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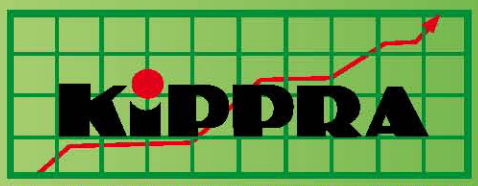

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Exploring Kenya Dairy Industry for Job Creation for the Youth

Grace Kyule and Judith Nguli

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THE KENYA INSTITUTE FOR PUBLIC POLICY RESEARCH AND ANALYSIS (KIPPRA)

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Exploring Kenya Dairy Industry for Job Creation for the Youth

Grace Kyule and Judith Nguli

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Bishops Garden Towers, Bishops Road
PO Box 56445-00200 Nairobi, Kenya
tel: +254 20 2719933/4; fax: +254 20 2719951
email: admin@kippra.or.ke
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Abstract

This study is based on the value chain approach to assess key constraints to growth of the dairy industry in Kenya, to explore the current job creation potential of the industry and to assess its labour skills requirements and skills gap. The dairy industry is well poised to contribute considerable number of jobs for unemployed youths in the country. However, the industry's growth faces enormous challenges that hinder its ability to generate jobs. Some of the challenges experienced by different actors along the dairy value chain include poor infrastructural services such as poor road networks, irregularity in power supply and water, competition from informal establishments, limited access to finance and strict customs/tariffs and regulations, among others. There has been an upward trend in total number of jobs created in this industry over the years. However, in the pool of unemployed youth, there are occupational skills gap for some occupations, namely: animal health professionals, farm advisors and dairy machine operators, among others. The total number of students enrolling for agriculture-related courses has been on the decline since 2017. Addressing these constraints will raise the industry's productivity, which in turn would create more jobs for the youth. The paper recommends setting up strict measures and regulations with solid implementation plans to protect the formal milk channel, which possess immense potential for job creation; invest more resources in research and development; improve infrastructure; and create more capacity of farmers to enhance their skills in milk handling techniques to minimize post-harvest losses. To attract more youths in the industry, there is need to professionalize the industry through provision of high incomes and quality jobs.

Abbreviations and Acronyms

AI	Artificial Insemination
DFSHGs	Dairy Farmers Self Help Groups
DTI	Dairy Training Institute
KEBS	Kenya Bureau of Standards
FAO	Food and Agriculture Organization
IFAD	International Fund for Agricultural Development
KARLO	Kenya Agricultural and Livestock Research Organization
KCC	Kenya Cooperative Creameries
KDB	Kenya Dairy Board
KIHBS	Kenya Integrated Household Budget Survey
KNBS	Kenya National Bureau of Statistics
MoALF	Ministry of Agriculture Livestock and Fisheries
NEMA	National Environment Management Authority
TVET	Technical And Vocational Education and Training
UHT	Ultra-Heat-Treated

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1. Introduction

The Kenya Vision 2030 recognized dairy industry as one of the fundamental avenues for employment creation particularly for the youth (Government of Kenya, 2008). The industry forms the largest agricultural sub-sector after meat, horticulture and vegetable and animal oil and fats (KIPPRA, 2018) with unpacked fresh milk being among the top five foods consumed by most households in Kenya (KIHBS 2015/16). It accounts for more than 4 per cent of Gross Domestic Product (GDP) and 12 per cent of the agricultural GDP (KNBS, 2019a). Further, the sector is a means of livelihood to about 1.7 million Kenyans and growing at a rate of about 5 per cent per year (Ministry of Agriculture, Livestock and Fisheries - MoALF, 2019). A well-structured dairy industry, therefore, has the potential to play a pivotal role in job creation for the youth, thus propelling Kenya to achieve its development goals.

The dairy industry was liberalized in 1992 and since then, the sector has witnessed increased private sector participation particularly in the processing and marketing of milk, thus contributing immensely to creation of employment within the industry. According to FAO (2011a), the dairy industry is estimated to generate 76 jobs for every 1000 litres of milk sold. Specifically, at the input and production level, about 23 full time self-employed jobs, 50 permanent full-time jobs for employees and 3 full time casual jobs are generated For the same amount of milk produced, more than 13 jobs are created within the processing stage (SDP, 2004).

With the Kenya's population projected to rise by about 35 per cent by the year 2030, the demand for milk is likely to increase, consequently increasing; more on-farm and off-farm employment opportunities (Willem et al., 2019). The industry is mainly driven by liquid raw milk but there is growing demand for processed dairy products such as yoghurt, whey, cheese and butter especially among the middle and upper income within the urban areas. Of the 55 per cent of the dairy milk produced and sold, 80 per cent is sold in raw form through informal channels while the formal trade milk claims only 20 per cent (Muriuki, 2011). The formal milk undergoes processing, which includes a range of activities starting from input supplies and service providers, production, aggregation and processing, marketing and distribution and the consumption stage. The entire chain of the milk processing activities forms the formal dairy value chain while the informal milk channel forms the informal dairy value chain.

In the process of adding value at every stage of production, the farmers not only increase their returns, but they also create employment at each level of the value chain. The dairy value chain as whole is estimated to provide about 700,000 jobs. The milk production stage, which creates the bulk of farm employment

opportunities within the industry, is estimated to create about 365,000 job opportunities for farm labourers, feed manufacturers, veterinary suppliers, animal breeding service providers, government extension officers, among other direct input service suppliers. The milk processing and marketing activities of the dairy value chain generate about 40,000 jobs with over 70 per cent of these jobs being in small-scale informal sectors. In addition to the direct jobs, the sector creates numerous indirect jobs in sectors such as trade and transport (Small Dairy Project-SDP, 2004).

However, even with such imperative evidence of job creation for the youth, the sector has received little attention in the past (MoALF, 2019). This is evidenced by limited data on youth involvement within the dairy industry. The industry has long been profiled to the older generation, with the general trend moving away to seek private modern wage sector jobs. The under-representation of the youth in the dairy industry has been attributed to the "desire for quick money", and the desire for clean, structured and sophisticated white collar jobs (van der Lee et al., 2016). As indicated by the International Labour Organization - ILO (2016), even under the most optimistic economic development scenario, it is impossible for non-agricultural sectors in the emerging economies to absorb all the unemployed youth labour force, and thus there is need for the youth to focus on the agricultural sector jobs such as dairy farming.

The opportunities for youth to be employed within the dairy value chain is accompanied by various skills requirements. Previously, the dairy industry was preserved to be for the illiterate who failed to obtain formal employment opportunities (FAO, 2003). However, the set of skills requirements in the dairy industry has evolved over time, with farmers with less than a high school education being associated with higher economic costs in the industry. Studies show that farmers who have gone through formal education tend to produce higher yields compared to their counterparts (Oduro-ofori et al., 2014). This is because formal education equips farmers with the knowledge required to improve the quality of labour provided, adopt new technology resources available and adjust fast to existing situations through optimum input utilization. The tendency of small dairy holders to believe that indigenous knowledge is sufficient to manage dairy enterprises has resulted to decreased productivity of their herds (Rademaker et al., 2016). Moreover, beyond the formal education, there is need for the farmers to acquire specialized dairy trainings and information as required in each stage of the value chain to increase the productivity of the sector (Wimmer and Sauer, 2016). This is more so given that complexity of the job knowledge increases as the dairy value continues to expand.

However, despite the growth and high job creation potential in the dairy industry, many youths are not employed in the sector. Seemingly, youth inclusivity is low with the older generation dominating the dairy industry (FAO, 2011b). With the youth unemployment persisting in the economy due to the inability of the private sector to absorb all the unemployed youth, there is reason to believe that the dairy value chain has huge untapped potential for the youth.

The overall objective of this paper is to evaluate the job creation potential in the dairy sector for the youth. Specifically, the study maps out the value chain and activities associated with each level of the value chain. To understand the potential, the study also analyses the constraints facing the sector and the required skills at each level of the value chain.

The rest of the paper is organized as follows: Section 2 reviews the key policy, institutional and regulatory frameworks governing the sector. Literature review and methodology are presented in sections 3 and 4, respectively. Section 5 presents results and discussions while conclusions and policy recommendations are in section 6.

2. Overview of the Dairy Industry in Kenya

2.1 Dairy Industry Performance

Dairy farming in Kenya was first introduced by settler farmers in the early 20th century while indigenous Kenyans got involved in the 1950s. It is the single largest sub-sector of agriculture in Kenya and one among the most developed and dynamic dairy sub-sectors in Africa by production of about 10.2 per cent, after South Africa's 10.5 per cent (IFAD, 2014). It contributes to food and nutrition security and to rural livelihoods. The sub-sector's contribution to various socio-economic dimensions is as summarized in Table 2.1.

Table 2.1: Overview of economic contribution of dairy sub-sector

Indicator	Estimated Value
Value of dairy contribution to overall GDP (%)	4
Value of dairy contribution to agricultural GDP (%)	12
Value of dairy contribution to the livestock GDP (%)	44
Number of lactating dairy cattle (million)	4.50
Annual milk production from all livestock (million litres)	4.75
Total annual milk production cows (billion litres)	3.56
Per capita consumption of milk per year (litres)	121
Amount of formally marketed milk per year (million litres)	600
Number of smallholder dairy farmers (million)	1.8
Number of indirect jobs created annually	750,000
Number of direct jobs created annually	500,000

Source: KDB 2017; FAO 2015, ILRI 2013

The dairy industry consists of several different players: producers; cooperatives (formal sector), processors (the formal sector); retailers (supermarkets, milk bars, shops and kiosks, mobile traders, and cooperatives, selling both pasteurized and unpasteurized milk) and consumers. Of the milk produced, 10.5 per cent is consumed by calves, 45.0 per cent is consumed at farm household level while the rest is sold for local consumption and exports (KDB, 2017). Of the remaining 55 per cent milk that is marketed, most (70-80%) is marketed raw (but boiled before consumption). Informal traders (middlemen/transporters) play an important role in getting raw milk to the market. Of the informally demanded raw milk, 16 per cent is processed artisanally to make homemade sour milk (*mala or mursik*). The rest, 84 per cent is sold either through mobile traders or milk bars in the rural areas (KDB, 2017). Even though milk bar business in urban areas is classified

as formal since the sellers are licensed by the Kenya Dairy Board - KDB, similar dynamics prevail in the formal market as it is in the informal market.

Of the milk processed, 85 per cent is sold as fresh milk either as short life pasteurized milk or long-life UHT milk while 3 per cent is processed to make yogurt, 7 per cent as fermented milk and 3 per cent is sold as powdered milk. The remaining 2 per cent is processed with value-added products such as cheese and butter. The value-added products such as cheese, ghee, butter, whey and other lesser derivatives of whey, whose demand is concentrated amongst middle and upper class (Njarui et al., 2011), make less than 2 per cent of the processed products in the dairy industry (KDB, 2017). The formal sector is expected to grow given the recent regulatory initiatives by the KDB (if effective) to ban the informal milk sector, and the shifting structure of the consumer demand. Recent statistics indicate that quantities of milk delivered to dairy processors increased by 18.4 per cent from 535.7 million litres in 2017 to 634.3 litres in 2018 (KNBS, 2019a).

In understanding the Kenyan milk demand profile, Kenya has the highest annual per capita consumption of 121 litres per person in Sub-Saharan Africa, surpassing the recommended 92 litres per person (Macmillan, 2020). Population growth, urbanization, rising incomes, and changing lifestyles are the main drivers of this trend. Milk consumption is highest within the urban areas compared to rural areas owing to higher incomes (Rademaker et al., 2016). To further segment the demand, the highest demand of processed milk and milk products is also high in urban areas. This is because of increased awareness and safety for the processed milk and milk products. Total milk consumption by Kenyans is growing at 4 per cent per year (MoALF, 2019) consistent with the population growth rate.

Although Kenya has an established competitive dairy industry ahead of most of the Sub-Saharan countries in terms of per capita milk consumption, milk supply is still lower than its potential (FAO, 2015). There is a huge unmet demand for milk and milk products in Kenya, which has contributed widened the demand-supply gap of milk and milk products. Compared to the daily demand of 8.2 million litres, the daily supply is 4.26 million litres (KDB, 2013). As a result of the demand-supply gap, Kenya is currently a net importer of milk. In 2016, Kenya processed about 648 litres of milk (KDB, 2017). This was largely contributed by the drought season that happened in 2017. Moreover, the country exports dairy products to the broader African region. In 2018, the country exported about 11 million litres of long-life milk and powder milk products to the East Africa Community.

As a high value enterprise, dairy farming presents opportunities to increase demand for milk and dairy products through sustainable intensification and commercialization of smallholders and medium-scale producers. Enhancing milk production and productivity requires supporting entrepreneurial farmers

to improve their dairy farming practices and farm enterprise management. The Kenyan dairy sector is transitioning from subsistence to greater commercialization, from low investment into capital-intensive and skilled enterprises, and from fragmentation to consolidation towards a sophisticated supply chain involving many actors and offering a wide range of milk and dairy products. However, much like the agricultural sector in general, dairy is dominated by an older generation of farmers, with limited youth involvement. This poses a potential demographic crisis. This is especially critical considering the high levels of unemployment in Kenya and the new avenues for employment and business that the dairy sector offers (Rademaker et al., 2016).

2.2 Review of Policy, Institutional and Regulatory Frameworks

2.2.1 Existing policy, institutional and regulatory framework

The Government uses several policy documents and pieces of legislation to manage and regulate the dairy industry. The dairy industry is governed by over-arching policy documents: The 2013 National Livestock Policy and the Kenya National Dairy Master Plan. Both policies are anchored within the Kenya Vision 2030 and the Agricultural Sector Development Strategy. Generally, the current dairy industry legislative and policy framework is as illustrated in Table 2.

Table 2.2: Kenya dairy industry legislative and policy framework

Value chain element	Policy Framework	Legislative Framework	Responsible organization	Aim
Entire Value Chain	Kenya Vision 2030 Agricultural Sector Development Strategy (2010-2020) National Livestock Policy (2008, 2013,2019); Kenya National Dairy Master Plan (2019)	Dairy Industry Act (1984/2012)	KDB	Regulation, development and promotion of dairy sector

Input (Feed Supply)		Standards Act (1981 / 2012)	KEBS	Setting and controlling standards or codes of practice for commodities produced or imported into Kenya
Input (Feed Supply)		Fertilizers and Animal Foodstuffs Act (1985 / 2012)	State Department of Livestock (Veterinary Services)	Regulation of the importation, manufacture and sale of agricultural fertilizers and animal foodstuffs and substances of animal origin intended for the manufacture of fertilizers and foodstuffs
		Standards Act Cap 496		
		Animal Feedstuff Bill (Currently Under review)		
Input (Reproductive Services and Breeding)		State Corporation Act with respect to Order No. 112 (2010 /2012) and Gazette Notice No. L.N 110 (2010)	KAGRC	Production, preservation and conservation of animal genetic material (semen, embryo, tissue and live animals) and rearing of breeding bulls for provision of high-quality disease-free semen to meet the national and export demand
Input (Reproductive Services and Breeding		Draft Livestock Breeding Bill (2015)	Proposed: Kenya Livestock Breeding Board	Regulation of livestock breeding and establishment of a livestock breeding board Training and provision of equipment to inseminators
Input (Veterinary Services)	Kenya Veterinary Policy (2014)	Veterinary Surgeons and Veterinary para-profession Act (2011/2012)	KVB	Training, registration and licensing of veterinary surgeons and veterinary para-professionals and provision for matters relating to animal health services and welfare

Input (Veterinary Services)		Animal Disease Act (1989/2012)	MoALF - Department of Veterinary Services	Regulating matters related to animal diseases
Input (Veterinary Services)		State Corporation Act (2012/2010) with respect to Legal Notice 223 (1990)	Kenya Veterinary Vaccines Production Institute	Undertaking research and development with respect to new vaccines and the production and distribution thereof
Input (Research and Extension Training)		Kenya Agricultural and Research Act (2013)	KALRO	Promotion, streamlining, coordination and regulation of agricultural and livestock research and expedition of equitable access to research information, resources and technology and promotion of the application of research findings and technology in the field of agriculture
Input (Research and Extension Training)		Technical and Vocational Education and Training Act (2013)	TVET Board TVET Curriculum Development Assessment and Certification Council	Licensing, registration and accreditation of institutions and trainers, as and regulation on training institute organization and training quality and relevance
Human Resource Development		Draft Livestock Breeding Bill (2015)	Naivasha Dairy Training Institute Animal Health Institutes ATCs/PTCs	Capacity building and training
Processing (milk bulking, chilling and processing; Feed manufacturing)		Environmental Management and Coordination Act (2012 (1999)/2006)	NEMA	Environmental protection, impact assessment, monitoring and restoration / streamlining of handling transportation and disposal of various types of waste to protect human health and the environment

2.2.2 Challenges in policy and regulatory framework of dairy industry

Despite establishment of robust and futuristic policies within the dairy value chain, policy implementation has been slow. The slow adoption of policies has been attributed to lack of involvement of key actors in the dairy value chain. Therefore, the policy interventions suggested tend to be unsuitable for the consumers. A good case in point is the establishment of the Kenya National Dairy Master Plan which promotes development of the processed, value added milk chain, yet consumers continue to strongly prefer raw milk.

Another challenge posed by the Dairy Policy Framework is over-concentration on promoting milk production with limited emphasis on processing, marketing and consumption. As illustrated in Table 2, most Acts concern to the input supplies and services stage of the value chain, thus failing to address the challenges faced in other value chain nodes. To increase dairy productivity and efficiency, there is need to proportionately balance policies and regulations in all the dairy value chain nodes.

Further, while there are diversified sources of dairy milk, the current polices and other intervention measures emphasize on dairy cattle and little attention to other milk-producing livestock species such as goats, sheep, camels and others. Dairy goats and camels contribute up to 16 per cent of the total milk production in Kenya. The multiplication facilities for goats, camels and other milk producing species have received inadequate attention and are unable to meet dairy producer's requirements. The development of these alternative milk species requires strengthening of the corresponding upgrading aimed at promoting the species as alternative sources of milk.

Overlapping of policies coupled with difficult to implement interventions is also of concern. A good case in point is the veterinary policy that contains several opportunities to facilitate the development of a robust value chain. Its implementation will need significant attention to actualize those opportunities. Further, the policy overlaps with several other pieces of legislation that are already operationalized, meaning harmonization will be necessary for its effective implementation.

3. Literature Review

3.1 The Dairy Value Chain

3.1.1 Overview

The dairy cow value chain is a set of linkages between stakeholders and processes showing the process involved in transforming liquid raw milk to finished products. As the milk goes through the several stages of the value chain, its value increases. Thus, the value chain consists of input and services to the dairy livestock, production of the milk, processing of the milk, marketing and distribution of the finished products, the value chain enabling services and finally the end consumer. Ideally, before the liberalization of the industry in 1992, the value chain was quite simple. The milk produced by farmers was collected and processed by the state corporation, Kenya Cooperative Creameries (KCC). After the liberalization, with no controlling powers over the actors, the dairy value chain improved and grew further complex with more fragmented actors (Global Hunger and Food Initiative, 2018).

Moreover, it is worth noting that the dairy industry can be broadly classified into formal value chain and the informal value chain. The formal milk value chain entails a market segment licensed by the Kenya Dairy Board dairy corporative, processor and organized market where the finished milk products are sold. They include milk bars (for up to 1,000 litres/day each), cottage industries (up to 3,000 litres/day), mini dairies (up to 5,000 litres/day), processors (up to 5,000 litres/day), producers (who process, manufacture, prepare or treat the milk for sale), and distributors (who buy for resale) (KDB, 2017). The informal value chain, which became prominent following the liberalization of the dairy industry and subsequent failure of the Kenya Cooperative Creameries. It entails the trade of raw milk at the farm gate with its value chain consisting of input and supplies stage, the production stage, retail and consumption stages only (FAO, 2018). Even though the informal value chain has been forbidden by the Kenya Dairy Act due to health risks it possesses, the industry continues to be heavily opted by the majority of small-scale farmers citing the high cost, huge burden of logistics at production and processing level of milk, and preference for cash at the farm gate (FAO, 2018). Among the reasons why consumers prefer the raw milk is because its cheaper than processed milk, it is widely accessible and within the reach of many people and sold in variable quantities, depending on how much money the customer has to spend.

The key players along the dairy value chain include over 600,000 small-scale dairy farmers, over 80 dairy cooperatives and more than 200 Dairy Farmers Self Help Groups (DFSHGs). There are also emerging farmer federations bringing DFSHGs

together for the purpose of delivering large milk in volumes and offering other services to dairy farmers. More to the direct actors, there are supporting agents who play a critical role in direct and indirect support of robust dairy value chain. They include financial services and insurance agents (IFAD, 2014).

3.2 Stages in Dairy Value Chain

This segment highlights the dairy value chain nodes which include: input supplies and services, production, aggregators, processing, market and distribution, consumers and the value chain enablers.

3.2.1 Input and service providers

This stage consists of provision of dairy input supplies and services such as stocking and selling dairy feeds, providing animal healthcare, breeding services and extension services.

Input suppliers:

The input supplies play a paramount role in the functional dairy value chain. They are variable in nature and directly determine the industry yield, consequently determining the profitability of the industry They include direct input supplies such as provision of semen, the dairy cows, the feeds and supplements, mineral salts and the animal health drugs and; the indirect supplies which include dairy equipment and machinery, pasture, forage seeds and fertilizers, among others (Kiambi et al., 2018).

Feed, which is the main component of input supplies, forms 70 per cent -80 per cent of the total cost (Mbugua et al., 2012). Majority of farmers feed their dairy animals on natural forages, cultivated fodder and crop by-products, with maize being a predominant feed resource especially among commercially orientated farmers. Other feeds include dairy meal, dairy cubes, calf pellets, molasses, cotton cake, wheat pollards and wheat bran. Only 20 per cent of dairy feeds are produced in Kenya while the rest, especially proteins from sunflower/cotton seed cakes, are imported from within the East Africa region. Premixes mainly come from South Africa and outside Africa, especially for market-oriented dairy producers. Underfeeding is the primary cause of low yields in smallholders' dairy farms (Rademaker et al., 2016).

Service providers

Several services are offered at this stage of the value chain, which include extension services, breeding and veterinary service provision. Even though

policies requiring the National Government to play the role of providing artificial insemination, veterinary clinical services and technical extension services to dairy farmers was phased out in early 1990s, the service provision has been left entirely in the hands of private institutions and NGOs. The county administrations have been charged with the role of ensuring adequate vaccine coverage in respective counties, given agriculture is a devolved function. However, owing to importance of such services to yield management of the counties, some County Governments have been subsidizing the farmers to meet such costs (IFAD, 2014).

The veterinary services mainly focus on disease surveillance, diagnosis, vaccinations and the animal hygiene. However, evidence shows that even though routine animal health practices such as vaccinations, deworming, and spraying are practiced, this is not done regularly, thus compromising the potential productivity of these animals (Auma et al., 2019). A few farmers (about 12%) use artificial insemination services, despite 30 per cent having access to the service. This is possibly due to past negative experiences (Auma et al., 2019). However, it is notable that policies exist on unauthorized use of, and restriction on veterinary drugs, although self-prescribed and administered drugs are a common practice.

Artificial Insemination (AI) and animal health services are important inputs to the dairy sub-sector. Through AI, there has been tremendous upgrading of the cattle in the dairy sub-sector in Kenya, complementing nutrition and management improvements in improving the breeding services. For instance, the focus of AI has increased the population of grade cattle from approximately 250,000 in the 1960s to 3.2 million cows by 2001 (Auma et al., 2019). However, studies indicate that in face of privatization of AI services, the number of inseminations has declined by 76 per cent in the last ten years. The privatization of AI services in 1992 was done with the anticipation that the private sector would take up the role left by the Government. Unlike the expected, currently the market is characterized by the emergence of highly concentrated oligopolies, mainly cooperatives or socio-organizations. Therefore, many farmers still keep local breeds even though the number of improved cows is increasing.

Moreover, financial services are a key input to dairy farming. Given that dairy cooperatives and unions rarely provide financial services in a way of credit in kind (inputs) to individual farmers, the need for financial credit cannot be underestimated. Farmers require more customized credit services given that dairy production requires at least three to five years to generate return on investment and cannot be done using such very short-term credits (National Livestock Policy Draft, 2019).

3.2.2 Production

This node forms the second stage of the dairy value chain, which entails the actual production of milk. Dairy production in Kenya is undertaken under three main production systems (technologies); smallholder zero grazing, smallholder open grazing and large-scale open grazing. Zero-grazing involves keeping cows in the farm and farmers bringing feed and water to the animals. Such farmers keep an average of two milking cows with an annual production of about 2,122 litres per cow, with the amount of yield varying by the level of supplementation and availability of nappier grass. In medium open grazing, farmers usually produce milk yield of about 1,510 litres per cow per year. Notably, low levels of supplementation characterize this production system, and poor animal husbandry practices compromise production, even among the farmers with improved breeds (Auma et al., 2019).

Most farmers in Kenya are predominantly open grazing and semi-zero grazing. The large-scale open grazing system has the highest yield per cow averaging 2,775 litres per year. In this system, farmers have more commercial orientation than any other production system, a fact attested by the high percentage of milk marketed (Auma et al., 2019). Like smallholder open grazing system, the breeds kept are both pure and crossbreeds, the only difference being the feeding regime. Most commercial dairy production is concentrated in the central and Rift Valley regions, leaving many other dairy potential areas under-exploited (Mbugua et al., 2012). Recently, farmers in other parts of the country have been reported to be slowly taking up commercial dairy production as well.

The population of cattle that contributes to total national milk production is reported to have dropped to about 75- 76 per cent in 2012 from 89 per cent 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 cent per year, also reflecting a 4 per cent increase in national dairy population reported between 2000 and 2010 (National Livestock Policy Draft, 2019). 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 (FAO, 2015). Total production estimates are based on a dairy population of about 4.5 million lactating cows per year.

Whereas milk production in Kenya is relatively high compared to other countries in SSA, milk production is still below the consumption levels. Estimates indicate that Kenya suffers from milk shortfall of about 45 to 75 million litres during droughts and suffers about 10 per cent extra milk surplus during rainy seasons (FAO, 2015). As such, to compensate for the shortfall, there is need to establish robust reserves to even-out milk supply during the drought season. However, in the current situation, the problem of supply fluctuations does not seem to get a lot of policy attention, other than at times when the processing sector is unable to absorb the oversupply that occurs in the wet season. As a result, a lot of losses occur during the rainy season, with an estimated loss of about 50 per cent of the total milk produced (FAO, 2015).

Moreover, this node forms the point of departure between the informal channel and the formal channel dairy value chain. About 75 per cent of producers are largely engaged in the informal channel where they sell most of their milk directly to consumers (each farmer selling on his own in rural areas, mostly to neighbours and low-income urban dwellers, while some sell their milk to local vendors, mobile traders, milk bars and, to a minor extent, nearby schools, restaurants, among others). About 20 per cent of the producers split their milk and sell part of the milk through dairy cooperatives and producer groups, especially during the rainy season when production volume is high (Mbugua et al., 2012). Notably, the informal market outlets are the most dominant, since farmers have a ready market, eliminated cost of middle persons and eliminated cost of milk transport. Moreover, both for the formal and informal channels, it is important to note that producer prices vary with marketing channels, seasons, volumes, transport costs, and, in some cases, time. Evidence shows that the farm-gate milk prices are the most favourable while milk sold to processors earns the least price (USAID-KAVES, 2015). Thus, the price differentials explain why most farmers prefer the informal marketing channels.

3.2.3 Aggregators - chilling, bulking and transportation

This node majorly applies for the formal channel where farmers supply milk to traders, co-operatives or self-help groups. Before market liberalization in the early 1990s, there was an organized milk collection and bulking system in the formal market, with two types of milk delivery to KCC facilities: by individual dairy farmers; or by dairy cooperative societies. With liberalization and the collapse of KCC, the collection and bulking system also collapsed. At present, collection and bulking is a complex of different systems depending on processors, intermediaries, the road network, milk sheds and many other factors. Most milk bulking, collection or buying centres are owned by dairy cooperatives, dairy self-

help groups, middlemen, small milk processors, individual bulk buyers and agents of large milk processors. Milk collection is organized along collection routes where farmers deliver the milk to the designated pick-up point or marketing in either aluminium or plastic containers mostly in the mornings or in the evenings. Speed is essential, given the perishable nature of milk and as such milk is transported to the bulking centres within two hours (van der Lee et al., 2016).

The bulking centres provide an important link between producers and the processors, while at the same time preserving the quality of the milk. They play an integral role in maintaining the cold chain, which is necessary for minimizing microbial growth. By use of instant chillers, the milk is chilled below 4 degrees centigrade. Upon chilling, the ready milk is dispatched to the processors mostly using bulk milk transport vessels. The transportation of milk depends on the amount and the buyer. Major processors have their own collection, bulking and transportation systems. Moreover, it is worth noting that bulking and cooling centres have been used to develop alternative market outlets, especially for raw milk to consumer milk markets within urban and peri-urban centres (Auma et al., 2019). Currently, there are about 500 coolers with a capacity of handling 3.4 million litres per day (National Livestock Policy Draft, 2019).

3.2.4 Processors

This is node which includes processing of the dairy milk presents the centre of the value chain and the ruler in the game with dairy farmer. It plays the critical role of preserving and converting milk into high-value dairy products. The process involves heat treatment of 'raw' milk to produce pasteurized milk and further processing of milk to manufacture dairy products such as cheese, ghee, butter, yoghurt, whey, whey protein concentrate, and lactose powder. Mostly, the milk processing is typically carried out locally, often close to dairy farms because 'raw' milk is bulky and perishable (Auma et al., 2019). Milk processing is, therefore, geographically spread worldwide and takes place in the same country where milk is produced. Due to milk perishability and seasonal variation in its production, processors are forced to use dry milk powder to even out supply (USAID-KAVES, 2015). The use of milk powder is therefore expected to increase during the dry period when fresh milk intakes are low

Before the industry was liberalized, the Government had authorized Kenya Cooperative Creameries (KCC) as the only milk processing plant. Currently, there are range of actors which include 30 licensed large-scale milk processing plants (Annex 2) with only 5 dominating the milk processing market. The dominants include Brookside Dairy Ltd (38%), New Kenya Cooperative Creameries (23%),

Githunguri Dairy Farmers Cooperative Society (14%), Sammer (4%) and Buzeki Dairy (4%) account for 70 per cent of the total milk processed in the market (KDB, 2016). Overall, the total milk processing capacity for all the processors in Kenya is estimated to be 3.5 million litres per day (KDB, 2017).

Notably, the capacity utilization ranges from 40-50 per cent of maximum operating capacity owing to seasonality of production and competition from the informal sector. The market for processed milk is dominated by four companies (Brookside Dairy Ltd, New Kenya Cooperative Creameries, Githunguri Dairy Cooperative Society and Sameer Agriculture and Livestock Ltd, which jointly account for 70 per cent of the processed milk market, and 21 per cent of Kenya's total milk market. Other processors account for the remaining 30 per cent of this market segment.

3.2.5 Marketing and distribution

This node represents the various routes that milk and milk products take from producers to the end consumer. It is characterized by a diverse set of players trading on milk and milk products through informal and formal channels, and include brokers, traders/hawkers, transporters, co-operatives and farmer groups. Co-operatives are the main channel for collecting milk destined to the formal market. Dairy co-operatives, which used to be an integral part of the formal milk collection and marketing, have been relegated to buyers of last resort.

The formal trading channel is where the produced milk goes through processing and the final milk and milk products are sold based on agreed prices using standard units of measure. The cost of the processed milk is often 30-45 per cent higher compared to the raw milk sold from the informal channels. However, recently, there has been resurgence of processed milk bars and other milk dispensing enterprises, especially within the low-income urban areas, which is meant to address the low-income consumers with quality milk at affordable prices. As such, this milk provided is sold approximated at 33 per cent of the packaged milk given that it goes through a shorter value chain (USAID-KAVES, 2015).

The informal milk trade channel is undertaken by traders or milk hawkers who collect liquid raw milk from farmers and sell it in raw form or in semi-processed form to consumers or other traders such as milk bars within the rural areas. This channel became popular due to historical problems of delayed payment by formal buyers, dairy farmers selling milk to the dairy processors (Auma et al., 2019). Notably, in this channel, there tends to be little regard for quality standards for the milk traded majorly as a result of lack of knowledge and lack of testing technology. Milk is exchanged in its raw form, which increases the risks of milk

spoilage, contamination, and adulteration, a health hazard to consumers (KDB, 2017). However, the informal market channel is considered as the main marketing agent of the dairy value chain as it controls 70 per cent of the total milk sold in the market. The retail prices of milk in this channel fluctuate with season unlike in formal channels where prices are relatively stable.

Further to the local sale, Kenya enjoys a regional market for its dairy products within Africa, with the exports totalling about 11 million litres in 2018 and projected to reach 32 million litres in 2022 (KDB, 2017). The exports were largely in the East African region and Southern Africa. Exports tend to be long-life milk and powder milk products. Despite the current challenges in having domestic supply meet domestic demand, export remains a key strategy of the Government, since Kenya has the largest milk production capacity on the continent after South Africa (FAO, 2015). To become a strong export player, Kenya will have to significantly increase production and processing capacity and value addition.

3.2.6 Consumption

The actors in this stage are the major players in the dairy value chain and have a very critical influence on how other players in the chain perform. They can be clustered into buyers of raw un-chilled milk, chilled/processed milk and dairy products. Since the post- liberalization era of the dairy industry, consumer prices for milk and dairy products have not been regulated but are determined by demand and supply (Mbugua et al., 2012). The national per capita consumption of milk is driven by total production trends, income levels, urbanization, and overall national demographic trends. Currently, Kenya's national per capita milk consumption is estimated to be 121 litres per year and is estimated to grow at an average of 3 per cent per year to about 139 litres per person per year by 2022 due to envisaged better incomes and better marketing (FAO, 2018).

3.3 Constraint Analysis of the Dairy Value Chain

Despite the significant contribution to the national GDP and livelihoods of more than 1.8 million in Kenya, the dairy industry is besieged by a number of constraints that have diminished the growth of the industry. The bottlenecks are present in each node of the dairy value chain, with the constraints at input supplies and service provision being more rampant. Notably, the yield management of the dairy industry largely depends on the input supplies and service provision. As such, there is need to provide more clarity in analyzing the constraints in that node.

3.3.1 Input supplies and services provider

Input supplies

Among the input supplies needed for the dairy livestock, feeding comprises 80 per cent of the total dairy production costs. The dairy cattle feeds manufactured in Kenya are dominated by private dealers with about 90 per cent of the dealers being small scale manufacturers. With bulk of the small-scale manufactures of feed producing less than 1,000 tons per month, the feed manufacturing in Kenya is 48 to 65 per cent below optimum levels compared to the utilization (KMT, 2017). Notably, the production level of the feeds, which is estimated to be 750,000 tonnes, utilizes only two-thirds of the installed capacity (Right Track Africa and Nutrimix, 2016).

Limited, 2016), 2017). The inability to fully utilize the installed capacity has contributed to high final cost of the feed to the consumers (USAID-KAVES, 2015). As a result, most farmers make their own home-made concentrates with only 14 per cent of livestock keepers in many pre-commercial dairy areas using dairy concentrates (Auma et al., 2016).

The lack of adequate and quality feeds has contributed to low milk production capacity. There is also the problem of influx of trade malpractices governing feed production in Kenya as result of weak regulatory framework, which has provided leeway of off-loading substandard feeds in the market (KMT, 2017). To overcome such constraints, there is need for establishment of feed planning practices which reduce the seasonality of feed availability. Moreover, there is need to enhance the adoption of high-quality forages to ensure that lactating cows can produce high quality milk. Further, there is need to adopt high feed and fodder preservation technologies. To reduce malpractices, there is need to create strong and robust regulatory systems on the quality of animal feeds produced.

Services

The dairy sector in Kenya is characterized by poor general makeup of the dairy cattle as result of erosion of genetic quality, leading to low sector productivity especially among the smallholders. The use of artificial insemination to accelerate the upgrade of breeds to better producing dairy animals has diminished. Since the privatization of the veterinary services, the exit of the government well organized and subsidized breeding system, the cost and convenience of acquiring the service has reduced (FAO, 2011a). There have been cases where semen is often acquired from poor quality bulls at a costly rate especially to the smallholders, thereby leading to low conception rates. Other infrastructural challenges encountered within the provision of artificial insemination include poor transportation and road network limiting accessibility of the farmers, lack of nitrogen semen containers to

store the semen and the shortage of technically competent and adequately trained inseminators (Auma et al., 2019).

Moreover, farmers especially the rural smallholders have insufficient knowledge on the importance of AI and they lack best practices for managing dairy cows' fertility cycles. Similarly, the provision of health services for the dairy cattle, especially vaccination, which has been partially privatized has become disorganized and, in some cases, reported as substandard. Significant supply-demand gaps prevail due to inability of the private dealers to meet the demand (Auma et al., 2019). To overcome such constraints, there is need to sensitize farmers on animal husbandry practices and quality breeding services, which will enhance the success of good breeds. Of importance also is the need to institute policies that reduce the gap between the availability of high-quality AI and the use of AI by controlling market prices to ensure it is affordable to farmers. To streamline the industry monopoly players causing artificial shortage, there is need for the government to establish a strong regulatory framework to enhance coordination and collaboration among the AI service providers. Hiring of technically competent extension of officers would promote higher provision of the breeding services.

In focusing financial services among the dairy value chain as service supplier, farmers struggle in raising credit from financial services. Lending by the financial institutions 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. From a 2015 survey by USAID-KAVES, it is estimated that about 36 per cent of rural households have no access to any form of financial services. As such, there is need for the Government to collaborate with financial institutions in establishing strong support development of financial products which target the farmers. Sensitizing farmers on the importance of well-organized groups will aid in attracting more credible funding sources for business continuity.

3.3.2 Production

There is no recent census report on which to base cattle population and growth rates in Kenya. Notably, the annual production estimates seem to have remained the same figures over the last two decades (van der Lee et al., 2016). Further, there is absence of reliable data on the actual demand of milk production, which compounds the problem of analysis of constraints in the industry. More to lack of statistics, dairy milk production faces constraints that have kept milk production low in Kenya. Lack of good breeds of dairy cattle that will produce the volume of milk commensurate to demand of the milk has been cited as a major contributor

to low quality and supply of milk (Auma et al., 2019). The small dairy farmers produce about 56 per cent and 70 per cent of total and marketed milk production, respectively, with the total productivity per animal remaining low (FAO, 2011a). In addition, these farmers possess poor and inadequate animal husbandry skills, resulting in long calving intervals, short lactation lengths, high mortality rates and, ultimately, low milk productivity (Mbugua et al., 2012).

Other specific constraints influencing production include over-reliance on rain-fed dairy production, use of low-quality agricultural by-products for feeds, and lack of adequate quality feeds and forages. Poorly fed dairy cattle compromise on milk productivity (ILRI, 2013). Moreover, under rain-fed systems commonly practiced by the dairy smallholders, variability in climatic conditions causes seasonal variability in milk produced and poor yields. The market associated factors that contribute to low milk productivity include losses due to spillage and spoilage, lack of ready and profitable markets, and milk rejection due to poor quality.

To close the demand-supply gap that is currently experienced in the country requires a concerted effort by farmers, and other stakeholders involved in the dairy milk production. Key programme interventions in this area include proper training and extension services for good animal husbandry skills for the purpose of raising productivity and reducing milk losses. The programmes that would increase business orientation of dairy producers would encourage the small dairy holders to view dairy production in lenses of commercialization and thus invest in improving the productivity per cow. This is important, since most dairy farmers view dairy production as a cultural role more than a commercialization role.

3.3.3 Aggregators - chilling, bulking and transportation

The amount of time needed to collect the small volumes of milk along the milk delivery routes, long distances to chilling and bulking centres, and poor transportation infrastructure are the key constraints in this particular node. The small volume of milk poses inefficient and high cost of milk collection. Moreover, poor transportation infrastructure is a constraint especially during the rainy season. Since milk is supposed to be chilled within two hours of production, bad roads may render roads impassable or take longer time to reach the chilling centres. Further, poor handling due to lack of proper on-farm storage and cooling equipment increases the rate of milk spoilage.

Further, insufficient management capacity of the cooling plants in the chilling centres has been cited as another source of losses for the producer's milk (USAID-KAVES, 2015). Another constraint associated with this node is the high cost of the cooling plants for which many cooperatives or producers cannot afford and

thus rely on donors or other external funders to establish one. Moreover, the unreliability of electricity supply especially within rural areas has proved to be a challenge in operating the cooling plants.

Milk handling and marketing constraints negatively affect the total volume and quality of milk reaching markets across Kenya. Losses at the farm level are a result of spillage, lack of market, and milk rejection at the market. Poor handling and storage practices at the farm and primary markets result in both financial losses and wastage. Milk-handling practices at the production level include weighing, filtering, and packaging. Milk storage is limited due to the short shelf life of raw milk and liquidity and capacity constraints of small-scale farmers that precludes investment in on-farm preservation and storage technology.

3.3.4 Processors

The most limiting constraint in this node is that milk market is largely characterized by oligopolists with main milk processors setting the raw milk processes to the detriment of farmers. The sectors strong linkage with top government officials has weakened farmers bargaining power to negotiate meaningfully for higher prices from sale of raw milk to processors (Rademaker et al., 2016). Moreover, the sector experiences shortage of processing equipment and the high cost of packaging materials. Currently, the cost of packaging material of the processed milk constitutes the highest cost element, more than the cost of raw milk itself (KDB and Tegemeo institute, 2016). Without addressing the prices paid to farmers by the processors, the sector will very likely see growth in the informal sector, which offers less potential for regional and international competitiveness.

Another constraint facing this node is the variability of milk production in Kenya. The milk processors suffer from milk fluctuations between dry and rainy seasons, resulting in capacity utilization of only 40-60 per cent in milk processing plants, thus constraining the profit of the processing plants (FAO, 2011a).

3.3.5 Marketing and distribution

Constraints in the marketing and distribution are largely contributed by large uptake of raw milk with lack of level playing field with the processed milk (Willem et al., 2019). The raw milk which has cost advantage over the processed milk is largely influenced by seasonality. Since the informal market is unable to absorb all the raw milk produced in the rainy seasons, this results into heavy milk spoilage of about 30 per cent to 40 per cent of the milk produced (Auma et al., 2019).

3.3.6 Consumption

The main constraint at the consumption level entails the price of the milk. Processed milk is roughly about three times that of raw milk, a wide gap that discourages consumers from buying processed milk (KDB and Tegemeo Institute, 2016). Due to the high demand in the informal market, some unscrupulous traders add water, which contaminates the milk and makes it unsafe for consumption (FAO, 2015). Moreover, the consumption of raw milk has been discouraged by the regulators and the health authorities due to health and safety concerns (KDB, 2017).

3.4 Youth Employment Opportunities within Dairy Value Chain

Over the last decade, high fertility and declining mortality rates have led to a very young population in most Sub-Saharan African countries and Kenya in particular. The structure of the labour force has increasingly shifted to having about 60 per cent comprising of young people aged 18-35 (KNBS, 2019a). With the country currently grappling with general unemployment, the youth have been largely affected. Moreover, the sluggish pace of demographic transition, combined with slow development of various economic sectors has aggravated the problem of youth unemployment (Fox and Filmer, 2019). The need to refocus economic sectors for job creation and especially to the youth is more needed now than ever before. In the Kenya Vision 2030, the dairy industry has been recognized as a fundamental tool in generating employment activities along its value chain. It is one of the largest sub-sectors contributing at least 2 per cent of National GDP, but has been neglected despite it potential for employment opportunities (KNBS, 2019a). As such, there is a need to create strong nexus between the youth employment and the dairy industry.

The potential of this industry to create jobs for the youth has received little attention in the past (MoALF, 2019). This is more so because of the notion that dairy farming belongs to the older generation. The migration of most youths to urban areas to look for better prospects of non-farm jobs has not helped either (Goldin et al., 2015). As indicated by ILO (2019), even under the most optimistic economic development scenario, the private modern wage sector in the emerging economies lacks the absorptive capacity to take up all the unemployed youth at least soon. As such, it creates the need to look deeper for employment within the agricultural sector. From a policy perspective, involving the youth in dairy farming is crucial as it provides a platform to tap into the potential of a young educated population that can be trained and skilled to meet input and services delivery gaps necessary to develop sustainable agrivalue chains and food systems.

Focusing on employment opportunities created for the youth, it is evident that the

recent growth of the Kenyan dairy sector triggered by increased demand of milk has resulted to many employment opportunities along in support activities for agriculture. In segmenting jobs created within the informal sector, the dairy value chain generates about 20 full-time jobs (17 direct, 3 indirect) for every 1,000 litres of milk traded (FAO, 2011a). Notably, about 500,000 litres of milk are traded daily in the informal market in Kenya (KDB, 2017). The jobs, which are majorly self-employment opportunities, include mobile milk traders, milk bars and shops and kiosks. Milk bars, which are semi-formal, create about 14 jobs (11 direct, 3 indirect) per 1,000 litres of milk handled daily (Agency and Development, 2015).

Within the formal sector, the dairy value chain has been estimated to generate an average of 12.5 (11 direct and 1.2 indirect) full-time jobs per 1,000 litres of milk handled daily. To dis-aggregate that figure, the jobs created within the formal sector vary by the size of dairy industry enterprise, since jobs created decline with scale, perhaps due to substitution of capital for labour. For instance, smaller-scale processors support about 13 jobs per 1,000 litres while larger-scale processors support about 6 jobs per 1,000 litres (FAO, 2011a). Notably, the jobs created within the formal sector of the dairy value chain are less than in the informal sector. This is because of the small fraction of the total amount of milk produced, which goes to formal processing compared to informal processing. However, it is also notable that formal sector dairy value chain provides more stable employment compared to the informal dairy value chain (Mbugua et al., 2012).

3.4.1 Analysis of job opportunities within the dairy value chain

The employment opportunities required at the input supplies and service, and the production stage of the value chain include and not limited to: farm labourers, feed manufacturers, veterinary suppliers, animal breeding service providers, and Government extension officers (McKague et al., 2014). The most common job created is farm labourers. The farm labourers who mostly have no previous training carry out a number of tasks such as feeding animals; milking cows either by milking machines or by hand and observing the general well-being of the animals for signs of illness, injury or unusual behaviour of cattle. The second most crucial job opportunity entail the veterinary suppliers whose responsibilities involve examining animals to detect and determine the nature of diseases or injuries; treating sick or injured animals by prescribing medication, setting bones, dressing wounds, or performing surgery and any other general care medical conditions of the cattle. The role of the farm manager, especially in the large commercial farms cannot be under-estimated. Farm managers are in charge of directing and coordinating the activities of workers engaged in production (USAID-KAVES, 2015).

Notably, at the input supplies and service and production stage of the value chain, the skills employed range from non-skilled labourers to veterinary science graduates in the university and agricultural colleges. For instance, extension and veterinary officers employed as specialists are degree holders while the diploma holders are hired as frontline extension staff. Even though some of the recruits lack in practical application of theory, communication for extension, they are given induction training (Oduro-ofori et al., 2014).

The milk processing level forms one of the most important components of employment in the dairy sector and accounting for about 10 per cent of the workforce engaged in the dairy sector (FAO, 2011a). The dairy processors, especially the large-scale processors, hire personnel with degrees and diplomas and provide on-the-job training. However, to scale down labour cost, the small-scale commercial processors tend to hire semi-skilled workers with experience.

The jobs created within the marketing stage include supermarkets, traders, milk bars, restaurants, automated milk machines, roadside vendors, shops and kiosks. Milk trading provides off-farm employment to a large number of people, who derive a substantial portion of their household income from milk marketing (Auma et al., 2019).

3.5 Empirical Review

One of the indicators for labour intensity is labour to capital and labour to value added ratio. This method was utilized by Tregenna (2018) to approximate labour to value added ratios for different sub-sectors in manufacturing and service sectors of the south African economy. Borrowing from the study, this paper applies the method to compute how intensively labour is used in the production process.

Another indicator for labour intensity is employment elasticity, which measures how employment varies with output. Though discussed less frequently than other key labour intensity indicators, employment elasticities can be useful in examining evolution of economic output and employment growth over time. They can also provide insights into how employment creation varies for different sectors/ industries in an economy (Kapsos, 2015).

Deepankar and Debarshi (2015) conducted a study on employment elasticity in India and the US. Although the two countries differ in their development state, a similar pattern (long term decline) in the evolution of aggregate employment elasticity was found in both. Similarly, a study by Islam and Nazara (2000) on estimating employment elasticity in the Indonesian economy found that employment elasticity fluctuates greatly, implying that elasticity of employment is

in a flux state. Therefore, it is essential to keep on updating employment elasticity estimation to include latest changes in computation.

On the same estimation, Ali et al. (2017) in their study on employment elasticity and their drivers focusing on Sub-Saharan Africa countries found that elasticities vary considerably across countries and sectors. The study also found that during periods of economic growth, employment elasticity is between 0 and 1, with majority of them ranging between 0.4 and 0.7, indicating that there is both productivity growth and employment growth.

A similar study conducted by ILO examined employment elasticities for three broad economic sectors, namely agriculture, industry and services. Generally, there was a decline globally in the employment intensity of growth. However, most employment intensive growth was registered in Africa and the Middle East.

Further, Fox et al (2013) applied employment elasticity in predicting African employment levels and investigating employment elasticities for Sub-Saharan Africa countries. Similarly, a study by Moren et al. (2019) on the employment elasticity of economic growth computed employment elasticity growth for 168 countries.

This paper computes employment elasticity for the dairy industry and makes a comparison with that of other related industries. It uses expanded datasets obtained from statistical abstracts to provide dairy industry estimates of employment elasticity over a long period. In addition, Bhorat et al. (2020) developed a methodological framework for analyzing labour skills requirement and skills gap for young people. He estimated the skills demand and identified skills gaps for a target population. A study on South African economy by Coulibaly et al. (2019) utilized a similar method and found that there is a skills mismatch between demand and supply in the job market.

4. Methodology

The overall objective of this study was to carry out a value chain analysis of the Kenyan dairy industry with specific focus on mapping the dairy value chain, identifying key constrains to growth of the industry, assessing current employment creation potential of the industry and identifying skills required at each node of the value chain. The methodology used in this study was a mix of both qualitative and quantitative analysis.

4.1 Data and Data Sources

A desk research, which consisted of a review of relevant literature including reports and studies was conducted, followed by an analysis of qualitative and quantitative data. Data used in the study was obtained from the Ministry of Agriculture, Livestock and Fisheries (MoALF), the Kenya Dairy Board (KDB), the Kenya National Bureau of Statistics (KNBS) and the World Bank (WB). Data analyzed included secondary data on Kenya's dairy industry obtained from various sources including statistical abstracts, economic surveys, Micro, Small and Medium Establishment (MSMEs) Survey 2016 (MSMEs, 2016), World Bank Enterprise Survey 2018 (World Bank, 2018) and Kenya Integrated Household Budget Survey (KIHBS 2015/2016), among others. Further information was also gathered from dairy stakeholders and experts in dairy matters, such as the Kenya Dairy Board (KDB) in a consultative stakeholder workshop.

The sampled establishments in the World Bank Enterprise Survey 2018, which was conducted in Kenya between May 2018 and January 2019, was obtained using a stratified random sampling with three levels of stratification, namely: industry, establishment size, and region. From the sample, a total of 20 manufacturers of farm inputs (18 manufacturers of prepared animal feed and 2 manufacturers of agro-chemicals), 23 manufacturers of dairy products and 46 wholesalers and retailers of food products including dairy products were sampled in the survey.

The MSMEs 2016 survey targeted establishments at both national, counties, urban and rural residences. It used household-based approach together with business registers maintained by County Governments to identify businesses/ establishments. Of the sampled establishments, an analysis of 16 sampled establishments engaged in veterinary activities is conducted in this study.

Data from KIHBS 2015/2016 cover all counties in Kenya. It was collected between September 2015 to August 2016. The sampling frame used for KIHBS 2015/16 is the fifth National Sample Survey and Evaluation Programme (NASSEP V) master frame developed from the Kenya Population and Housing Census

(KPHC) conducted in Kenya in 2009. The census frame is a complete list of all census enumeration areas (EA) created for the KPHC 2009. Data for various occupations together with education level for the respondents is captured. Captured occupations related to dairy include animal health professionals such as veterinarian, farmhands and related labourers, farming advisors, dairy and livestock producers, dairy officers, life science technicians such as drug inspectors and dairy product machine operators, among others.

4.2 Analytical Approach

This study adopted multiple approaches in addressing the study objectives. Each objective required a different method as discussed below.

The first objective on developing the dairy industry value chain was achieved through extensive literature review and consultations with experts in dairy matters. In this study, a generic dairy industry value chain customized to fit the Kenyan context was developed. The key activities and actors at each stage of the value chain were identified. The developed value chain gives an illustration of the movement of activities from dairy input supply and service delivery stage of milk production materials all through to consumption of final processed dairy products.

To achieve the second objective on analyzing key constrains to growth of the dairy industry, this study used the World Bank Enterprise Survey 2018 data, MSMEs 2016 survey data, and KIHBS 2015/2016 data. From the datasets, the main obstacles faced by dairy value chain actors and the extent to which these obstacles impede growth were identified and summarized by carrying out descriptive statistical analysis. These obstacles were identified based on four drivers for industrial location, namely: the investment climate (infrastructure, skills and regulatory environment), exports, agglomeration and firm capabilities. The results from these surveys were weighted to eliminate bias and give a representation of the entire population.

Objective three on estimating employment creation potential of the dairy sector considered two indicators of labour intensity, namely: Labour-capital and labour-to-value added ratios, and employment elasticities as discussed below. This is because these indicators inform us about employment creation potential in the dairy sector on the assumption of constant labour intensity over time and varied assumptions about national and sectoral growth.

Labour-capital and labour-to-value added ratios are used to compute how intensively labour is used in production. This study made a comparison of dairy industry LVAR and other related industries such as fisheries and meat processing industry. The formula used in computing this ratio is as shown below:

$$N = DIAG\,(P)\,(DIAG\,(X)\,)^{(-1)}$$

Where *DIAG(P)* is a diagonal matrix obtained by transforming a vector of employment per industry P_{nx1}, where P_i is the number of employed individuals in sector *i* and *DIAG(X)* is also a diagonal matrix obtained by transforming a vector of total output flow X_{nx1}, where X_i is the total output for sector *i*. The labour-to-value added ratios for each sector is represented by the diagonal elements of the matrix *N*.

Employment elasticity method estimates percentage changes in employment induced by changes in GDP. It can be computed in various ways. The most common approach is the descriptive method used to calculate arc elasticity as shown below:

$$\varepsilon = [(E_1 - E_o) / E_o] / [(Y_1 - Y_o) / Y_o] \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

Where ε denotes employment elasticity, *E* is the number of employed people in the sector, *Y* is the sectoral contribution to GDP, 1 and 0 represent different time periods. However, arc elasticity which computes elasticity between two different points in time has been shown to generate unstable results (Islam and Nazara, 2000). Thus, this study employed the use of an alternative approach, i.e. the Ordinary Least Squares (OLS) method, which involves the use of time series data to run a liner regression shown below:

$$\delta ln\,(E_{\_t}) = \alpha \delta ln\,(GDP_{\_t}) + \varepsilon_{\_t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

Where, E_t is the sectors employment level in *t* period, GDP_t is the sectoral contribution to GDP at time *t*, α is the employment elasticity and *ln* signify the natural logarithm. Employment elasticity with respect to output represents proportionate change of employment to proportionate change in output (GDP) ratio, holding all other factors constant. If the employment elasticity α is below 1, it implies that unemployment is relatively inelastic to changes in GDP. However, this approach has a major limitation that it cannot estimate the quality of jobs but only estimates the quantity of jobs created (Kapsos, 2006).

Objective four on assessing labour skills requirement of the dairy industry was estimated through the following several steps: first, by coming up with a list of occupations in the sector; then mapping the list of occupations to the required skills for those occupations. This objective made use of the KIHBS 2015/16 data and educational attainment as a proxy of skills (which is an indirect skill measure) due to limited data availability and it was the only proxy for skills that was captured in the dataset. Occupation-specific skills requirement was estimated by the average level of education by occupation classification.

In calculating Kenya's dairy sector skills gap on the basis of education (skills requirement for the sector to the availability of skills in unemployed youth), we used the formula below:

Sectoral Skill Gap=Skill supply (S)-Skill requirement (D) .....(3)

Where skills supply (S) represents skills supply of the unemployed youth separated by different education levels, and skills requirement *(D)* represents skills requirement, which is the total number of workers required in each education level for a single sector. Skills requirement *(D)* is computed by summing the total number of individuals required in each education level. If sectoral skills gap is positive (+), this indicates that skills surplus and when it is negative (-), it implies skills shortage.

The study further estimated occupational specific skills gap, which is computed by taking the difference between skills requirement for a given occupation and the national modal education level in this case measured by years of schooling of the youth. Occupational skills gap is computed as shown below:

$$O_i = Y - R_i \quad \ldots\ldots(4)$$

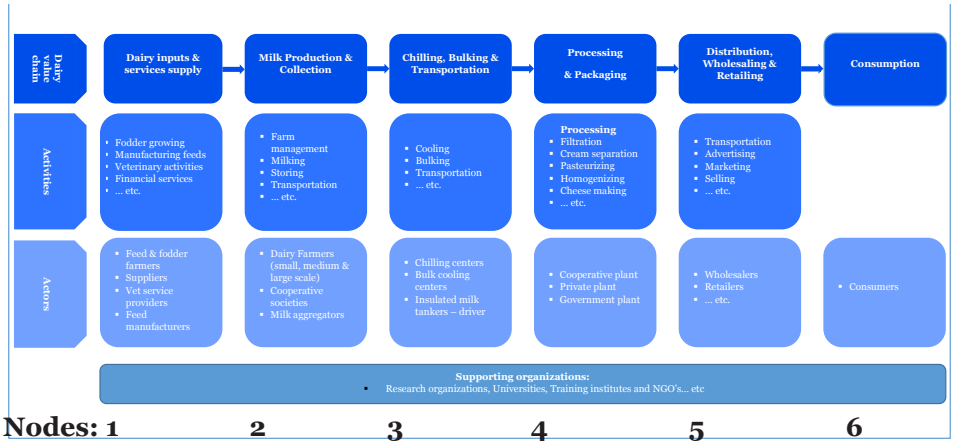
Where O_i is the skills gap for occupation i, Y is the skills possessed by the youth measured by modal years of education and R is the occupational skills requirement also measured by modal years of education. Here, a positive occupational skills gap implies that unemployed youth already have the required skills for that occupation. However, a negative gap means that there is a gap that needs to be filled for the youth to meet the required occupational requirement.

5. Results and Findings

5.1 Mapping the Dairy Value Chain

Kenya's dairy industry value chain involves 6 stages starting from dairy farm inputs and service supply stage through to final consumption of dairy products as shown in Figure 5.1.

Figure 5.1: Dairy industry value chain map



Different activities that require different levels of expertise are carried out by different actors at each stage of the chain.

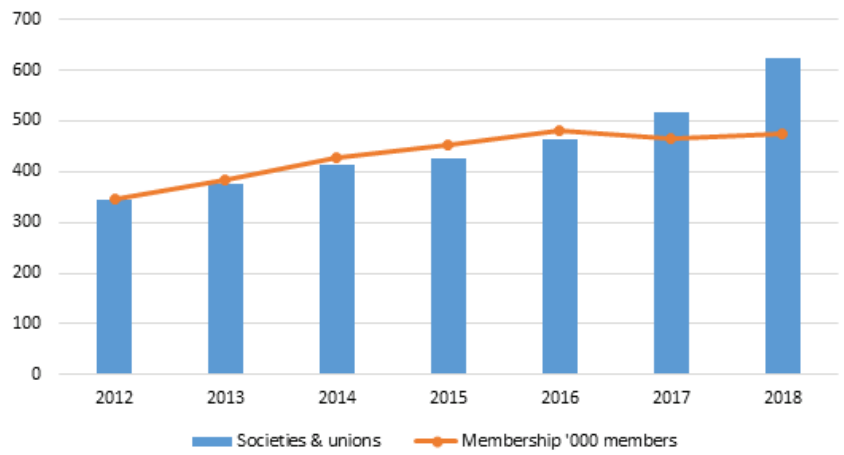
Activities that involve supply and provision of dairy farm inputs and services are carried out at the first node. They include feed and fodder farming, animal feed processing, veterinary activities, cowshed construction, farm equipment/ machinery repairs, manufacture of animal drugs and vaccines, among others. These activities provide employment opportunities for shelter designers, engineers, construction and farm labourers, veterinary assistants, veterinarians, animal feed nutritionists, dip technicians, feed mill production workers and non-production workers.

Dairy farming activities are carried out at the second stage; that is, milk production and collection stage. They include dairy farm management activities such as dairy animal raising, feeding, and milking, among others. Also at this stage, we have farmer's unions who collect and transport milk for their members to the next stage. Job opportunities for skilled, semi-skilled and unskilled labourers are created at this stage. Skilled farm managers and operators are required at this stage. They are responsible for the maintenance of facilities related to dairy production and care of the dairy herd. Once milking is done, transportation jobs are created at this stage for those involved in the movement of milk to the next

stage (aggregation level). However, most jobs available for dairy producers are largely informal, unskilled and low or no value added, as this segment is majorly dominated by small and medium scale farmers who are based in rural areas. This stage requires services of farm workers who include dairy farmers, farm labourers, farming advisors, milkers, herdsmen, extension officers and farm demonstrators, among others.

The next stage of the dairy value chain is chilling, bulking and transportation. Chilling and bulk cooling facilities in Kenya are either cooperative societies, union shops, collecting agents for processors or government-installed facilities. Various activities with potential for job creation among the youth are carried out in these facilities. The number of registered societies and unions in Kenya has almost doubled from 345 in 2012 to 623 in 2018, thus expanding their job creation scope. This was accompanied by an increase in the membership numbers as shown in Figure 5.2:

Figure 5.2: Dairy cooperative societies/unions and their membership (2012 – 2018)



Source: KNBS (Various), Statistical Abstracts 2013 - 2019

One of the key activities carried out at this node is milk cooling and marketing for members. Some cooperatives/unions in Kenya have set up agro-vet shops and services where members can get farm inputs on credit to be recovered from milk proceedings delivered. Also, training services are offered to farmers, such as training on animal feeding and proportions for high quality produce. Therefore, employment opportunities for marketers, licensed agro-vet shop attendants, and trainers among others are generated. In addition, some cooperatives also

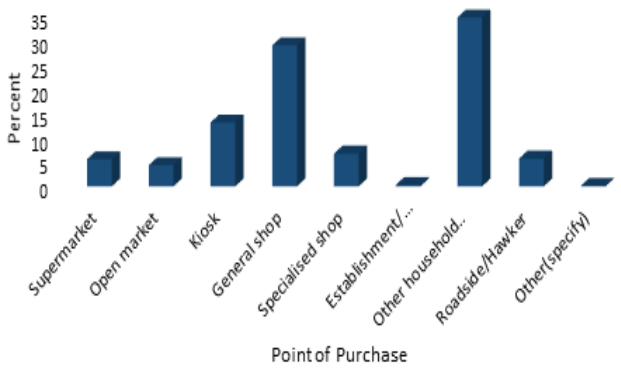
offer artificial insemination and veterinary services. For this to be achieved, a cooperative needs vets, inseminators, and extension workers.

Milk cooling facilities are equipped with basic milk testing equipment, such as weighing scales, milk cans and can washing facilities. Once milk has been delivered to a cooling plant, it is tested with a lactometer to determine its density before it is accepted. Further testing, such as the alcohol test and the clot-on-boiling test, may be performed to determine the stability of the milk proteins. Accepted milk is then chilled to 4°C and kept at this temperature and maintained until it reaches the processors to avoid multiplication of micro-organisms in the milk. This process requires energy, refrigeration facilities and insulated storage tanks for the milk. Various skilled personnel are required to test milk delivered at the facility, to operate facility machineries, to record, keep and maintain milk collection records for each producer for calculating payment details. Once milk has been chilled, it is transported from the cooling facility to processors by trained drivers in insulated milk road tankers or milk cans maintaining its temperature.

The next stage of the dairy value chain is processing and packaging. Processors carry out various activities such as filtration, cream separation, pasteurization, homogenizing and packaging that generate employment for skilled personnel. Also, to test the quality of milk received from milk cooling centres and other suppliers, employment opportunity is created for persons who control the quality of milk. Dairy processors also play a key task of marketing and distributing their products. Some of their marketing strategies include running adverts on billboards, TVs and media prints, selling and delivering dairy products to consumers and other businesses, among others. These activities generate job opportunities for marketers. Some of the key jobs at this stage involve dairy product machine operators (powder milk machine operators, milk pasteurizing machine operators, milk processing machine operators and condensed milk vacuum pan operators) and dairy products makers (butter, cheese and cream makers), among others.

Dairy products wholesalers and retailers vary by operational size. The number of jobs created by these actors depend on the size and scope of the firm. From KIHBS 2015/2016 dataset, most households purchase milk products either fresh un-packeted or packeted cow milk, yoghurt, cheese, among others, at various points of purchases as shown in Figure 5.3.

Figure 5.3: Milk and dairy products retailers



Source: KIHBS 2015/2016

These purchase points, namely supermarkets, kiosks, establishments, shops and open markets, among others, create employment for those engaged in operating and assisting in running the premises. Retailing involves selling of milk products, transporting and quality assessment. However, some dairy processors have partnered with distributors who get the packaged milk and dairy products directly from the processing plant and supply it to wholesalers and retailers in different regions of the country. Whole selling, retailing and distribution job opportunities are created at this stage.

The final stage of the dairy value chain is consumption of dairy products. Consumers are the major players in the dairy value chain and their preference has a very critical influence how other players in the chain act. They can be clustered into buyers of raw un-chilled milk, chilled/processed milk and dairy products. Consumption of cheese product in Kenya has been on the rise owing to growing number of emigrants in the country, thus creating increased need of cheese makers. To create awareness to the public on the benefits of consuming processed dairy products over raw milk, sensitization job opportunities are created at this stage.

The dairy value chain is further supported by various organizations at different stages of the chain. Such organizations include research organizations, universities, training institutes and NGOs, among them being the KDB, MoALF, Dairy Training Institute (DTI) in Naivasha and KARLO. The Ministry of Agriculture, Livestock

and Fisheries (MoALF) plays a key role in regulation and policy direction of the sector, while the Kenya Bureau of Standards (KEBS) has the mandate of assuring quality standards for milk and dairy products traded in the domestic market. As a result of their role and link with the dairy industry, they offer both technical and non-technical opportunities for those involved in the support services.

5.2 Constraints to growth of dairy industry

5.2.1 Farm input and service supply

An analysis of the World Bank Enterprise Survey 2018 points out poor infrastructure services as a major constrain faced by farm input manufacturers such as manufacturers of animal feeds, pesticides and agro-chemical products. The infrastructure includes roads, water and electricity. About 77.1 per cent of dairy farm input manufacturers report electricity as an obstacle to their operations. For instance, to get electricity connection, start-up firms have to wait for about 30 to 60 days before obtaining the service. To obtain water connection, the firms wait for about 10 days on average before connection.

Power outage is also another challenge indicated by 88.9 per cent (16 of 18) of these firms. In a month, they report to experience about 4 power outages on average lasting for about 7 hours. As a result, annual losses averaging at 10.6 per cent of total annual sales are reported, with the highly affected firms reporting a 45 per cent loss in total annual sales. Similarly, in the MSMEs Survey 2018, power interruption was reported as a major constraint by those involved in veterinary activities. About 50.7 per cent of these firms owned or shared a generator with about 9.8 per cent of the establishments' electricity being from generators, which is costly thus resulting to high cost of production.

Another constrain is low visibility and limited access to potential dairy input customers through online platforms. This is evidenced by close to half of the dairy input manufacturers (43.5%) not owning a website. This makes it difficult for dairy farmers to access information about these firms and the products they offer online, thus leading to high production costs due to insufficient access to market information. Creation of a company website offers indirect jobs to web designers and programmers.

Other identified obstacles to business operations at this stage were customs and trade regulations (Figure 5.4). For firms to get customs clearance of imported material input and services, it takes about a week, on average. These delays may derail firm's operations, leading to low production.

Figure 5.4: Degree to which transport, customs and trade regulations are obstacles to business

Source World Bank Enterprise Survey 2018

Majority of dairy farms' input manufacturers do not allocate funds for research and development (R&D). This is evidenced by only 7.7 per cent of these firms spending funds on research and development activities, which are carried out either in-house or contracted. Lack of R&D influences the firm's viability. Addressing this constrain would generate job opportunities for researchers and analysts.

Unfavourable business environment is another constraint faced by dairy farm input suppliers and service providers. As an illustration from the World Bank Enterprise Survey 2018, senior management of prepared animal feed manufacturers spend about 8.2 per cent of their time in dealing with government regulations. Further, during inspection visits by tax officials, corruption was evidenced by 6.3 per cent firms who reported that an informal gift was required by tax officials in their visits. This accounts for about 4.9 percent of total annual sales paid in informal payments.

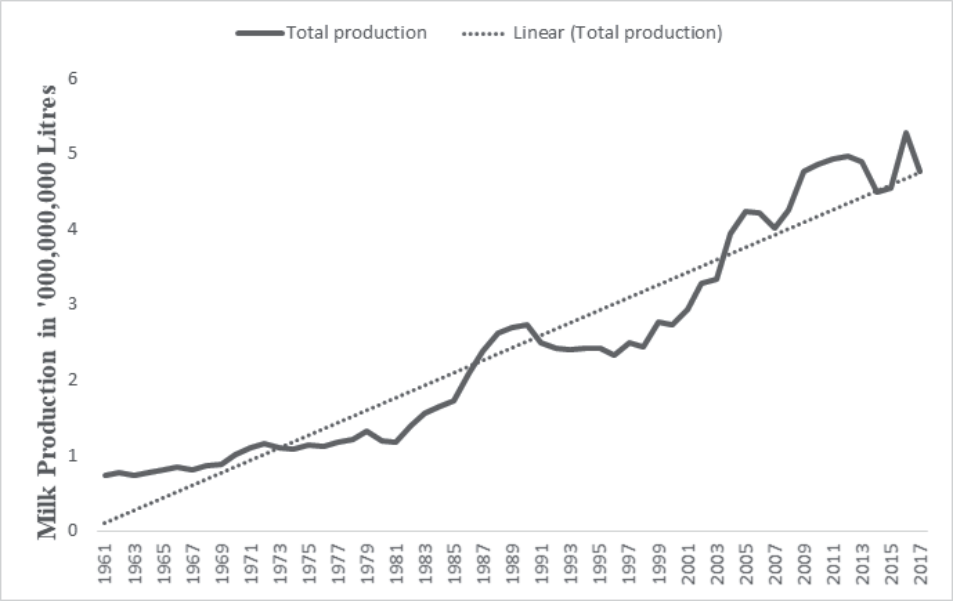
In the MSME survey, veterinary service providers ranked constrains affecting their operations starting with lack of collateral for credit as the most serious constrain, followed by power interruption and obtaining operating licenses as the third most serious constrain. In the World Bank Enterprise Survey, shortage of raw materials and stock such as animal drugs and vaccines, among others, was reported as an obstacle by 33.3 per cent of the actors involved in veterinary activities. Inaccessibility to dairy farmers as a result of poor roads and transport, especially in rural areas was also cited as a challenge by 16.7 per cent veterinary

service providers. In addition, 33.3 per cent noted that obtaining operation licenses is a major constraint to their business and operations.

5.2.2 Milk production and collection

Drought, leading to seasonality of milk production, is a major constrain faced by dairy producers. Dairy yield per animal, which in turn affects the overall amount of milk produced in Kenya fluctuates greatly during drought years; that is 1992-1993, 1999-2000, 2005-2006, 2008-2009, 2014 and 2017 as shown in Figure 5.5. For instance, the total annual milk produced in 2017 was about 4.7 billion litres with over 500 million litres decline from about 5.2 billion litres in 2016.

Figure 5.5: Trends in Kenyan milk production (1961- 2017)



Source: Kenya Dairy Board

From analysis of data from KIHBS 2015/2016 survey, shocks such as drought accounted to losses amounting to about 10.8 per cent of total dairy produce. Also, about 13.5 per cent of total dairy animals were reported to have been lost or stolen.

Poor genetic makeup and reduced variation of dairy herd is another challenge faced by dairy farmers. This makes it hard for dairy cattle adaptation to varying climate. According to KIHBS 2015/16 data, most dairy farmers (52.02%) reported lack of access to any artificial insemination services, leading to poor natural breeding and thus low yields and productivity.

Lack of common knowledge on most contagious diseases such as mastitis and delayed treatment practice is another challenge faced by small-scale farmers. According to KIHBS data 2015/2016, 2.15 per cent of dairy animals die as a result of contagious diseases, with reduced milk production on animals with other non-deadly diseases.

Although producer price for whole milk per litre has been on the rise over years as shown in Table 5.1, dairy farmers in Kenya often complain of low earnings from milk sales, coupled with delayed payments by milk processing plants. This is attributed to little involvement of farmers in the making of milk marketing policies.

Table 5.1: Whole milk producer price per litre (2009-2018)

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Price	28.00	22.00	26.50	26.50	31.00	34.70	34.43	35.43	38.97	35.30

Source: KNBS (Various), Statistical Abstracts

Dairy farming is dominated by small-scale farmers who have not commercialized this farming practice (TechnoServe Kenya, 2008). This is due to lack of civic education on commercializing dairy farming, which in turn leads to lack of adequate government support as most farmers rear dairy animals for meeting their dairy needs. Further, from the KIHBS 2015-2016, more than half of dairy farmers (59.7%) are highly unskilled and have primary education level.

Another challenge experienced at this stage is lack of proper registration and recording system. This makes it difficult to know the exact number of dairy farmers in Kenya for planning purposes. To date, the Kenya Dairy Board has licensed 11 dairy producers and only one dairy manager, yet according to KIHBS 2015-2016 data, there are about 28,989 households practicing dairy farming.

Lastly, poor road networks and marketing infrastructure in rural areas lead to delays in delivering milk to cooling and bulking facilities. These delays pose the risk of milk spoilage or poor quality, which does not meet processors specifications.

5.2.3 Chilling, bulking and transportation

Lack of electricity in some milk bulking and chilling centres, especially in remote areas, has led to high cost of cooling milk using diesel. This in turn has led to little pay to farmers compared to the profit margin farmers would get if electricity was used.

Although improvements have been made through capacity building, lack of adequately trained personnel to handle the facility equipment and other resources

is also another challenge facing aggregators. Besides, most firms involved in the manufacture of dairy products do not offer training to their staff; in the World Bank Enterprise Survey, only a small proportion (27%) allocate funds for research.

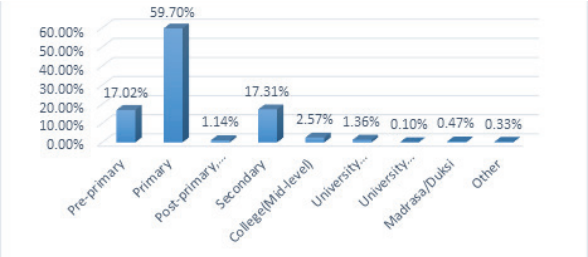
Milk adulteration by farmers who add water and other chemicals to increase milk quantity has led to high testing and maintenance cost in this stage. Aggregators incur huge costs in testing and setting up associated quality control infrastructure, which helps them ensure that they only accept quality milk. Field surveys conducted by USAID-KAVES report milk losses averaging at about 1.1 per cent to be a constrain faced by most cooling plants (Agency and Development, 2015) .

Most small-scale dairy producers are located in rural villages with poor road infrastructure that presents aggregators with limited access to market for surplus milk especially during rainy seasons. Another constrain faced at this node is drop in milk supplied to the facilities, especially during drought years or months and during festive seasons where milk is diverted to the informal channels.

5.2.4 Processing and packaging

Growth of the dairy product manufacturers is constrained by limited access to finance, strict customs and trade regulations, irregularity in electricity supply, political instability and competition threat from informal and unlicensed establishments. Of these menaces, electricity is the main obstacle to firms processing dairy products (Figure 5.6). These firms require a lot of energy for running and operating their machines; however, irregularity in electricity supply continues to disrupt their operations. In the World Bank Enterprise Survey, manufacturers of dairy products reported to experience power outages about 3 times on average in a month for between less than one hour to 15 hours. The losses as a result of power outages account for about 3.2 per cent loss of the total annual sales.

Figure 5.6: Education level completed by dairy farmer's



Source: MSME Survey 2016

Despite the government discouraging sale of raw milk, processors face direct competition from informal milk markets, which continue to grow as small-scale farmers prefer instant cash. Selling of unpackaged processed milk has been on the rise in Kenya. To date, the Kenya Dairy Board has registered about 276 milk bars and 189 milk dispensers in various parts of Kenya. However, in Kenya, majority of milk is sold directly to consumers through informal channels (hawkers) without being processed or packaged. These milk hawkers collect the milk from producers at farm gate and sell it to consumers.

Further, unfavourable business regulatory environment is yet another constrain at this stage. About 8.8 per cent dairy processors' senior management time, which accounts to a considerable loss, is spent in dealing with government regulations. Also, obtaining operating license for manufacturing dairy products takes about 4 days, on average, and a maximum of about 2 weeks (14 days).

Losses due to theft, robbery, vandalism and arson are also experienced at this node of the value chain. About 5.7 per cent of value of products was lost in transit due to theft. Also, 20.6 per cent losses due to theft, robbery, vandalism or arson accounted for about 22.1 per cent of total annual sales.

Lack of adequate research and development carried out by most processors either in-house or externally coupled with lack of skilled manpower in processing and quality control section, financial constraints and incompatibility with existing technology is a major obstacle to technological upgrade of this establishment with three quarters (75%) of all milk processors experiencing them. Although research and development is key in ensuring that processors meet market needs and demand specifications, only 27.5 per cent (6 of the sampled 23) dairy processors allocate and spend funds in carrying out R&D.

Lastly, political instability was cited as a major reason for limited production by most dairy processors (83.3%) who did not operate to their full capacity.

5.2.5 Distribution, wholesaling and retailing

In the World Bank Enterprise Survey, delays in getting electrical connection was reported to be a key constrain faced by wholesalers and retailers. In obtaining this service, about 11.29 per cent of the sampled wholesalers and retailers reported that informal payment was required for connection. Further, time taken to obtain the service ranged from 49 to 360 days. In addition, 88.02 per cent of the actors involved in this stage reported to experience at least 3 power outages in a month, on average. These outages last for about 4 hours in a day, leading to 2.81 per cent loss of the total annual sales.

Corruption is also another constrain facing wholesalers and retailers. For instance, for the actors involved at this node who had applied for water connection service, about 9.83 per cent reported that an informal gift was required in obtaining the service. Similarly, 32.34 per cent reported that an informal gift was required in clearing customs.

Further, competition from informal milk channels was reported by 64.21 per cent of the sampled licensed wholesalers and retailers.

High transportation cost from dairy processors to the marketplace is a huge challenge reported by wholesalers. In the World Bank Enterprise Survey 2018, most wholesalers and retailers of food, which includes dairy products reported product loss while in transit as a result of threat, breakages and spoilage.

Despite Kenya having been the main supply hub in East Africa for processed milk over years, it has been confronted by an emerging threat of cheap milk imports from Uganda. In 2019, about 110.7 million litres were imported into the country from 3 million litres import in 2016. In addition, the Kenyan dairy sector continues to battle with imports of cheese, butter, cream and milk powder from European countries which, because of their lower prices, impacts the success of the dairy industry in the country for years to come. The dairy industry imports and exports regulations 2020 highlight conditions and other requirements for dairy importation (Dairy Industry (Imports and Exports) Regulations, 2020). These conditions are expected to address this constrain if properly implemented.

Consumption

Despite the extensive formal marketing network in Kenya by public and private milk processors, data from KIHBS 2015/2016 show that most people (57.7%) prefer consumption of fresh unpacked milk, with only 9.73 per cent consuming fresh packed cow milk. This is illustrated in Table 5.2:

Table 5.2: Milk consumption in Kenya

Dairy product	Percentage consuming the product (%)	Dairy product	Percentage consuming the product (%)
Fresh unpacketed cow milk	57.73	Milk sour – packeted mala	2.80
Fresh packeted cow milk	9.73	Condensed/ powder milk	2.36
Milk sour – unpacketed mala	8.81	Camel milk	1.93
Goat milk	8.12	Fresh flavored packeted cow milk	0.45

UHT- Long life milk	4.30	Baby milk-tinned	0.07
Yoghurt	3.65	Cheese	0.07

Source: KIHBS 2015/2016

Some of the key factors driving the above consumption trends are traditional preferences for fresh raw milk and the unwillingness of consumers to pay the costs of processing and packaging (KDB, 2018). Recent survey by KNBS (2018) shows that milk for the last ten years has costed processors an average of Ksh 31.283 while the after processing, the cost to the final consumer is about Ksh 50. As such, consumers prefer to buy from farmers directly, thus bypassing the pasteurizing and packaging costs incurred by processors.

Although milk intake in Kenya is high, consumption of processed milk is too low compared to raw un-chilled milk. This is due to lack of sensitization to the public on the importance of consuming processed milk and its products over raw milk.

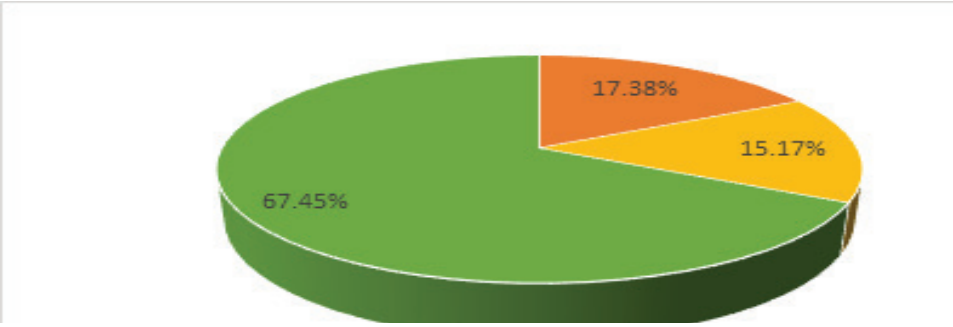
To actualize the dairy industry's potential to generate jobs, the constrains discussed above need to be addressed.

5.3 Employment creation potential of the dairy industry

5.3.1 Characteristics of dairy industry workers

Generally, there is gender parity in dairy farming workers with 52.21 per cent and 47.79 per cent of total dairy farmers being male and female, respectively. The sector is dominated by the older generation (more than 35 years), which constitute 57.07 per cent compared to the youthful generation (15-34 years), which constitute 17.84 per cent of the dairy farming workers. With regard to education level, more than half (59.70%) of dairy farmers have primary school qualification and 17.31 per cent secondary school qualification, of which majority of the farmers lie in those two categories as shown in Figure 5.7.

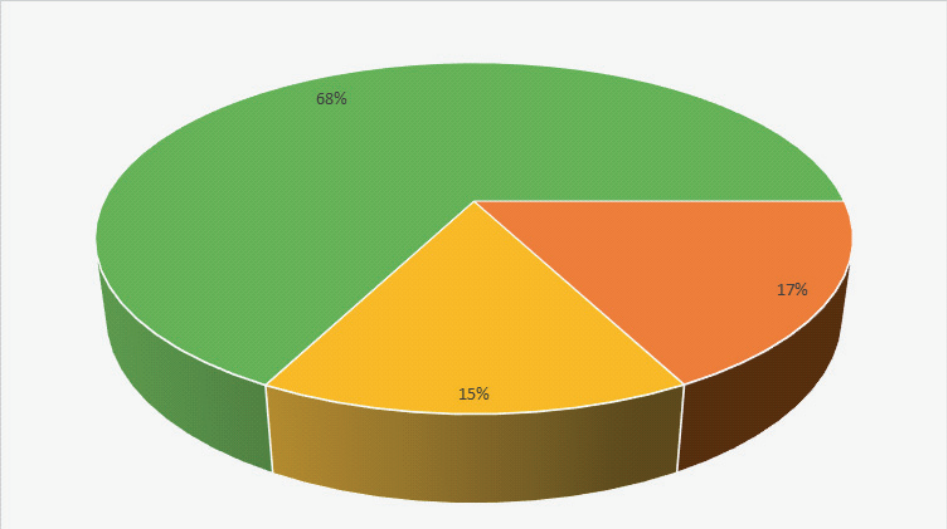
Figure 5.7: Education level completed by dairy farmer's



Source: KIHBS 2015/2016

From the World Bank Enterprise Survey 2018 data, we further classified production workers into three categories based on their skills level as shown in the Figure 5.8.

Figure 5.8: Skills level for dairy production worker's



Source: World Bank Enterprise Survey (2018) data

5.3.2 Estimating current employment in the dairy industry

From the MSMEs survey 2016 data set, 1,919 workers were involved in activities related to veterinary services. Of the total workers, 41.2 per cent worked in their own establishments, 53.5 per cent were full-time regular employees, 2.8 per cent unpaid family workers while 2.5 per cent were casual employees. On educational attainment, 56.5 per cent had attained KCE/KCSE as their highest level completed followed by diploma at 25.1 per cent, university degree at 12.8 per cent, 1.0 per

cent certificate and 4.6 per cent having no education.

Table 5.3: Total employment in the value chain (2018)

Value chain	Activity	Number of employees	Total
Farm input and service supply	Manufacture of prepared animal feeds	1,430	34,929
	Manufacture of pesticides and other agrochemical products	972	
	Support activities for animal production	30,020	
	Veterinary activities	1,305	
Production	Raising of cattle and buffaloes (Ranches)	21,907	21,907
Processing	Manufacture of dairy products.	7,833	7,833
Wholesale and retailing	Wholesale of agricultural raw materials and live animals (dairy animals)	39,264	43,027
	Retail sale of food in specialized stores (dairy products and other food products)	3,763	
Support activities	Advertising	1 305	1 305

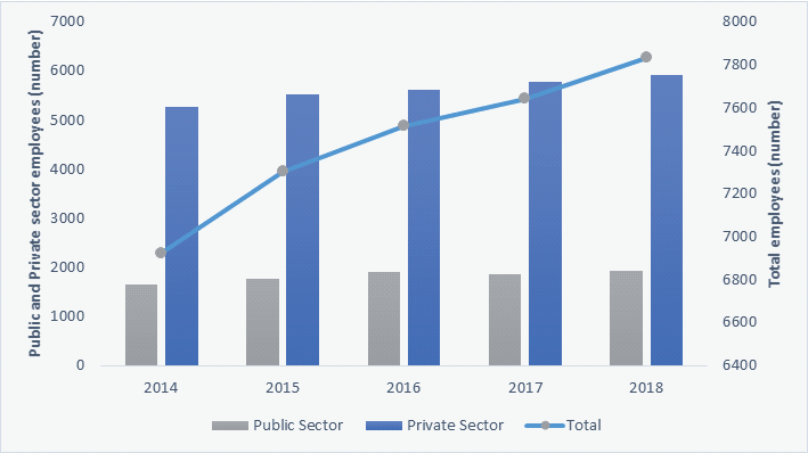
Source: KNBS (2019), Statistical Abstract

From Table 5.3, data for wholesaling and retailing involved both wholesalers and retailers who are not only dealing with dairy products but also other food stuffs; therefore, the numbers presented may not give a perfect representation of dairy industry wholesalers and retailers. Similarly, data on the actors involved in production represents both dairy and non-dairy animals. Also, data for other dairy animals such as goats, camels and sheep is excluded.

Processing stage of the dairy sector value chain has the least number of employees. This can be explained by the fact that most activities at this stage are highly mechanized thus requiring few personnel.

The total number of wage employment in the manufacture of dairy products is reported to have been on the rise over the years. For instance, wage employment increased by 11.6 per cent from 6,923 in 2014 to 7,833 in 2018 as illustrated in Figure 5.9. This upward trend is expected to continue, thus employing more youths in the industry.

Figure 5.9: Manufacture of dairy products wage employment (2014-2018)



Source: KNBS (Various), Statistical Abstracts 2015-2019

Table 5.4 shows the total number of fulltime persons employed when the organization begun its operations.

Table 5.4: Number of full-time employees at start-up stage

Actors	Employees (number)		
	Average	Minimum	Maximum
Manufacturer of animal feed and agro-chemicals	9	2	58
Animal production	11	1	100
Manufacturer of dairy products	8	3	25
Retailers	7	1	70

Source: World Bank Enterprise Survey 2018 / MSMEs Survey 2016

For start-ups, the average number of jobs created at different nodes of the value chain range from 7 to 11; this implies that if the youth are financed and mentored to start their own establishments, they would create about 8 job opportunities on average per establishment.

During high production seasons, data from the MSMEs Survey 2016 show that establishments involved in animal production, i.e. in rearing of the dairy animals, create seasonal jobs by engaging about 16 extra persons on average to meet extra production.

5.3.3 Labour to value added ratios

Comparing dairy and meat processing industry's labour to value added ratio (LVAR). We found that the dairy industry is more labour intensive at 9.56 while meat processing industry LVAR is 1.44. This implies that dairy industry requires a large amount of labour (workers) to produce dairy outputs. Therefore, it is crucial for the Government and investors to channel their support to this industry for continued sustainability and job creation.

5.3.4 Employment elasticity

The computed employment elasticity for the dairy sector using equation (2) in the methodology section was $\alpha = 0.86$. This implies that a percentage change in dairy sectors contribution to GDP leads to 0.86 per cent increase in the dairy sectors' employment, holding all other factors constant. Therefore, for the industry to create considerable number of jobs, it has to contribute more to the national GDP.

Comparing this with computed elasticity for processing and preserving of meat and processing and preserving of fish, crustaceans and mollusks, which is 0.3 and 0.33, respectively, the dairy industry has a higher potential for generating more jobs. Therefore, it is important to give investment priorities to the dairy industry.

5.3.5 Dairy industry labour skill requirements and skill gap

Using KNOCS classification, we identified 13 occupations along the dairy value chain whose data was available in the KIHBS2015/2016 dataset. They include animal health professionals (veterinarian, veterinary assistants and veterinary research officers), farm-hands and related labourers (farm labourers or herdsman), farming advisors including extension officers and farm demonstrators, dairy and livestock producers (dairy farmer), livestock officials (dairy officer), life science technicians such as drug inspectors, life science professionals such as veterinary pathologists, dairy product machine operators, dairy products maker, wholesaling and retailing among others. Using those occupations, we estimated the number of employees required (skills requirement) for each occupation across different education levels.

Table 5.5: Estimate of the Kenyan dairy sector skills gap based on the chosen occupational distribution

Occupations	No education	Primary	Post primary	Secondary	Certificate	Diploma	Degree	Postgrad. Degree
Skills supply	1,627,626	3,093,835	1,747	1,379,875	126,117	118,048	77,952	906
Skill requirement	1,160,635	578,883	14,266	292,605	66,440	63,390	30,830	6,051
Animal health professionals	655	3,202	-	2,971	9,162	18 762	10,702	3,606
Life science professionals	-	-	-	-	171	4,241	535	-
Agriculture and related professionals	-	421	-	-	779	2 037	4,795	85
Livestock officials (dairy officer)	-	1,095	-	1,778	515	509	418	154
Life science technicians	-	-	-	228	1,150	660	482	296
Agricultural engineers	-	743	-	299	5,513	2 009	311	-
Dairy farmers	299,899	89,680	2,936	39,088	5,844	11 056	3,992	-
Farming advisors	-	62	-	1,674	-	2 877	1,081	1,392
Farm hand and related laborers	782,245	351,496	9,794	143,311	20,258	8 258	3,343	-
Dairy products maker	615	221	-	1,389	-	-	-	-
Dairy product machine operators	-	-	-	376	-	913	-	-
Packaging	235	235	-	1,749	-	508	-	-
wholesale and retail	76,986	131,728	1,536	99,742	23,048	11,560	5,171	518
Skills Gap	466,991	2,514,952		12,519	1,087,270	59,677	54,658	47,122
Skills availability ratio	1.4024	5.3445	0.1225	4.7158	1.8982	1.8622	2.5284	0.1497

Source: KIHBS 2015/2016

From Table 5.5, there are about 6.4 million unemployed youth in Kenya. Of these, majority of them (3.1 million) have primary education, followed by those with no education at about 1.6 million with the least being postgraduate holders at 906. Based on the above, computed skills requirement for the dairy industry, there is a sectoral skill gap (shortages) of 12,519 for post-primary education level and 5,145 for postgraduates in the industry. This implies that unemployed youth do not possess the skills required for those education levels. However, there is no skills

gap for other education levels in the dairy industry, with skill surplus (positive gap) ranging from 47,122 for degree to 2,514,952 for primary education. Further, from the skills availability ratio, we observe that all education levels have relatively small ratios less than 10. This implies that the number of unemployed youths in each education level is less than 10 times higher than the skills requirement for the sector. For example, the number of unemployed youths with diploma education is about 2 times higher than the diploma skill requirement for the industry. Therefore, the skills base is inadequate to accommodate other industries/sectors. Thus, despite the required skills being available among unemployed youth, those skills may not be attracted in the dairy industry as a result of competition from other sectors where unemployed youth may seek employment.

After estimating the modal years of education for unemployed youth and computing the skills requirement for each occupation, we generated Table 5.6 for occupation-specific skills gap.

Table 5.6: Occupational skills gap

Occupation	Skills Supply	Skills Requirement	Skill Gap
Animal health professionals	8	14	-6
Life science professionals	8	14	-6
Agriculture and related professionals	8	14	-6
Livestock officer	8	12	-4
Veterinary assistants	8	13	-5
Life science technicians	8	13	-5
Agricultural engineer	8	13	-5
Dairy farmer	8	0	8
Farming advisors	8	14	-6
Farm hand and related labourers	8	8	0
Dairy products maker	8	12	-4
Dairy product machine operator	8	14	-6
Packaging	8	12	-4
Wholesaler and retailers	8	8	0

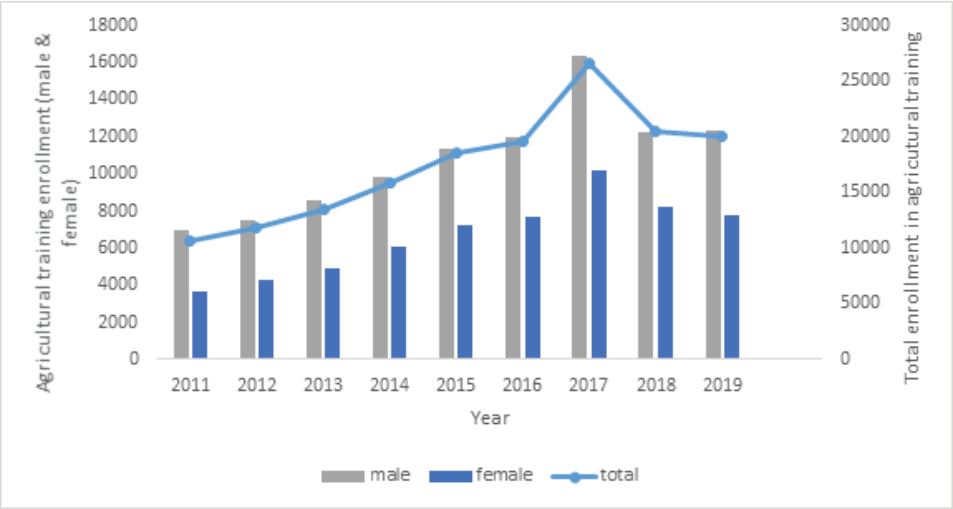
Source: KIHBS 2015-2016

From the above table, there is no occupational skills gap for farmhands and related labourers, and wholesalers and retailers. Also, there is a positive skills gap for dairy production (farmers), which implies that unemployed youth already have the required skills for that occupation. All the other occupations such as animal health professionals, dairy product machine operators, farm advisor and life science professionals, among others, have a negative skills gap. This implies that

the industry cannot find qualified people for those occupations in the pool of the unemployed youth. Therefore, there is a gap in terms of education (the number of schooling years) that need to be filled to meet the skills requirement for those occupations.

Further, analysis of the number of students enrolled in agricultural training institutes for courses related to dairying such as animal health, the number has been increasing until 2017 where it started to decline.

Figure 5.10: Enrolment in agricultural-related courses



Source: KNBS (Various), Economic surveys 2011-2019

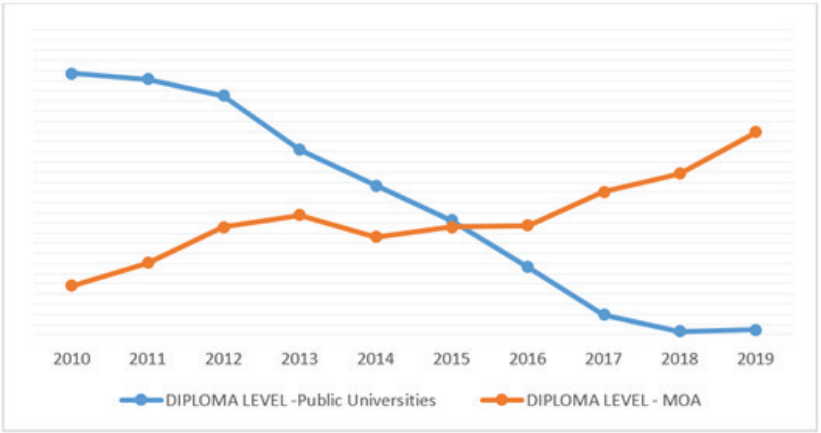
Investigating this further by looking at those enrolled for degree, diploma and short courses separately, a similar trend was seen for degree and short courses enrolment. The total number of students enrolling for agricultural training courses in public universities and for short term short courses has been on the rise over the years, with a decline being experienced over the last two years.

Figure 5.11: Degree and short term course enrolment in public universities

Source: KNBS (Various), Economic survey 2010-2019

For diploma education levels, public universities specifically Egerton University, has experienced a tremendous decline in the number of students enrolling for agricultural trainings at this level. However, the number of diploma enrolment in the Ministry of Agriculture (MOA) institutions such as Bukura Training Institute and Naivasha Dairy Training Institute together with animal health training institutes such as Kabete and Ndomba have experienced an upward trend as shown below. This gives an indication that these training institutes are gaining preference by students over public universities.

Figure 5.12: Enrolment for diploma courses in public universities and other training institutes



Source: Economic surveys 2010 - 2019

With a continued decline in degree enrolment and an increase in diploma enrolments, it implies that there will be skills surpluses and skills shortages for diplomas and degrees, respectively, in the near future.

On job trainings offered by dairy value chain actors

At input and service supply stage of the dairy value chain, about half (50.89%) of the sampled manufacturers of animal feeds and agro-chemicals reported to offer formal training programs for permanent full-time employees. Also, at the processing stage, 52.52 per cent of the manufacturers of dairy products train their full-time employees and only 10.25 per cent of wholesale and retail staff are trained. These trainings help build skills and knowledge required for optimal performance of staff. They also act as a bridge between any existing employee's skills gap and the firm's requirement.

Further, on exploring the total number of working experiences for top managers in the dairy value chain, we generated table 5.9:

Table 5.7: Working experience for top managers in the dairy value chain

Actor	Work experience (total years)		
	Minimum	Average	Maximum
Manufacturer of dairy products	3	11	17
Manufacturers of animal feed and agro-chemicals	4	14.8	50
Wholesaler and retailers	2	15	30

Source: World Bank Enterprise Survey 2018

Although we have top managers with as little as 2 years of working experience, on average most of the top managers have about 10 years working experience, which is reasonably ideal for their position, as the standard requirement for most firms for occupying a top management position requires at least 5 years working experience.

6. Conclusion and Policy Recommendations

6.1 Conclusion

From the developed dairy value chain map, milk moves through a range of activities requiring different expertise to deliver the final dairy products to consumers. These activities involve various actors who create considerable amount of jobs for the youth. Therefore, it is crucial to strengthen the dairy value chain by responding to challenges, weaknesses, opportunities and threats so as to ensure sustainability of jobs generated at each node of the chain. Milk production and collection node has a higher potential for creating more jobs in comparison with the other nodes. This is attributed to the low skills requirements at this stage, its labour intensiveness and the potential to produce more milk in the country to meet the high demand. Although some of these jobs may not be created directly at the dairy farm (production) level, considerable amount of jobs may be generated indirectly in providing necessary inputs and services for milk production and in support organizations.

From our study findings, poor infrastructural services such as electricity, water services and road networks were identified as the major obstructions to growth of the dairy industry facing almost all actors in the dairy value chain. Power interruptions/outages was a major concern to manufacturers of dairy products and dairy input manufacturers who rely heavily on electricity for their machine operations. These outages result to low production levels, which in turn affect the total number of persons employed in the firm. More jobs for unemployed youth can be generated if this constrain is addressed as a result of increased productivity.

Unfavourable business environment was also identified as another challenge facing the dairy industry. This entails competition from unlicensed informal establishments hawking raw un-chilled milk, and also corrupt tax officials. A strategy focusing on uplifting marketability of processed dairy products over raw milk is crucial as it involves changes at both production and consumption level. At production level, dairy farmers need to be sensitized on health risks associated with selling raw milk directly to consumers and the importance of taking milk to cooling centres. Specific information campaigns are needed towards creating awareness on benefits associated with consuming processed milk, thus increasing demand for processed dairy products. This will create additional job opportunities in the formal milk channel as a result of increased activities.

Low milk production is a major challenge facing dairy farmers as a result of poor genetic make-up of the dairy animals due to natural breeding and high reliance

on rain for forage. Further, these farmers also encounter post-harvest losses due to poor milking practices. These problems can be addressed by coming up with strategies that increase fodder production, and preserve and store fodder and forage in well constructed barns for use during drought months and years. This will further create more jobs for fodder and forage farmers and farm workers. Similarly, to boost milk yield and ensure quality produce under high hygienic standards, it is essential to offer trainings to dairy farmers on milk handling and storage, animal welfare, herd management and disease control to improve their farming skills and expertise. Also, an introduction of quality-based payment systems would motive quality produce.

Another hindrance to dairy industry growth is inadequate research and development carried out both in-house and externally coupled with lack of trained personnel by dairy value chain actors, especially those at the processing stage.

Most dairy farmers are older persons, which implies that dairy farming is repulsive to the youth. A strategy that aimed at professionalizing and improving the dairy sectors image with high incomes and quality jobs for educated youth is essential to tap on the skills available in unemployed youth population. This will further boost the number of students enrolled in agricultural programmes, animal production and food processing courses, among others, thus, bridging occupational skills gap for vet assistants, animal health professionals, life science professionals, farm advisers and dairy product makers, among others.

Lastly, if unemployed youth are facilitated to start up their own establishments, they will be well poised to generate jobs for other unemployed youths.

6.2 Policy Recommendations

The Government could strengthen the dairy value chain through the Kenya Dairy Board and the Ministry of Agriculture, Livestock and Fisheries by setting up strict measures and regulations with solid implementation plans to protect the formal milk channel which has been shown to possess immense potential for jobs creation. Also, there is need to establish solid implementation plans of the newly set policy prohibiting sale of unpasteurized milk. This will not only ensure milk safety but will also create job opportunities at milk pasteurizing stage of the chain.

The National and County governments need to invest resources to improve access to infrastructure such as roads in rural areas, and improve water and electricity service delivery to animal feed manufacturers and dairy product processors.

There is need to reduce the time taken to get construction permit approval and other approvals by the concerned authorities. This includes the relevant

government authorities enforcing stringent penalties for those found guilty of impeding such approvals.

Agriculture being a devolved function, County governments in collaboration with non-state actors need to facilitate frequent training to dairy farmers on milking and milk handling techniques to minimize post-harvest losses.

County governments need to take a leading role in facilitating private-public partnerships to provide artificial insemination services to dairy farmers, specifically small-scale farmers at a subsidized cost to ensure high quality breed that is drought resistant.

The Government in collaboration with development partners and dairy firms need to allocate funds for dairy research and development, and capacity building of the dairy value chain actors. Such funds can be used to support innovation, research and development in dairy firms and agriculture training institutions.

All dairy industry actors need to professionalize the industry by offering high incomes and quality jobs to attract students to take up courses in the industry and also attract unemployed youth to the industry.

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Kenya Institute for Public Policy Research and Analysis
Bishops Garden Towers, Bishops Road
PO Box 56445, Nairobi, Kenya
tel: +254 20 2719933/4, 2714714/5, 2721654, 2721110
fax: +254 20 2719951
email: admin@kippra.or.ke
website: http://www.kippra.org