk transporters on the other hand have no access to credit services because they operate with limited capital and are not well organized, except in Taita-Taveta and Rongo where transporters have formed associations.

3.7.4 Extension services

Since the devolution of agricultural services, extension services have been the sole responsibility of county governments but the level of service provision varies across the counties. Most extension services in the project areas are provided by both private and public livestock and veterinary extension staff and NGOs. Most of the agro-vets (input providers), are owned and managed by livestock production and animal health practitioners and they also provide advice to farmers over the counter. In some cases, local administrators through public 'barazas' (public meetings) also reach out to farmers. A few farmers obtained general information through the media (radio, print and television). Magazines such as *Seeds of Gold* in the *Daily Nation* newspaper and television programs such as *Shamba shape-up* are a case in point.

Overall, information is delivered through home/farm visits, field demonstrations, exchange visits, trainings, office visits and phone calls. Most of the extension services are donor supported through government programs and projects (Figure 9). It was evident from the discussions that these services are mostly provided when farmers seek them. Most sought-after information comprises general dairy management, animal health/clinical/treatment services, disease management, breeds and breeding, feed conservation (silage and hay preparation), deworming, spraying, AI, pregnancy diagnostics, and vaccinations. The study did not find evidence of variation by gender in access to extension services.

Farmers across all counties expressed a desire for more trainings on general dairy management, feeding, feed conservation and feed formulations, breeding and animal health. In particular, farmers in Siaya and Homa Bay counties are most interested in learning how to control ECF. Other areas of interest included capacity building on milk value addition, record keeping and milk handling and marketing.

Figure 9. Dairy supporting institutions in Wundanyi, Taita-Taveta, Kenya.



3.7.5 Transport services

In the dairy value chain, organized and efficient milk transportation from producers to processors or to market outlets is critical because milk is highly perishable. However, milk production in the project areas is low (except for Taita and Mwatate sub-counties in Taita-Taveta) compared to traditional and high potential dairy areas of Kenya. Because of this investing in organized formal transport for milk is not prioritized.

However, findings showed that there is some level of organized, but informal transportation for milk in some areas. Farmers contracted by Brookside Dairy Limited in Taita-Taveta have organized-formal milk transportation. Their milk is transported to Wumingu chilling plant and the cost of transport is met by farmers through a check-off payment system. Similarly, a relatively organized vehicle transport system exists in some parts of lower eastern (Kitui, Makueni and Taita-Taveta). In some parts of western Kenya (Busia, Migori and Siaya), the use of bicycles and tricycles was also observed and reported (Figures 10–13). In some few cases in Kitui and Voi, milk delivery is done through public service vehicles or ‘matatus’.

The mode of milk transport is dependent on the type of market, distance to the market and the volume of milk transported. Buyers are diverse; ranging from dairy cooperative societies, middlemen (brokers), milk bars and shops, mobile traders and vendors, institutions (hotels and schools) and processors such as Brookside Dairy to individual consumers. Majority of those who sell milk directly to consumers walk on foot when delivering milk because distances to customers are short and in many cases customers collect milk directly from producers. A few dairy cooperative societies have organized transport services for collecting milk from producers to the cooperatives chilling plants. In some cases, members of cooperatives take milk to collection centres on foot at no cost or hire bicycles or motorcycle/ vehicle operators to deliver it. Cooperative societies with organized transport mainly use bicycles, motorcycles, and pick-up trucks to carry milk from collection centres to other intermediaries or to final consumers. This was the case in Taita-Taveta, Makueni, Siaya, Busia and parts of Migori counties. In Busia, Butula Dairy Cooperative uses both bicycles and motorcycles to transport milk from collection points to the chilling plant. Use of bicycles and motorcycles for milk transportation poses a number of challenges for the value chain, for instance, huge losses during wet seasons because of accidents, low volumes being transported per trip and difficulties in handling the prescribed aluminium milk containers.

In general, it was noted that milk transportation could be a viable business in Kenya if financial and credit services were improved to support it. Also, training on milk handling, quality and safety will reduce milk wastage and is critical for the overall improvement in the value chain.

Figures 10–13: Various methods of transporting milk in western Kenya.





3.7.6 Information services

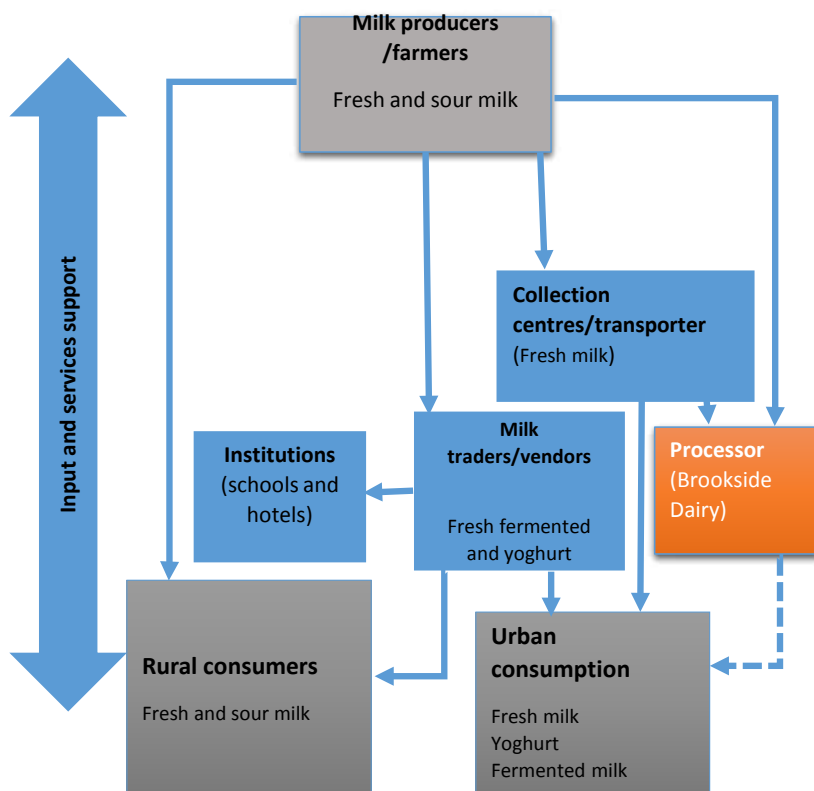
Production and market information, particularly on breeds, animal husbandry and health, feeds, markets and prices is vital for increased dairy production in Kenya. Most farmers in the target counties obtain information from milk traders in the markets, government extension officers, agricultural fairs, input service providers, fellow farmers/ neighbours/relatives and the media. NGOs working in the project areas of western Kenya such as One Acre Fund and Heifer International provide farmers with production/husbandry information. In lower eastern, most farmers rely on government extension and input service providers for information. No major variations by gender in information access were reported, except in Kitui where more women than men seemed to access breeding information from fellow farmers. Most farmers reported that the information received was reliable, except in Rongo where farmers were less content with the breeding information they received. Also, as a result of the numerous sources of information, some information was found to be inaccurate, unreliable and likely to lead to negative consequences of technology use. Cases of misinformation were evident in relation to suitability of certain dairy breeds, their feeding and overall dairy animal management.

3.8 Marketing channels and relationship between channels

3.8.1 Value chain actors

A milk marketing channels and actors map is presented in Figure 14. Despite the informal nature of milk marketing in the study area, marketing functions are performed by different actors in the chain who sometimes combine two or more functions. These market actors include producers, transporters and collectors, milk buyers and sellers, and rural and urban consumers.

Figure 14: Milk value chain marketing channels/actors map.



Producers: Most farmers in the project areas, particularly in western Kenya where milk volumes are low, sell milk directly to consumers. However, where the individual milk production is high, for instance in Taita-Taveta and Salama in Makueni, the chain is longer with other actors performing various market functions including aggregation, transportation and distribution, chilling, and packaging. Interestingly, in Taita-Taveta, farmers who produce high volumes of milk (>50 litres daily) bypass middlemen and sell directly to milk bars and milk kiosks in Voi town using pooled vehicle transport. They receive better prices (KES 60–70/litre) compared to those who sell through brokers and middlemen (KES 45–50/litre), especially during the dry season. In wet seasons, most farmers sell milk to milk bars and cooperatives because they are offered guaranteed market compared to informal markets which become unpredictable. In dry seasons, farmers prefer to sell to individual consumers because of competitive prices. Some farmers participate in milk marketing by undertaking milk aggregation and transportation, running milk bars (or kiosks), and/or engaging in mobile milk trade or vending, a form of vertical market integration.

Producer price: This varies depending on marketing channels, season, volumes, transport costs, and in some cases time. Ninety per cent of milk in the project areas is sold fresh. The remainder is processed, especially during wet seasons. Fresh milk prices range from KES 23–90 per litre depending on the channel (buyer), region and season. Milk prices seemed comparably low in Wundanyi (Taita-Taveta) ranging between KES 23 and KES 40 per litre in the wet and dry season, respectively. The highest milk prices were reported in Vihiga (Luanda) at KES 60–75 per litre and in Migori (Masaba) at KES 60–90 per litre.

In Taita-Taveta (Wundanyi) and Migori (Rongo), Brookside Dairy, the sole milk processor with chilling plants in the project areas, purchases milk from farmers at between KES 23 and KES 34 per litre in the wet and dry season, respectively. The processor transports milk at an average of KES 8 per litre. Producers selling to cooperatives receive between KES 45–60 per litre in western Kenya and KES 23–35 per litre in eastern Kenya. Across the study areas, farmers who sell directly to consumers received between KES 50–90 per litre. These prices are consistent with those of the AVCD baseline study (2016) where the median producer price ranged between KES 60 and KES 30 per litre.

Milk collectors: Except for some areas in Taita-Taveta and Migori where Brookside Dairy is present, milk collection in most project areas is highly informal and done through mutual contractual arrangements between farmers, cooperatives, other milk traders. Because of low milk volumes, collectors also end up engaging in transportation. As a result, milk collectors in the project areas have numerous titles. In Siaya, they are referred to as ‘marketing agents’ because after getting milk from farmers, they sell it for a margin and then deliver the balance to the cooperative’s chilling plant (a case in Sam Malanga Dairy Cooperative). These marketing agents are paid a monthly commission of KES 4 for every litre collected and sold. A similar arrangement was found in Busia (Butula Dairy Cooperative) where collectors receive a commission of KES 4 per litre on milk sold and KES 2 per litre on milk delivered to the chilling plant. This is because once milk is collected, it is first delivered to the chilling plant and thereafter allocated in part or fully for sale. In Taita-Taveta, milk collectors are also called ‘brokers’. After buying milk from farmers, they aggregate and deliver it to milk bars, hotels, and institutions through identified transporters paid on the spot (KES 5 per litre). In Migori (Rongo), milk collectors earn KES 2 per litre of milk collected from the farmers and delivered directly to the dairy cooperatives. This is payable monthly by the cooperative. Some milk bar proprietors collect and transport milk from producers for retail and sometimes they distribute or sell it to other milk traders (Figure 15). Such milk bars have invested in vehicles, tricycles and motorcycles for transportation as observed in Makueni, Busia and other project areas, respectively.

The milk collectors are responsible for ensuring milk quality and safety since any loss incurred would fall back to them or on the farmers. Some of them ensure milk quality by testing it with lactometers, maintaining milk container hygiene and they observe Kenya Dairy Board rules and regulations regarding milk handling. Many handlers have, however, not received any training, except from a few cooperatives that offer training on milk handling regulations. In Migori (Rongo) and Taita-Taveta, milk collectors (transporters) are organized through their formal associations to collectively address key challenges they face.

Figure 15. Milk distribution point in Voi town in Taita-Taveta.



Milk traders and retailers: Milk businesses in most project areas are mostly informal. They involve distinct actors grouped into three main categories based on their roles; 1) milk bars or kiosks, 2) mobile traders, and 3) milk vendors. Some of these informal market actors are seasonal and are active only during times of peak milk production, especially in western Kenya. Some actors combine more than one function i.e. milk transportation and sale, milk production-aggregation or transportation and selling. A majority of milk traders collect between 70–100% of milk directly from local farmers within their counties, during peak production periods but expand their catchment areas during the dry seasons. This dynamism in sourcing for milk is best captured below in a discussion with the milk trader:

‘All of the milk comes from the farmers directly during the long wet season, 70% during the short wet season and 30% during the dry season. Transporters supply milk only during the short wet season (30%) and dry (70%). In the dry season the transporters also get milk from neighboring counties (Nandi)’—Key informant from Vihiga.

When milk is sourced outside a county, traders contact transporters (collectors) but not producers directly. Milk traders in Migori, Vihiga and Makueni collect milk from Narok, Nandi and Kajiado counties, respectively, during the dry season. Most of these traders sell directly to consumers in urban and peri-urban areas while rural consumers buy milk from producers directly.

Whereas some mobile traders and vendors collect milk from producers directly, others source it from milk bars and kiosks at a discounted price of KES 5 below the final consumer price. Milk bars mostly receive their milk directly from producers but during scarcity they get supplies from collectors/transporters and other milk bars. Most milk bars have small cooling facilities and handle larger volumes (50-350 litres) per day compared to mobile traders (10-100 litres) and vendors (<20 litres) (Figures 16–18). Volumes vary by region and reduce significantly in dry seasons. While some milk bars also undertake value addition and process milk into ‘mala’ (fermented milk) and yoghurt, mobile traders and vendors solely sell fresh milk and only convert what is not sold into fermented milk. Even though these milk traders compete in milk marketing, an isolated case was reported of one milk trader’s association in Taita-Taveta that links traders to the Kenya Dairy Board for improved adherence to milk handling regulations.

Figures 16-18: A milk bar with a deep freezer and fridge displaying fresh milk, yoghurt and ‘mala’ in Voi town, Taita-Taveta County.



Cash is the main mode of payment for milk supplied to traders which is done monthly, fortnightly, or weekly after delivery. In isolated cases across all project sites, some milk traders had agreements with a large-scale producers (supplier) to pay the equivalent of 10 days of daily collection in advance as guarantee of commitment on the part of the trader.

Most of these traders rely on bicycles, motorcycles and pick-up and mini trucks to transport milk collected or delivered. Milk is collected and transported in both plastic jerry cans (5-40 litres) and aluminum milk cans, the latter being widespread in western Kenya.

Cooperatives: Cooperative societies are a formal channel. A number of them in the project areas are inactive, underutilized and operating below capacity due to mismanagement and low membership. Members deliver only a small portion of their milk to the cooperatives just to maintain membership and to access this market outlet whenever the informal market becomes less competitive. Most of these cooperatives have milk cooling facilities that were donated by government or through the development assistance offered by donor-funded projects (Figures 19 and 20). However, it was evident that the facilities were donated without addressing the leadership challenges that often undermine cooperatives in Kenya and also implementing thorough milk supply analyses. The underutilization of these cooling facilities is evident in the Butula Dairy cooperative in Busia where a 1,100 litre-capacity tank is hardly ever over 35% full and in Shamakhokho (Vihiga) where a cooling tank is used as a water tank. Members of these cooperatives prefer to sell milk to informal channels because of the low prices offered by the cooperatives (KES 23–50 per litre) by the cooperatives compared to KES 40–70 per litre or higher offered in the informal channels.

Figures 19 and 20. A cooperative cooling plant in Butula-Busia donated by a development project.



Due to low volumes of milk delivered to most of these cooperatives, their business models end up being similar to individual milk bars, where 90% of the fresh milk is sold directly to individual consumers without value addition. Two dairy cooperatives (groups)—Rongo Dairy in Migori and Tagho Dairy group in Taita-Taveta—process milk into ‘mala’ and yoghurt in addition to delivering a small proportion of milk to Brookside Dairy chilling plants, especially during the

peak production season. Due to low volumes of milk delivered by members, there has been little effort to formalize milk supply arrangements with other milk traders to guarantee markets. Only two cooperatives, one each in Vihiga and Taita-Taveta, approached traders to formally supply milk; an arrangement which had not taken off due to low volumes.

The cooperatives buy fresh milk directly from both registered and unregistered farmers in the locality. Membership is low because the cooperatives are poorly managed as cited in most group discussions. One of the reasons that discourages farmers from collectively selling milk through them is the lack of an organized or guaranteed market. For instance, a case of milk being returned to farmers due to lack of markets was cited in Rangwe, Homa Bay County. In Vihiga, Busia and Makueni, cooperatives have the capacity to handle more milk but their daily supply was hardly a quarter of the carrying capacity of the cooling facilities. One of the outstanding features of cooperatives visited was that they were not linked to a market and were struggling to sell even the little milk collected from farmers. This was evident in farmer groups of western counties, such as Butula Farmers' Cooperative that could not find market for milk and resorted to competing with farmers in selling milk.

Most cooperatives do cash payment fortnightly or monthly for milk delivered by the farmers after deducting operational costs. Check-off systems of payment are rare with only one reported in Taita-Taveta. Here, Brookside Dairy has contracted farmers and Tagho Dairy Cooperative members are supplied with inputs by particular agro-vets and the cost is deducted directly from farmers' proceeds. The main buyers from cooperatives are individual consumers in urban and peri-urban areas, local schools, hotels and health facilities across the study areas. This finding underscores the need for forward market linkages to guarantee market outlets and increase dairy production. Some cooperatives process yoghurt, sour milk and cream from fresh milk but are unable to sell these products despite their higher prices.

3.8.2 Inputs and service providers

The government has privatized AI services and farmers meet the entire cost of service delivery, whether provided by government staff or private service providers. The breeding services available include use of bulls and AI. Both private and public AI inseminators provide these services even though the former are more expensive and the latter are fewer. In high dairy production areas like Taita and upper parts of Mwatate in Taita-Taveta County, AI services are available, reliable and just a phone call away compared to western Kenya where there is a shortage of service providers. However, even where providers are available, services are comparably poor forcing farmers to resort to using bulls. Most farmers in Homa Bay County reported high AI failure rates and many in Makueni, Vihiga and Homa Bay counties expressed difficulty in affording the services. AI prices range from KES 1,000– 5,000 per service depending on the quality of semen (breed) and distance between the farmer and service provider. Sexed semen prices vary between KES 6,000 and 10, 000 and few farmers in Taita-Taveta have used it.

In some counties, such as Busia and Makueni, AI services have been subsidized by the county governments. Farmers there can access AI for KES 1,000–1,300 or in some cases for a low of KES 50 per service. However, several farmers reported that subsidized services are not readily available due to high demand and other challenges associated with the costs of transportation.

The cost of accessing improved bull services range between KES 200–300 in western Kenya and KES 500–1,000 in lower eastern region. Local bull services are free and some farmers resort to these whenever AI services are inaccessible. A majority of farmers either use their own bulls or borrow from their neighbours for breeding purposes.

3.9 Marketing margins

Due to the informal nature of milk marketing, the dynamics of the business and the combination of marketing functions by various actors, calculating marketing margins at each node of the dairy value chain is difficult. In addition, the lack of specialization in marketing functions along the value chains has implied that most market actors directly

reach the final consumer. In the study areas, market actors can be grouped into eight categories for purposes of computing market margins: producers/collectors, collectors/mobile traders, collectors/milk vendors, vendors, mobile traders, bars and kiosks, cooperatives and chilling plants. As previously mentioned, milk collection and transportation are basically the same function in the study areas and therefore involve the same people.

In Table 3, the estimated marketing margins are presented for each node. Caution should be taken when interpreting these margins since they greatly vary across actors. Overall, the marketing margins range between 11–43%, with mobile traders having the lowest (20-25%) and cooperatives the highest (38–43%). This might further explain why farmers in the study areas avoid selling milk through cooperatives. Cooperatives that were receiving these margins also sell milk directly to consumers and compete with informal milk traders.

Table 3. Indicative marketing margins by market actor group

Actors	Buying price (KES)	Selling price (KES)	Marketing margins (%)	Remarks
Collectors/producers	35–60	45–90	22.2–33.3	Farmers aggregating and selling
Collectors/mobile traders	35–60	40–90	12.5–33.3	Transporters aggregating and selling
Collector/milk vendors	35–60	50–90	30.0–33.3	Collector aggregating and selling
Milk vendors	40–60	45–90	11.1–33.3	Sourcing from farmers/ and milk bars
Mobile traders	40–60	50–80	20.0–25.0	Sourcing from farmers/ and milk bars
Milk bars and kiosks	30–55	45–80	31.3–33.3	Milk bar sourcing from farmers, middlemen
Cooperatives	23–50	40–80	37.5–42.5	Cooperatives sourcing from farmers directly
Chilling (Brookside Dairy)	23–34			Chilling plants in Rongo and Taita sub-counties sell processed milk

Source: authors' computations using study data

4. Summary of challenges and opportunities for improving the dairy value chain

A large proportion of small-scale farmers in the AVCD project sites keep dairy animals to generate extra income and to meet household needs such as school fees and nutrition/food security demands. However, most of them have not realized these outcomes due to several challenges summarized below.

Dairy cattle management and housing

Dairy cattle are mostly open grazed but zero-grazing is now increasingly common. At the same time, open grazing is slowly evolving into a tethering system due to decreasing access to land. Although the open grazing system is cheap to manage, it leads to relatively low productivity due to high disease incidence, poor breeding practices and general poor management of dairy animals. However, despite the fact that extensive systems are less expensive, their productivity is relatively low. Improving productivity among smallholders will largely entail better general management of dairy cows.

Dairy breeds and breeding technologies

A large proportion of farmers keep local zebu cows and fear transitioning to better and more productive animals due to the high risks associated with the improved breeds despite their being linked with higher profits. Nonetheless, promotion of AI while addressing promoting improved breeds might be a more cautious and better paying alternative than relying on purely local cattle breeds.

Feeds, feeding and feeds availability

A number of farmers feed their animals on green forage composed of grasses and pastures, especially Napier grass. Crop residues in western Kenya are fed directly from the field while in the east they are harvested and used during the dry season. The study found that feed conservation by haymaking was more common in the lower eastern region whereas conservation of feeds by silage was common in the western. The study concluded that the storage capacity of farmers in western Kenya is very low compared to eastern Kenya, even with the bumper harvests (of both grown and natural grasses) realized in the western region during the wet seasons. This often results in huge forage losses for farmers there. Feeds and forage conservations should be a high priority for counties in western Kenya because of this wastage during wet seasons.

Animal health services

Animal health services are provided by both private and public providers. The county governments are also key providers of other livestock-related services which often include animal health services such as pregnancy diagnosis, AI and livestock registration. There was a feeling that increased subsidization (from county government or NGOs) had led to increased use of animal health services. However, the biggest challenge remains the lack of adequate and qualified animal health personnel.

Input support services

AI is provided by both the government and privately companies. Private provision is inadequate, poor and uncoordinated resulting in poor service and low animal productivity. The challenges to AI provision have included lack of relevant technology and skills. Moreover, for small-scale farmers, the services are sourced from poor quality breeds leading to low productivity.

Transport services

Milk transport services are mostly informal and unregulated. Transporters do business with individual farmers instead of cooperatives/ farmer groups due to cooperatives being weak and distrusted. The generally widespread low milk production and the lack of organized marketing among producers has rendered investment in organized milk transportation an untenable business venture. Nonetheless, large processors such as Brookside Dairy have taken up transport roles in some areas. Use of bicycles and motorcycles to transport milk leads to losses due to difficulties of handling the aluminium milk containers and the generally poor handling of the milk. Milk adulteration has been cited among transporters contracted by cooperatives. The key challenges of milk transport services have included low access to financial support and lack of training in milk handling, quality and management.

Credit and financial services

A number of credit services exist although few farmers have access or afford them due to lack of collateral and high interest rates. In addition, the services are unavailable to milk traders, vendors and transporters because of the low milk volumes handled at various nodes in the market chain. Credit facilities have been noted to exist for the upstream actors in the value chain including cooperatives and processors.

Extension services

Extension services are provided by private and public providers and are largely driven by farmer demand. Generally, milk producers demanded for training in milk value addition, breed selection, record keeping, milk handling and milk marketing. In special cases in Siaya and Homa Bay, producers specifically asked for information on control of ECF.

Value chain map/actors

Producers are numerous and largely unorganized. Those who sell to neighbours, especially during the dry season, receive better prices because supply is low supply during that period. They sell most of their milk as fresh milk. Their biggest problem is low supply due to ownership of low productivity breeds.

Milk collectors are informally organized and often have several other functions including being transporters. They lack milk handling and quality maintenance knowledge.

Milk traders and retailers perform more than one marketing function and they are not formally organized into groups or cooperatives. More than 70% of milk is purchased directly from producers although they engage transporters during the dry season when milk supplies are low.

Cooperatives are largely inactive and underutilized due to low membership and poor management. They have also lost members' trust due to poor leadership. Cooling plants in cooperatives operate below capacity due to low volumes of milk procured. In addition, cooperatives offer low and uncompetitive prices compared to the informal market and yet they run a business model that is very similar to that of milk bars i.e. selling milk directly to consumers without any value addition. Few farmers sell to them due to lack of guaranteed payment and lack of organized

marketing structures. The uncertainty around milk procurement has forced cooperatives to invest little in building lasting and profitable relationships with other actors (especially suppliers). Formal linkages with other actors are key to sustaining cooperatives to spur both production and milk supply.

Input and service providers are both private and public. Subsidization of services, including AI and vaccination, has been in high demand although the challenges of meeting this demand remain.

Summary of key challenges and opportunities for improving the dairy value chain

Value chain stage/function	Activity	Challenges	Intervention areas
Production	Breeding and animal health	Poor genetic makeup of the dairy herd, leading to low productivity, particularly in smallholder dairy farms	Promote farmers' access to quality AI and other breeding materials
		Wide gap between availability and use of AI services	Promote practices that increase the success rate of breeding technologies
		Widespread genetic erosion due to use of poor quality bulls	Enhance adoption of good animal health and breeding practices
	Feeding	High cost and seasonality of milk production due to low capacity to produce and preserve high-quality fodder	Promote feed planning practices to reduce seasonality of feed availability
		Lack of adequate and quality feeds and forages	Enhance adoption of high quality forages
	General husbandry and production management	Low commercialization among small-scale farmers when dairy is not the core business	Promote feed and fodder preservation technologies
		Poor husbandry management	Increase business orientation of dairy producers through producer organizations
		High milk spoilage at the farm level	Develop simple financial farm toolkits that enable farmers to start monitoring and controlling their costs
		Low technical knowledge of husbandry and technology use	Offering low-cost means of improving productivity and reducing milk losses
		Lack of cost control	Increase dairy producers' access to technical dairy husbandry technical knowledge
Transportation		Poor quality management due to use of poor handling equipment	Support enforcement of milk handling regulations
		Highly informal transportation business barring entry of organized transporters	Support development of financial products targeting milk transporters
Selling and retailing		Lack of milk quality assurance and poor handling	Support enforcement of recommended milk handling regulations
		High milk delivery costs	Enhance access of technical knowledge to milk traders and retailers
Collection and cooling		Low utilization of established capacity of cooling plants	Forward or backward linkages of the chilling plants as costs centres of producers or processors
		Inefficient and high cost of milk collection and cold chain development	Chilling plants should actively manage cost of transportation for their members

Processing		High consumption of unprocessed milk	Support market expansion of processed products
		Operation below installed capacity increasing cost of production	Support the regulation and supervision of dairy market participants
		Competition from thousands of small-scale informal traders who offer farmers low but reliable prices.	
Consumption		Majority of consumers purchase milk directly from producers	Support the enforcement of milk handling regulations
Value chain stage/ function	Activity	Challenges	Intervention areas
Input and service provision		Lack of access to finance or technical expertise to sustainably and efficiently provide these services	Support development of financial products targeting inputs and service providers
		Mismanagement of the breeding service chain from poor transportation, poor AI infrastructure, poor management of the fertility of dairy animals, and shortage of competent technical people	Increase linkages between inputs and services providers and dairy producers
		Strong government parastatal monopoly in the provision of AI and vaccines outcompeting private providers	Enhance coordination and collaboration among inputs and service providers
		Inadequate supply of AI and vaccines from government parastatals	
		Unavailability of information related to vaccines market potential	
		Inadequate supply of technically competent practitioners	
		Low participation of financial institutions due high risks levels, the lack of collateral and the general lack of information among key value chain actors.	
		Lack of information on financial products among value chain actors	
		Lack of reliable data on vaccine production and distribution to establish the actual demand for vaccines in the county and support private sector investment	
		High fragmentation of value chain actors and lack of loyalty among them	

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