Prioritizing Policies for Driving Inclusive Agricultural Transformation: Kenya

Value Chain Deep Dive Report: Beef

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DIVING INTO THE **REPORT**

The development and prioritization of appropriate and effective policies and public sector investments to drive inclusive agricultural transformation is high on the agenda in most African countries. In recent years there has been a significant shift in the policy context. Whereas the focus in the past has mainly been on increasing productivity at the farm level, the rapid rate of urbanisation and changing diets is putting greater strain on food systems, and market dynamics and private sector investment are becoming much more important.

In Kenya, the Ministry of Agriculture, Livestock and Fisheries (MoAL&F) is implementing the Agricultural Sector Transformation and Growth Strategy (ASTGS) and supporting the Presidential vision of the Big Four initiative. Both policies seek to accelerate agricultural production and agro-processing, achieve food and nutritional security, improve farmer and local community incomes, lower the cost of food, and increase employment, especially for women and young people. Under the ASTGS Flagship 8 seeks to strengthen research and innovation, with a focus on developing tools for better decision-making and supporting evidence-based policy development, planning, prioritisation and monitoring.

In response to a request for support from the Ministry, the Alliance for a Green Revolution for Africa (AGRA), in collaboration with the Bureau for Food and Agricultural Policy (BFAP), the International Food Policy Research Institute (IFPRI) and the Tegemeo Institute at Egerton University initiated a project called the Policy Prioritisation through Value Chain Analysis (PPVC). This project uses a set of methodological tools to identify the impact of specific investment and policy interventions in value chains that have been identified under the ASTGS and Big Four Agenda. Through the PPVC approach investments and policy interventions in specific value chains can be determined and ranked according to their impact on agricultural production, employment, farm incomes, dietary and gender transformation and smallholder inclusiveness.

In a first output of the PPVC project (Box 1), preliminary value chain scan and field investigation data were combined with Partial Equilibrium and Computable General Equilibrium modelling outputs to present a list of 12 prioritised value chains. These were ranked according to the PPVC criteria of Market Led Potential, Inclusivity, Transformation Potential and a Value Chain scan that provides qualitative information and a combined ranking on policy support, investment support, scalability and agro-ecological suitability. From the list of 12 value chains, three were chosen by the Kenyan Government for Deep Dive analysis, namely coffee, aquaculture and beef.

Box 1: Overview of the PPVC methodology

The PPVC is a market-led approach that aims to:

- Assist governments with evidence-based analysis to adequately prioritise their policies and investments (e.g. the ASTGS)[1] and the accompanying National Agricultural Investment Plan (NAIP) for Kenya, Kenya Vision 2030[2], and the Big Four Presidential Agenda[3])
- Determine which policies and public investments are most (cost) effective at driving market-led inclusive agricultural transformation, and
- Involve public- and private sector stakeholders right from the start.

First, the current state or "as-is" baseline is established. For the aquaculture value chain, for example, this provided the current state and historical trends of fish supply and demand, identifying critical stakeholders throughout the value chain, with associated market shares, operational costs, capacities and constraints, and then summarising challenges faced by the various value chain actors. Secondly, an "ideal state" for the value chain was defined, in which key bottlenecks and constraints were addressed using specific levers of change (e.g. value chain investments and policy levers). In order to reach the ideal state, a combination of investments and policies were formulated at specific nodes of the value chain aimed at unlocking more value out of the market system. These changes were then translated into gross margin impacts at the various nodes of the value chain. The impact of interventions on the aquaculture sector was modelled over a medium-term horizon (10 years, using BFAP's partial equilibrium model) and the resulting impact on agri-food system GDP, poverty reduction and off-farm agri-food system jobs was modelled using the IFPRI RIAPA CGE modelling system.

Beef is a key source of animal protein in Kenya and constitutes approximately two thirds of all meat consumed in the country (Kenya Meat Trust, 2014). Nairobi and Mombasa, the country's largest cities, account for 75% of national beef consumption (Kenya Meat Trust, 2018). Given its importance in both dietary transformation and food/nutrition security, it behoves the government to develop and implement appropriate and effective policies and public sector investments which drive the continued development of the sector.

Beef is among the agricultural commodity value chains that have been prioritized in government policies, namely, the Agricultural Sector Transformation and Growth (ASTGS) and the Big Four Presidential Agenda. Against this background, this value chain analysis presents an in-depth view of alternative policy and investment outcomes which can unlock growth potential in the value chain. It identifies players, policies, constraints, and the

[1] The Agricultural Sector Transformation and Growth Strategy (ASTGS, 2019-2029) is a 10 year strategy aiming at developing and transforming the agriculture sector through increasing farmers' incomes, value of agricultural produce, and build households' resilience.

[2] The Kenya Vision 2030 is implemented through three pillars: Economic, Social and Political. Agriculture is a key sector under the economic pillar. The goal is to attain 10% annual economic growth through transforming the sectorto be highly commercially oriented.

[3] The agriculture sector contributes significantly to two agendas of the Big Four Agenda: Attainment of 100% Food Security and Nutrition and Manufacturing. Under Food Security and Nutrition, the government aims at attaining food self-sufficiency and lower the cost of food. Under manufacturing agenda, the government aims to grow the manufacturing industry through agro processing and agro-based SMEs

potential for upgrading the market to a new optimal state that sets the sector on a much higher growth trajectory.

The optimal or upgraded state is underpinned by a market-driven approach that considers the fundamentals such as productivity growth and exogenous factors such as the rapid rate of urbanisation, increasing population, improved incomes and changing diets, as well as market dynamics and incentives which attract private sector investment. Establishing this upgraded state involves the use of a package of empirically grounded tools that are designed and linked in a systematic framework to answer key questions at different stages of the policy process and to assist with the prioritization of public investments.

This report is, therefore, structured as follows: The first section provides the general context of the beef market globally, regionally and in Kenya. This is followed by a detailed structural and economic analysis of the Kenyan beef value chain where key policy and market related constraints are identified. The third section presents an ideal state where the constraints are addressed as potential upgrades that are introduced in the form of policy and market interventions. The final section presents a market and policy consistency assessment when the potential future outcomes are generated within the combination of analytical tools used.

1.1. Global context

In the face of growing global demand for agricultural products, particularly animal protein, production has had to grow rapidly. Gains were supported by some expansion in herd numbers, combined with substantial gains in productivity in the livestock industry. Improved productivity was induced by several factors such as:

- Increased use of high-energy and high protein feeds
- Improved genetics
- More comprehensive animal disease controls
- Sound management practices

Beef is the third largest source of animal protein globally, after pork and chicken. Global beef production has increased steadily in the last few decades, with production reaching 62.5 million tons in 2018 (USDA FAS, 2019). In the 2019 Organisation for Economic Co-operation and Development- Food and Agricultural Organization (OECD-FAO) Outlook, it was projected that livestock production will grow by nearly 15% over the coming decade. This growth is set to be achieved in many countries by a combination of an increasing number of animals and improving the average output per animal per year, with more intensive production systems resulting in higher slaughter weights per animal as well as shortening the time to finish an animal for slaughter (OECD-FAO, 2019).

The USA, Brazil, the EU, India, Argentina and Australia together produce almost two thirds of the global beef supply, with the USA the largest at almost a third of the global total.This represents a sharp decline from its 44% share in 1992, indicating that production has grown faster elsewhere. Meanwhile, the share of EU beef supplies in the global market also dropped from 22% in the early 1990s to 13% in 2018. The declining dependence on the USA and EU has been accompanied by rapid growth in Brazil and India, whose contributions to global beef supplies grew to 16% and 7% respectively by 2018. Figures 1 and 2 reflect major beef production regions, and the growth in major producing countries in recent years.

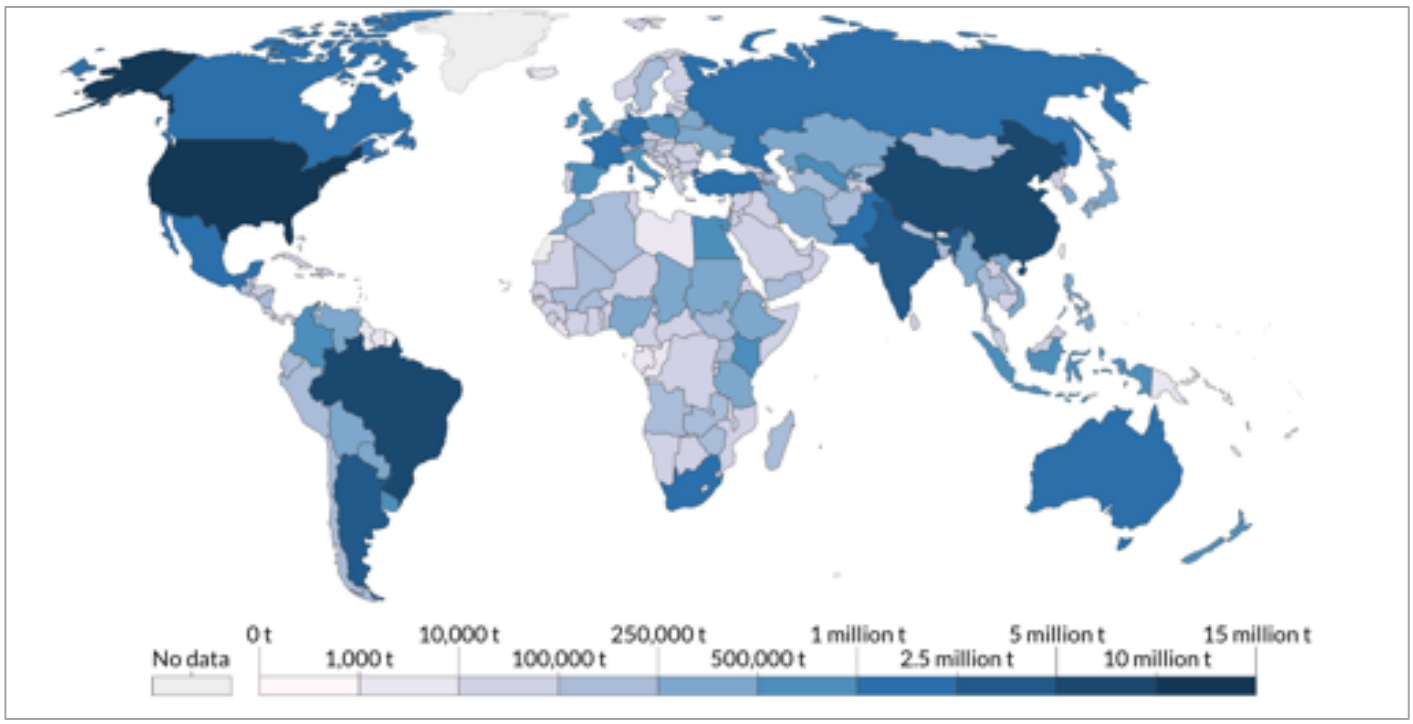

FIGURE-1 GLOBAL BEEF PRODUCTION MAP (2018)

Source: FAO (2020)

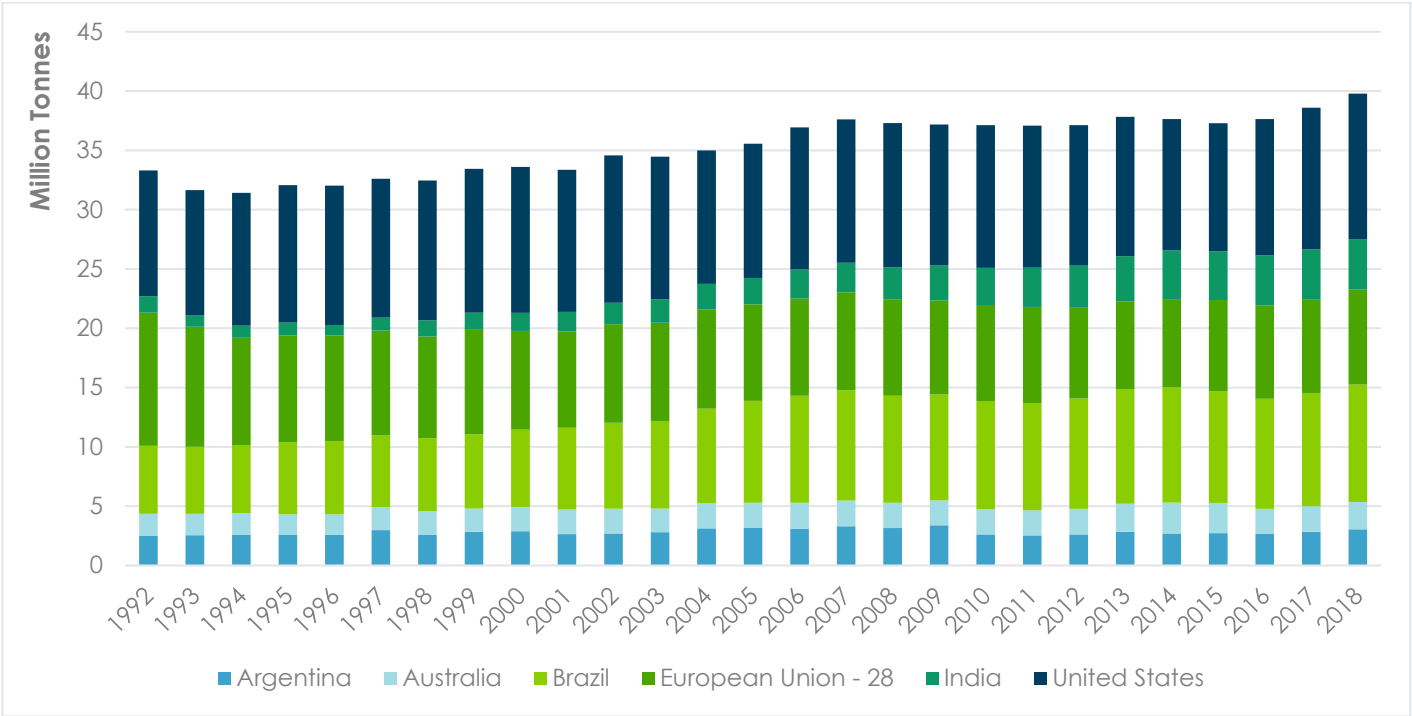

FIGURE-2 GLOBAL BEEF PRODUCTION TRENDS (1992-2018), '000 000 TONS

Source: USDA (2020)

The beef industry has been among the critical sub-sectors whose contribution to agricultural trade plays a significant role in ensuring food security in certain parts of the world, and a key source of income in others. Global trade is even more concentrated than production, as the top 5 exporters contribute a combined 70% of beef exports (USDA, 2019). Brazil is the largest exporter, accounting for 20% of global exports in 2018, followed by Australia (16%), India (15%), the USA (14%) and the EU (3%). In the last two decades, there have been significant shifts in beef imports from North America and the EU to the Middle East, and more significantly, East Asia. About 42% of global beef exports are now destined for East Asia.

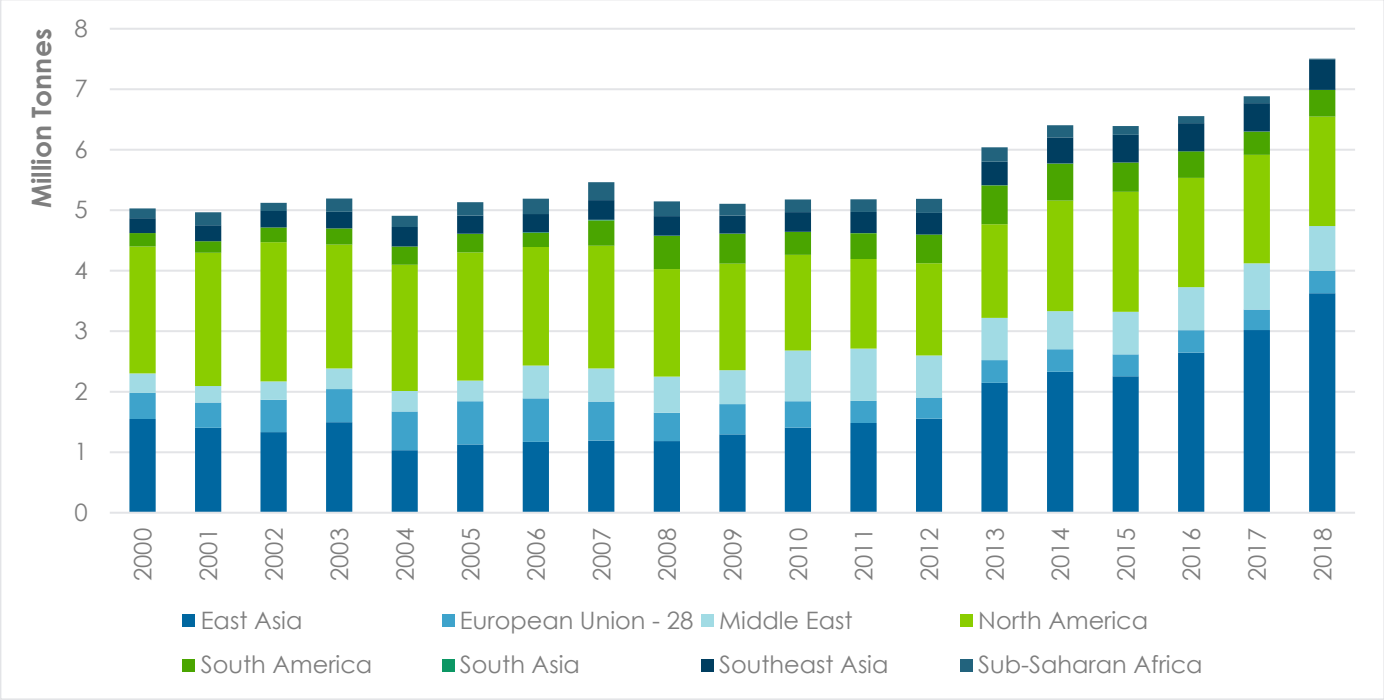

FIGURE-3 GLOBAL BEEF IMPORTS (2000 – 2018), '000 000 TONS

Source: USDA (2020)

Over the past decade, global beef prices have grown only modestly, from US$4.09/kg in 2010 to US$4.35/kg in 2020 (OECD-FAO, 2021). In the more recent past, prices have moved mostly sideways, weighed down by expanding production, particularly in the USA.

1.2. Regional context

In East Africa[4], beef production is mainly through pastoralism, which accounts for about 80% of the region's supplied volumes. The region is dominated by nomadic pastoral production systems underpinned by a cultural tendency that places a significant focus on preserving cattle as a store of wealth, rather than a commodity to be traded commercially in the market. Cattle are slaughtered ostensibly for special events such as weddings, funerals, and rights of passage, but are mainly kept for the products they provide (milk, calves, etc.). Nevertheless, the practice of selling cattle is not unknown, as more cattle are sold for cash in periods of drought (i.e. to liquidate wealth) when there is little access to good pastures.

The East Africa region (i.e. South Sudan, Uganda, Kenya, Somalia, Ethiopia and Tanzania) has a herd population of over 130 million head of cattle (FAO, 2020) – a sizable number of which transcends international boundaries under the nomadic pastoralism systems that stretch across the region. Ethiopia has the largest herd size, accounting for 48% of the regional herd in 2018. Tanzania followed with , then Kenya (15%), Uganda (12%) and Somalia (4%).

The regional herd size increased by 25% between 2009 and 2018, from 104 million to 130 million cattle (Figure 4). With the fluidity of the cross-border movement of livestock, it is difficult to determine with certainty the extent to which each of the countries drove the increase in herd size. For instance, the total number of cattle in Kenya and Somalia declined by about 60% over the same period, while the herd size in Uganda and Ethiopia tripled. Despite the variations in trends and the marked shifts in the herd sizes, what is clear is that the beef herd has been growing over time in the region.

[4] The definition of East Africa used here follows that of the African Union.

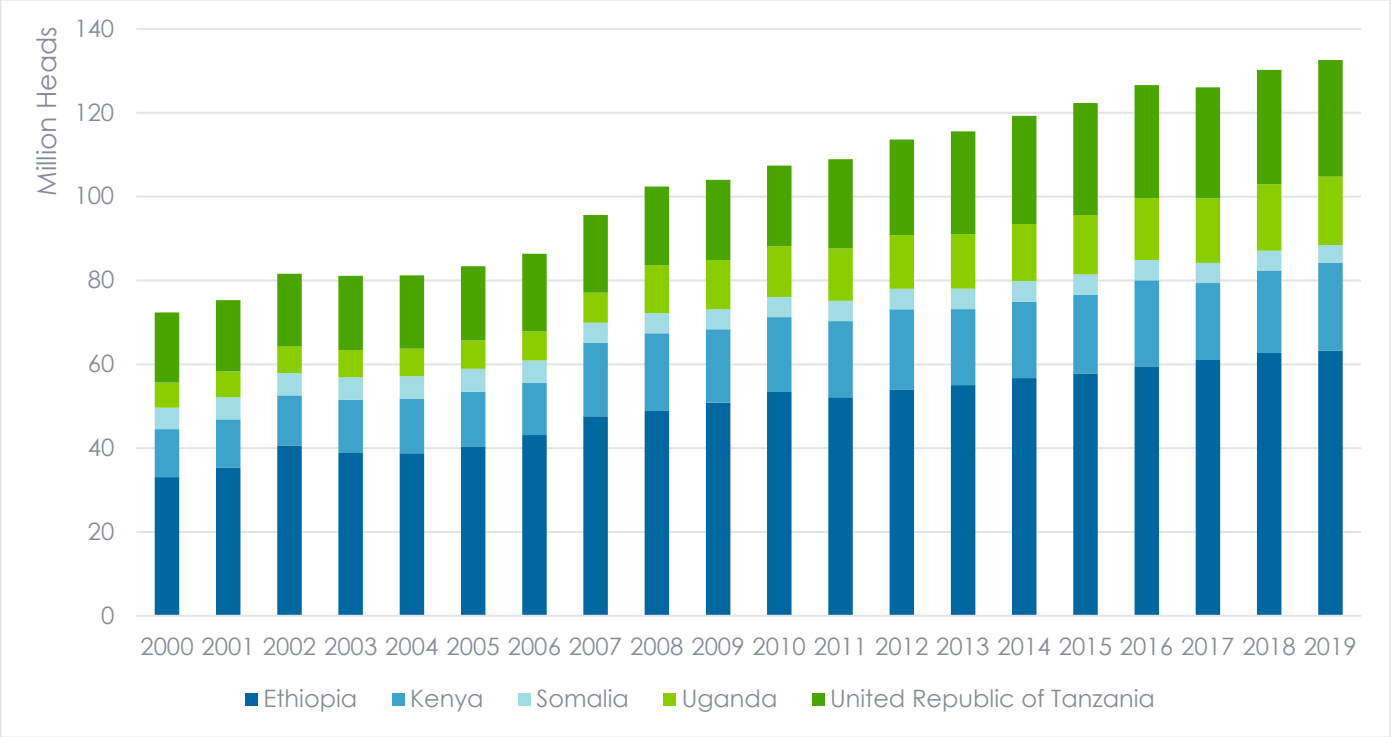

FIGURE 4 REGIONAL CATTLE STOCKS (2000 – 2018), MILLION HEADS

Source: FAOStat, 2020

An average of 9% of the total herd has been slaughtered annually over the period 2009-2018 in the region as a whole. Kenya and Somalia are slightly below the regional average, slaughtering 8% of their total herd annually, Tanzania and Ethiopia slaughter an average of 13% of their respective herds, and Uganda an average of 19%. Given increased total herd size, the number of animals slaughtered has also increased consistently over the past decade (Figure 5), with Tanzania growing the fastest in the region at 6% per year. The number of animals slaughtered in the other countries in the region, grew at between 2% and 4% per annum, except for Somalia, where it remained stagnant. Increased slaughter volumes have therefore been one of the primary drivers of gains in beef production (Figure 6).

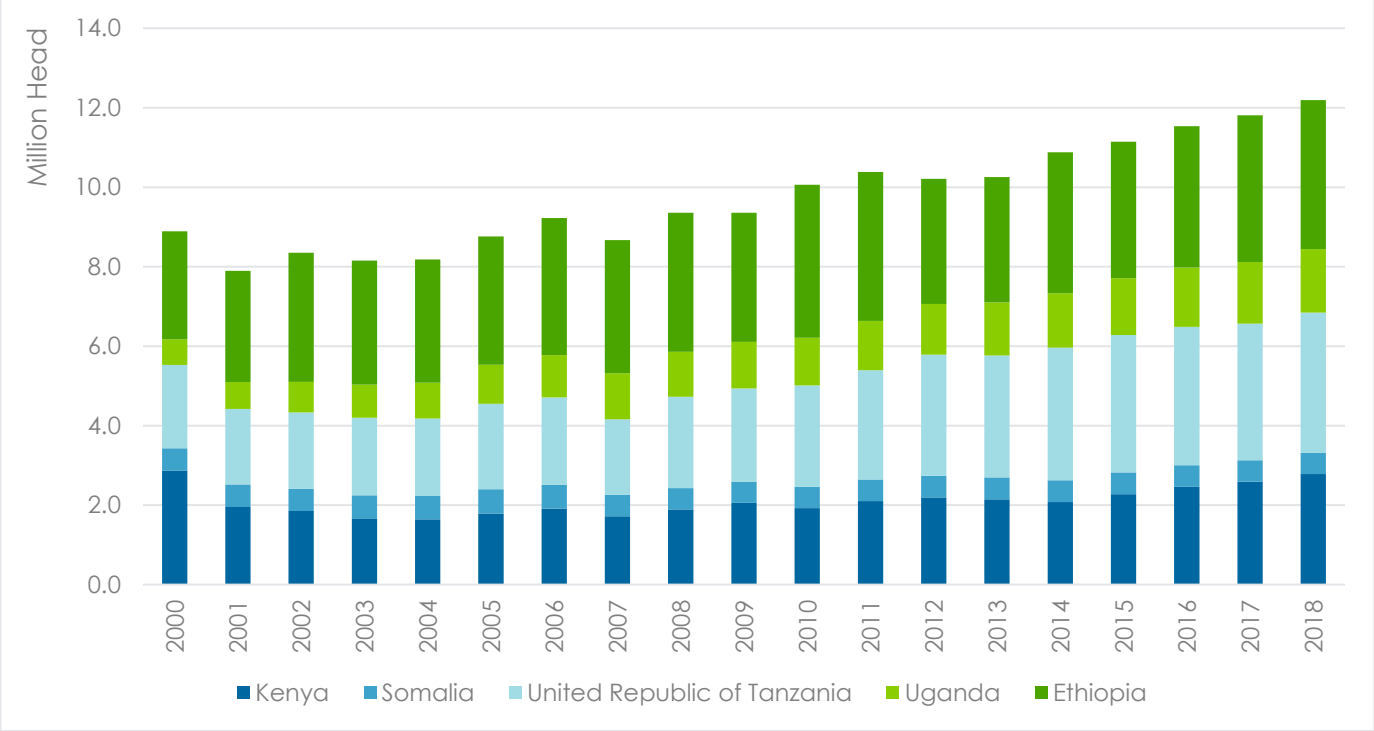

FIGURE 5 NUMBER OF ANIMALS SLAUGHTERED (2000 – 2018), MILLION HEAD

Source: FAOStat, 2020

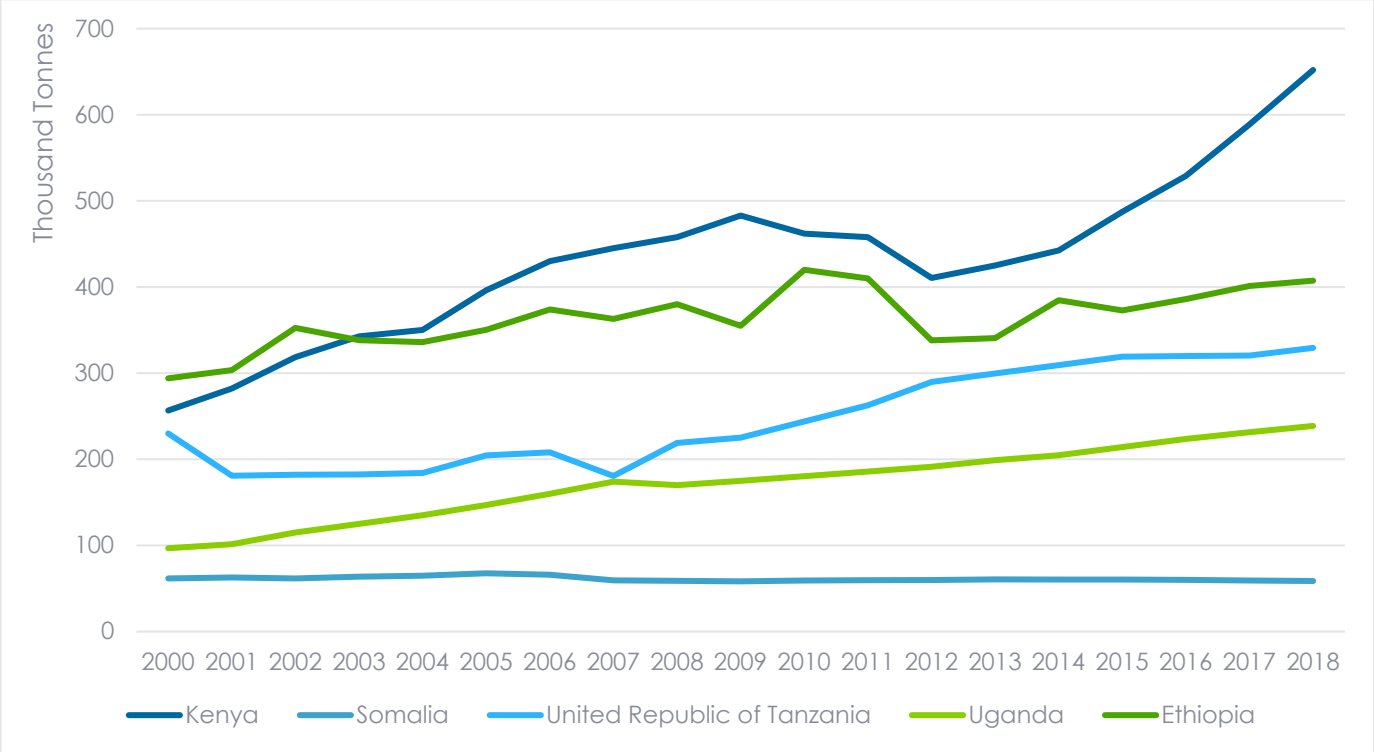

FIGURE 6 REGIONAL BEEF PRODUCTION BY COUNTRY (2000 – 2018), '000 TONS

Source: FAOStat, 2020

Per capita consumption of livestock products is still low in Africa compared to the rest of the world. Figure 7 shows the top five meat consumers in the world, compared to countries in the East Africa region. On a per capita basis, Uruguay is the leading beef consumer at 124kg/person/year, while Argentina is second with 120kg/person/year. The average for the sample of the East Africa region is significantly lower, fluctuating around 6.1/kg/person/year. This disparity is primarily the result of low income levels.

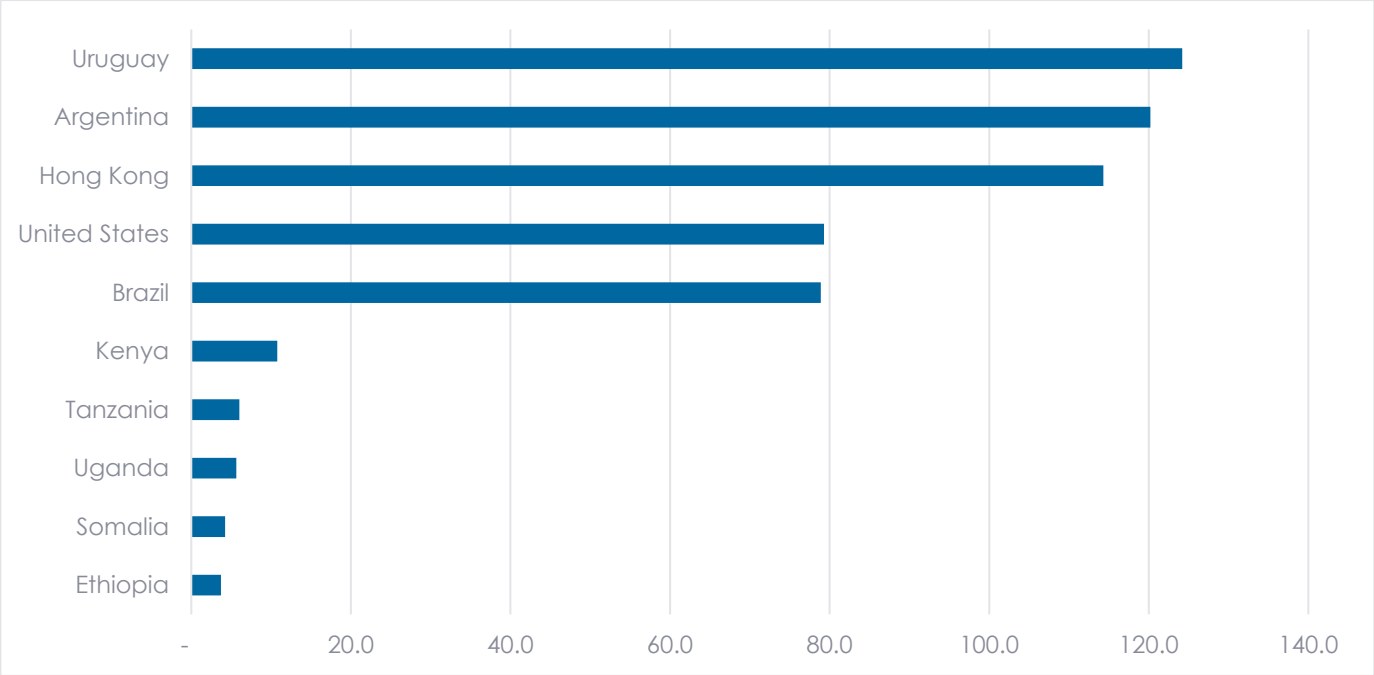

FIGURE 7 PER CAPITA BEEF CONSUMPTION BY COUNTRY (2016), KG/PERSON/YEAR

Source: FAOStat, 2020; Cook (2020)[5]

The average per capita consumption of beef in the region as a whole hardly grew over the period 2009-2018 (Figure 8). However, Kenya's average beef consumption increased by 7% over the same period, slower only than Tanzania's which grew by 12%. Per capita consumption declined in Somalia and Ethiopia by 21% and 10%, respectively.

[5] https://beef2live.com/story-world-beef-consumption-per-capita-ranking-countries-0-111634

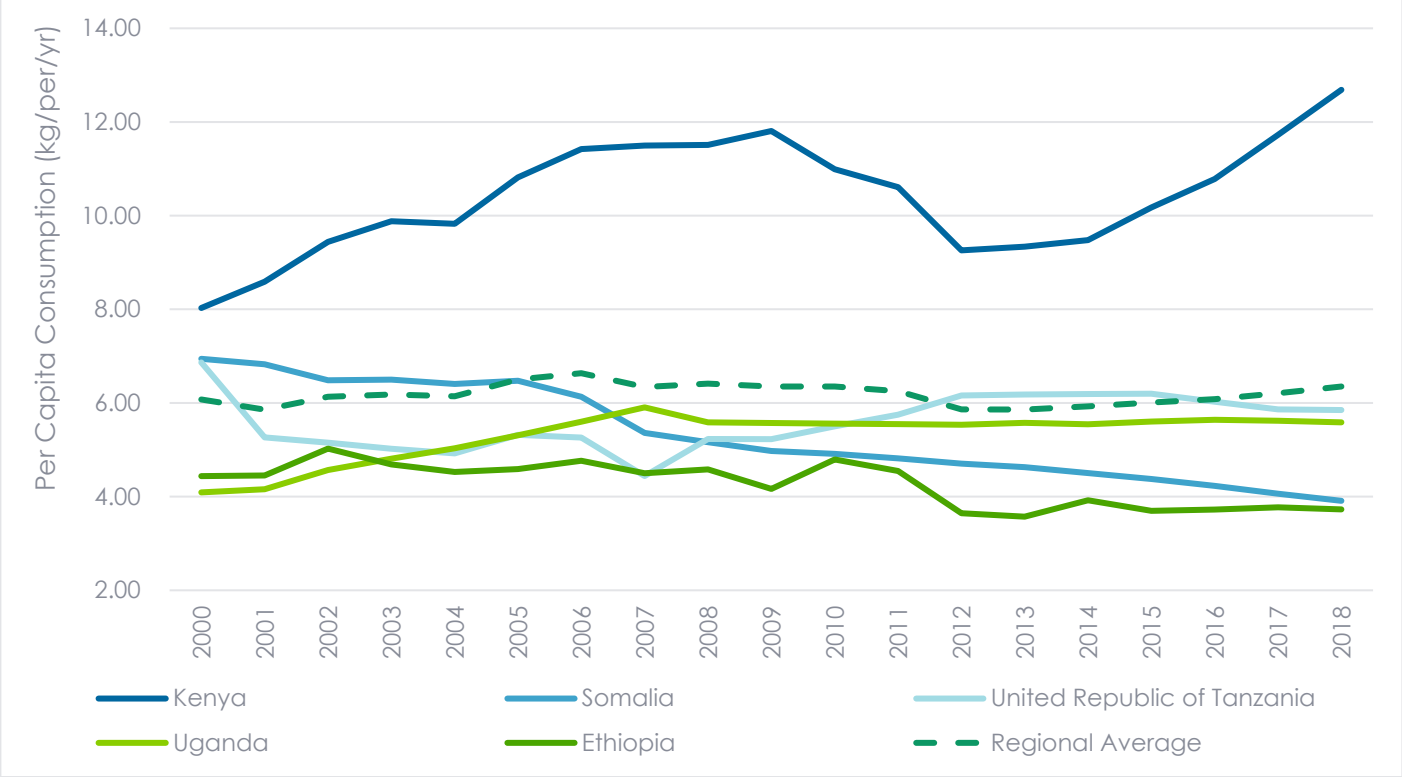

FIGURE 8 PER CAPITA BEEF CONSUMPTION BY COUNTRY (2016), KG/PERSON/YEAR

Source: Derived from UNPD-DESA and FAO (2020)

1.3. Domestic market

1.3.1 Supply and demand

Two-thirds of all meat consumed in Kenya is beef, and the size of the country's beef market averaged 526 000 tonnes per annum over the period 2014-2018. The size of the beef market has been growing consistently over the past ten years, from a consumption of 456 000 tonnes in 2008 to 592 000 tonnes in 2018 (Figure 9). The increase in beef consumption is partly driven by population, which increased from 38.6 million in the 2009 census to 47.6 million in the 2019 census. Besides population growth[6], the increase in beef consumption has also been driven by income growth (measured by annual gross national income (GNI) per capita), which grew from KES 3,137 in 2008 to KES 4,135 in 2018 in PPP (constant 2017 international $), an increase of 32%. Rising urbanization is also a contributing factor. Farmer and Mbwika (2012) report that most of the growth in meat consumption is concentrated in urban centres such as Nairobi and Mombasa, with these two main cities having the highest per capita meat consumption of 25.8 and 21.2 kg per year, respectively. Nairobi city

[6] Population is predicted to double and reach 97.2 million in 2050 (UNPD-DESA, 2020),

represents the major consumption centre for ruminant meat, with 14% of national consumption (Kenya Market Trust, 2014).

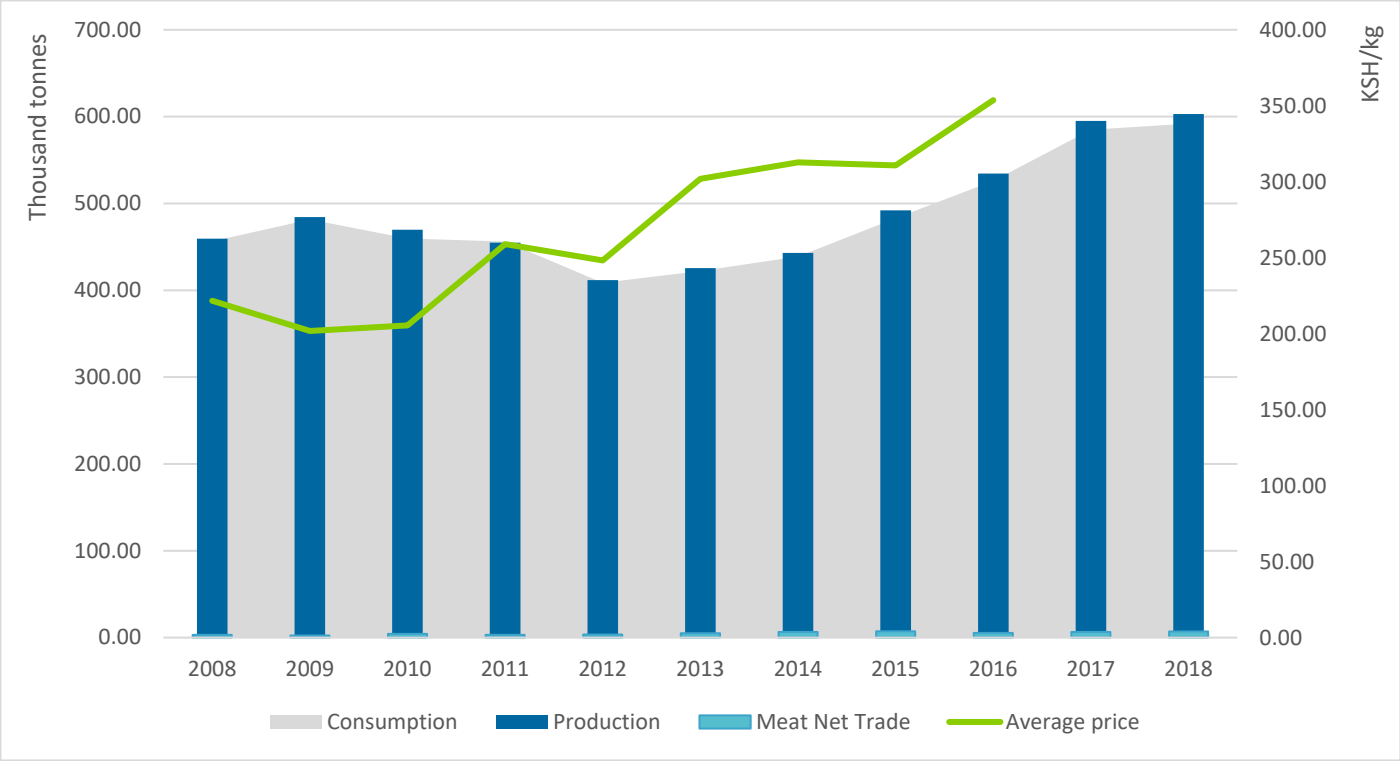

FIGURE 9 TRENDS IN BEEF PRODUCTION, CONSUMPTION, TRADE AND PRICE IN KENYA (2008-2018)

Source: KNBS, 2019; ITC Trademap, 2019

Kenya's consumer market can be segmented along three distinct but typical income groups namely, high income, middle income, and low-income segments. A study by the KMT (2019) found that purchasing decisions of red meat varied considerably across household income segments. High-income households tend to be health conscious and consider measures such as drug residues and hygiene factors taken in both producing and handling of the meat. Low-income households, on the other hand, prioritize price and affordability, and are very price elastic in their demand for beef.

The KMT (2019) makes further noteworthy observations which differentiate meat at butchery and slaughterhouse level. For the middle-income consumers, there is a drive to source beef from the Maasai ecosystem, ranches in Northern Tanzania, Uganda, and feedlots. For the low-income segment, beef is sourced from lean animals from any pastoralist market.

Most Kenyan consumers prefer fresh meat over the cold chain. This preference is a result of a lack of knowledge on the benefits of the cold chain, mostly the perception that meat kept in cold storage loses taste over time. With reference to the latter, consumers consider

fresh meat as safer than that kept overnight. The view on shelf life plays a significant role in consumption behaviour. Therefore, the quality of meat is judged according to taste, freshness (taken as slaughtered on the same day it is to be consumed) as well as leanness.

The key drivers of this trend in the high- and middle-income segments as ranked by significance are health concerns, uncertainty about the genuineness of the product, as well as quality and safety attributes. Therefore, phytosanitary issues are a key threat in the consumption of beef in Kenya.

In terms of production, the Kenya National Bureau of Statistics estimated that in 2020 Kenya's livestock sector contributed 3.6% to the nation's GDP and 17% to agricultural (crops & livestock) GDP. Kenya's beef cattle farming system can be classified into extensive grazing (which includes pastoralism and ranching), semi-intensive grazing (which includes mixed crop-pastoral (or agro-pastoral) farming) and intensive systems (feedlot) (FAO 2019).[7] Pastoralism is characterised by communal sharing of grazing areas and water resources. Livestock keeping in the system is uncommercialized with cattle breeds mostly indigenous. Ranches consist of large tracts of grazing land with most ranches also having disease control, feeding and water management infrastructure. They are commercially oriented and keep both indigenous and improved livestock breeds, with a focus on premium beef markets. Pastoralism and ranching are practiced in arid and semi-arid areas. Agro-pastoralism is practiced in areas that also support rain-fed agriculture. The system integrates livestock and crop production in a symbiotic relationship, where livestock are fed on crop residues, animal manure is applied to crops and animals are used for ploughing fields and transport. The system is mainly subsistence and the number of animals kept per holding is much smaller. A feedlot is a commercial system where livestock are kept under an intensive feeding regime for weight gain over a short period of time (about 100 days) and thereafter sold. The system is capital intensive, high-input and high-output and targets premium beef markets.

The FAO (2018) estimates that in terms of proportions, the extensive pastoralism accounts for 34% of production units; extensive ranching accounts for 11%; the semi-intensive system (agro-pastoralism) is the largest, accounting for 54% of production units; followed by the smallest (feed lots) which account for 1% of production units. Overall, an estimated 70% of Kenya's livestock production, including beef cattle, is in the Arid and Semi-Arid Lands (ASAL) (KMT, 2019)[8]. Farmer and Mbwika (2012) estimated that Kenya's livestock production in the ASAL was worth US $ 800 million in real terms (2005 base year of US$) while internal trade in pastoral areas was roughly US $90 million per annum.

[7] Alternative classification of Kenya's beef value chain is provided by Carabine et la., 2018): a more formal chain consisting of private ranches raising cattle and the other of informal pastoralists raising cattle in extensive production systems. This classification views the formal system as involving private ranching that incorporates a fattening component before the cattle is sold into the market, and the informal system as involving pastoralism with cattle being raised through extensive grazing and sold directly into the market.

[8] Other analysts estimate that pastoralist contribute 60 to 65% of beef supply in Kenya.

Sources of red meat supply consists of 65-70% from pastoralists, 20-25% from informal cross border traders and an estimated 2-3% from private ranches targeting the high-value market (KMT, 2019). Kenya has 450 ranches, most being private companies, whereas the rest consist of cooperative, group and Agricultural Development Corporation ranches (ADC) (KMT, 2019).

One key caveat which underlines the production and consumption numbers is that a considerable portion of informal trade in live animals takes place between Kenya and its neighbouring countries. Therefore, what is slaughtered in Kenya does not strictly represent animals produced in the country. Past studies (e.g. Farmer and Mbwika, 2012) noted that between 20 -25% of beef consumed is imported in the form of of live animals from Ethiopia, Somalia, Tanzania, and Uganda. Therefore, although Kenya appears to be self-sufficient in beef production (Figure 9), the country is generally a net importer of live cattle and, therefore, does not produce enough to cover its domestic consumption needs. According to the 2019 population and housing census, which also included a census of livestock, Kenya's national cattle herd consisted of exotic stock (improved breeds) of 2.8 million heads, of which 0.6 million were beef and the rest dairy, and indigenous stock of 13 million heads.

1.3.1. Policy framework

1.3.1.1. Evolution of Kenya's livestock sub-sector policies

The main policies and laws governing the Kenyan beef sector are summarized in Table 1. Immediately after Kenya's political independence, the government prepared the Sessional paper No. 10 of 1965 on "*African Socialism and its Application to Planning in Kenya*" as the basis for economic planning and investment. Among the agendas of the Paper were equal opportunities and increased incomes and its equitable distribution among the population. Public investments were to prioritize areas that had the potential to generate higher returns to investment the soonest. Thus, areas with high rainfall, rich soils for agriculture and a better network of roads and other infrastructure would be prioritized in the allocation of public development expenditure. This meant that arid and semi-arid areas dominated by nomadic pastoralism received little attention in terms of investment for development. These areas had also been neglected by the British colonial system. As a result, Kenya's beef value chain in general was starved of public investment during the colonial era and the immediate post-independence period.

In 1980, the National Livestock Development Policy was formulated with a broader view to spur growth in the livestock sector to combat the high incidence of poverty, enhance food security and foreign exchange earnings, promote sustainable use of the environment, and provide raw materials to the manufacturing industry. Input subsidies to livestock farmers were introduced, especially artificial insemination (AI) and tick control (through dipping)

services. These subsidies, however, were discontinued with market liberalization under the structural adjustment programmes (SAPs) in the late 1980s to early 1990s. The cost of livestock inputs and services became unaffordable to farmers while some services that the private sector could not offer became unavailable to many farmers. The result was a general decline in performance of the livestock sub-sector.

The National Livestock Policy 2008, the successor to the National Livestock Development Policy of 1980, aimed at addressing challenges in the livestock sub-sector, specifically relating to breeding, feeding and nutrition, disease control, marketing and value addition and research and extension. Two remarkable interventions in the policy were the commitment to enhance livestock marketing and value addition, including facilitating access to global markets for domestic livestock products, and expanding the scope of food items important to food security in Kenya to include livestock products, particularly milk and meat. These interventions were expected to expand demand and market opportunities for beef through exports and food security interventions.

Recognizing the changes brought about by Kenya's constitutional changes in 2010 and the development agenda in the Kenya Vision 2030 and Sustainable Development Goals, the country has proposed a review of the National Livestock Policy 2008. Thus, the Draft National Livestock Policy 2019 is currently under discussion. The Draft Policy seeks to address gaps in collaboration and coordination between the national and county governments as created in the 2010 Constitution; align the sub-sector's policy objectives to the Kenya Vision 2030, Sustainable Development Goals (SDGs) and other prevailing government policies; and address gaps in the use of ICT, in gender and social inclusion, in genetically modified organisms and in climate change mitigation as they interact with the livestock sub-sector.

1.3.1.2. Laws affecting the marketing of livestock and meat products

Established in 1950 through an Act of Parliament (The Kenya Meat Commission Act), the Kenya Meat Commission (KMC) was mandated to purchase livestock and to acquire, establish and operate abattoirs in the country. The Act was amended in 1967 to expand the definition of livestock to include cattle, sheep, goats and camels. Later amendments provided the KMC with an expanded mandate, which currently includes trading in livestock and meat products on a commercial basis while at the same time pursuing a welfare mandate through relief purchasing of livestock from farmers. It was hoped that KMC would provide a market for livestock farmers and supply quality meat products to consumers, but because of its mismanagement, the Commission accumulated unsustainable debts in later years and ceased operations in 1996. It was revived in 2006 but is still not performing well due to the accumulated debts and competition from the private sector operators in the industry. The business model of KMC and management problems have been blamed for its dismal performance and failure to serve its envisioned purpose. There has been talk within the government about plans to privatize the KMC to ensure its sustainability.

The Meat Control Act Cap 356 was instituted in 1975 to regulate the slaughter of animals and ensure quality control of meat. While it guides sanitary standards for food safety in the meat value chain, the jurisdiction of the Meat Control Act is limited to the abattoirs. Enforcement of standards in the meat value chain beyond the abattoirs is vested in the public health officials through the Public Health Act. This has raised concerns that uninspected illegal meat can potentially find its way into butcheries and be sold to unsuspecting consumers since public health officials are not trained to identify meat from different animals. Indeed, cases of dog and donkey meat being sold in retail butcheries in large towns have been reported. These cases are health hazards, raise integrity issues and can affect public confidence in the meat value chain.

The Livestock Bill 2019, which is still under discussion, is a draft Act of Parliament that seeks to consolidate the laws relating to livestock and livestock products and for connected purposes. It provides for the regulation and development of Kenya's livestock sub-sector by supporting management, processing and marketing of livestock and livestock products. The Livestock Bill 2019 implements the Livestock Policy 2008 and its amendment which is still in draft form - the Draft National Livestock Policy 2019. Emerging from the Livestock Bill 2019 is the Livestock and Livestock Products Marketing Bill, 2019, which is also still being discussed and aims to establish the Livestock and Livestock Products Marketing Board as the main agency through which issues of marketing of livestock and livestock products will be addressed. The Livestock and Livestock Products Marketing Bill, 2019 is premised on the realization that Kenya's livestock industry is regulated by several agencies that often perform their functions in an uncoordinated manner, leading to poor service delivery to the disadvantage of livestock farmers. This Bill will streamline marketing of livestock and livestock products in Kenya for the benefit of famers and other value chain actors.

TABLE 1: Policies and regulatory frameworks affecting the beef value chain in Kenya

Policy/ Regulation/ Strategy	Verification	Implications
Meat Control Act Cap 356	• Was instituted in 1975, with latest amendments in 2012 • Aimed at regulating slaughter of animals, including establishment of abattoirs and sanitary standards therein and health standards for animals to be slaughtered.	The Act guides food safety standards but only in the abattoirs. Beyond the abattoirs, enforcement of standards rests with public health officials under the Public Health Act. This creates a concern that uninspected illegal meat can find its way into butcheries and be sold undetected since public health officials are not trained to identify meat from different animals.
Kenya Meat	• The Act was passed in 1950 to	• Establishment of KMC was

Policy/ Regulation/ Strategy	Verification	Implications
Commission Act Cap 363	establish a commission, the Kenya Meat Commission (KMC), to purchase cattle and small stock, and to acquire, establish and operate abattoirs, meat works, cold storage concerns and refrigerating works for the purpose of slaughtering cattle and small stock, processing by-products, preparing hides and chilling, freezing, canning and storing beef, mutton, poultry and other meat foods for export or for consumption within Kenya, and to confer certain exclusive rights upon the Commission, and for connected purposes.	hoped to provide a market for livestock farmers and supply quality meat products to consumers. • However, largely because of mismanagement, the KMC accumulated unsustainable debts and collapsed in 1996, was revived in 2006 but is still not performing well due to the accumulated debts. • The business model of KMC, which has combined a profit making motive with relief purchase of livestock from pastoralists, and management problems have been blamed for its dismal performance and failure to serve its envisioned purpose.
National Livestock Development Policy of 1980	• The policy had the following objectives: address the high poverty incidence; enhance foreign exchange earnings and food security; promote sustainable use of the environment; and provide raw materials for processing and manufacturing industry. • The livestock sub-sector received subsidies under the policy until implementation of the structural adjustment programmes (SAPs) in the late 1980s to early 1990s.	• The SAPs introduced market liberalization and the subsidies to the livestock sub-sector were stopped. The cost of livestock inputs and services became unaffordable while some services that the private sector could not offer became unavailable to many farmers. The result was a decline in performance of the sub-sector.
Sessional Paper No. 2 of 2008 On National Livestock Policy	• The policy aimed at addressing challenges in the livestock sub-sector, specifically relating to breeding, feeding and nutrition, disease control, marketing and value addition and research and extension.	• The policy provided direction for the delivery, management and funding of livestock research and extension; livestock inputs and veterinary services; and disease control. It also committed to enhancing livestock marketing and value

Policy/ Regulation/ Strategy	Verification	Implications
	• Objectives included to: develop appropriate livestock management systems for sustainable development of the livestock industry; improve and conserve animal genetic resources; improve management and control of animal diseases and pests; ensure safety of food from livestock products, including meat; ensure quality standards and quality assurance in livestock value chains; and address a range of cross-cutting issues that affect the livestock sub-sector.	addition, including facilitating access to global markets of domestic livestock products. • One of the important interventions in the policy was to expand the definition of food security to include livestock products, particularly milk and meat. This would be expected to lead to recognition of these products in food security interventions and expand their supply and demand. • The policy outlined establishment of modalities for emergency livestock off-take to mitigate losses to farmers in drought conditions, which would further ensure continued supply of livestock products.
The Constitution of Kenya 2010	• The Constitution of Kenya 2010 introduced two levels of government - the national and county governments – and delineated the functions of each. • In the agriculture sector, the national government is responsible for developing policies, standards and norms and regulations for international trade, and capacity building for county governments. The county governments are responsible for crop and animal husbandry; livestock sale yards; county abattoirs; plant and animal disease control; and fisheries.	• Because management and control of livestock pests and diseases is the function of county governments, it is necessary to establish a formal framework for coordination of such activities among the counties. While there exists a Joint Agriculture Sector Consultation and Cooperation Mechanism (JASCCM) as a technical linkage between the national and county governments, no such formal framework exists for coordinating agricultural activities among counties.
Draft National Livestock Policy 2019	• The draft policy seeks to address gaps in the National Livestock Policy 2008,	• The policy is in draft and has not been passed yet. • Some of the new proposals in the

Policy/ Regulation/ Strategy	Verification	Implications
	specifically: ○ collaboration and coordination between the national and county governments as created in the 2010 Constitution. ○ aligning policy objectives to the Kenya Vision 2030 and Sustainable Development Goals (SDGs) and other prevailing government policies; and ○ other gaps such as use of ICT, gender and social inclusion, genetically modified organisms and climate change.	policy include: ○ Establishment of sustainable and accessible livestock insurance schemes. ○ promotion and encouragement of private sector investment in livestock insurance. ○ enhancement of the capacity for general supervision and control over transfer, handling and use of livestock-related genetically modified organisms (GMOs); and ○ strengthening of the KMC to play its role and serve as the custodian of strategic meat reserves in the country. This implies that meat will be recognized in food security considerations.
The Livestock Bill 2019	• The Bill is a draft for an Act of Parliament to consolidate the laws relating to livestock and livestock products and for connected purposes. • Its objective is a legal framework that provides for the regulation and development of Kenya's livestock sub-sector by supporting management, processing and marketing of livestock and livestock products • The Bill implements the Livestock Policy 2008 and its amendment which is still in draft, the Draft National	• The Bill provides a framework to support collaboration and coordination between the National and County Governments in performing their functions in the livestock sub-sector. • The Bill also establishes several agencies for regulating and managing the livestock sub-sector, namely: ○ National Livestock Regulatory Board to regulate the livestock industry, carry out sanitary veterinary mandate, and provide advice to the National and County

Policy/ Regulation/ Strategy	Verification	Implications
	Livestock Policy 2019.	Governments on the regulatory and development issues in the livestock sub-sector. o Livestock and Livestock Products Marketing Board as the main agency on matters of marketing of livestock and livestock products. o Kenya Veterinary Institute for commercial vaccine production and marketing in the East African region. o Kenya Animal Genetics Resources Agency to guide livestock gene development, upgrading and conservation. o Kenya Tsetse and Trypanosomiasis Eradication Council to coordinate tsetse and trypanosomiasis eradication efforts; and o Kenya School of Livestock to train middle level cadres in the livestock sub-sector.
The Livestock and Livestock Products Marketing Bill, 2019	• This is an Act of Parliament to establish Livestock and Livestock Products Marketing Board, which will be the main agency through which issues of marketing of livestock and livestock products in Kenya will be addressed.	• The rationale for the Bill is that Kenya's livestock industry is regulated by several agencies that often perform their functions in an uncoordinated manner, leading to poor service delivery to the disadvantage of livestock farmers. It is hoped that the Bill will streamline marketing of livestock and livestock products in Kenya for the benefit of famers and other value chain actors. • The Bill is still in parliament for discussion.

2. VALUE CHAIN ANALYSIS: CURRENT STATE

2.1. Value chain map of product flows

Kenya's beef value chain is long and complex, involving various segments that handle live animals and meat products (Figure 10Figure 10). Figure 10 highlights three important observations:

- Firstly, Kenya's beef market relies on a substantial number of cattle imports from its neighbouring countries (Figure 11), to meet the growing demand for meat. It is estimated that up to 17% of total marketed cattle are imported.
- Secondly, the share of feedlots in total production is currently low, and they predominantly supply markets that demand products of higher quality, such as high-class butcheries, the hospitality industry and export markets. It is important to note that promotion of feedlots is currently part of the government's policy and investment agenda for the sector. If the plan is implemented, it has the potential of increasing the supply of beef to high-end markets, including exports, as a result of improved quality products from the more intensive system. There is currently no Keyan standard for exports; beef exports are based on the standards of market requirements. Therefore, increasing the share of production from the feedlotting system would require some kind of grading system.
- Thirdly, pastoralism & agro-pastoralism are important sources of animals for feedlots. This implies a need for improving the quality of animals in the pastoralists' & agro-pastoralists' herd to supply quality animals to feedlots and ensure efficiency in the system.

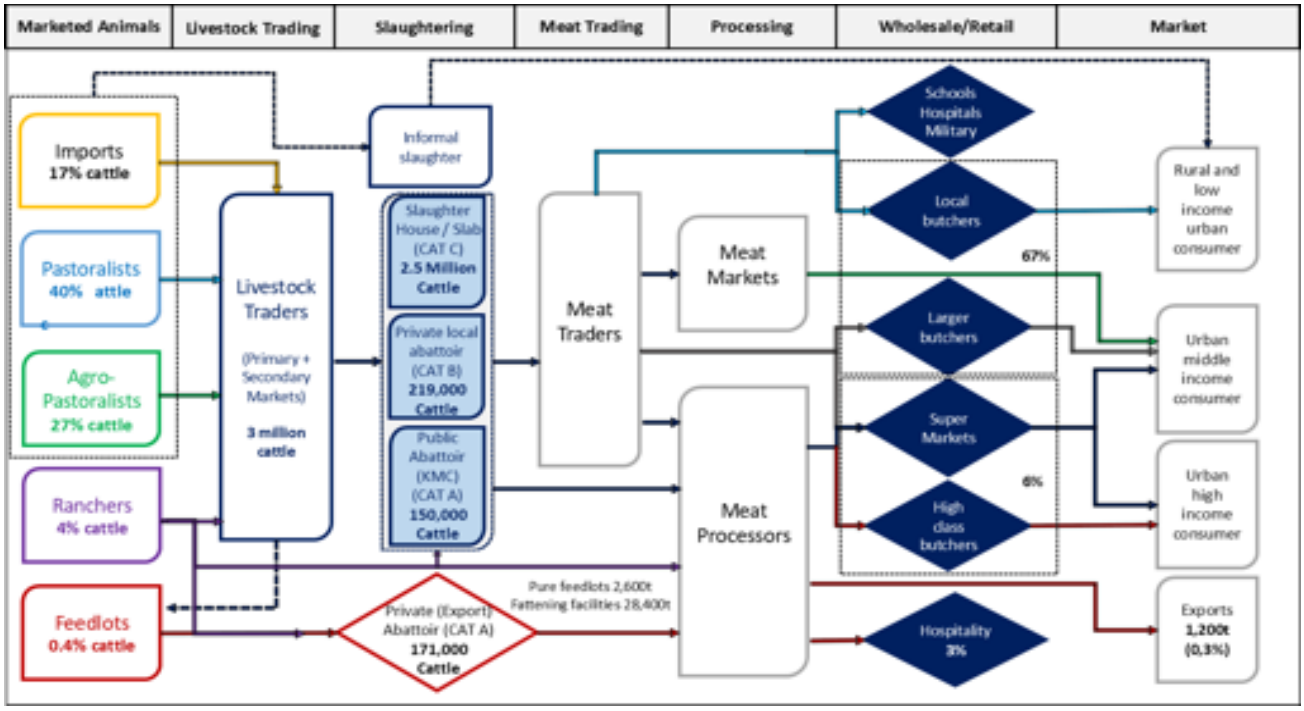

FIGURE 10 CURRENT STATE OF THE BEEF VALUE CHAIN PRODUCT FLOW
Source: PPVC, 2020

FIGURE 11 KENYA LIVESTOCK TRADE CORRIDORS

Source: KMT, 2020

2.2. Players at each value chain node

The purpose of this section is to establish the current "as is" scenario. It presents the current state of the value chain through primary or field level data and the evaluation of the most recent beef value chain literature available. This was combined to build a macro-picture of what the beef value chain looks like in terms of actors, activities and the indicative gross margin analysis.

2.2.1 Domestic production, marketed animals and livestock trading:

Kenya's primary beef production system can essentially be categorised into 4 groups, pastoralism, agro-pastoralism, ranching and feedlots (Figure 12). Within the pastoral system, which constitutes an estimated 34% of farms and 40% of the cattle that enter the market, production is extensive in nature, often in communal areas. Animals are typically kept as assets and only sold when necessary, resulting in a non-commercial production system that relies predominantly on indigenous breeds. These breeds are well adapted to the arid and semi-arid conditions, but productivity remains low. The average herd size is typically about 50 cattle, offtake rates are estimated to be as low as 15%, and growth rates are also slow. Slow growth, combined with inherently small carcasses associated with East African Zebu and Boran parent stock results in low carcass weights. Cattle are sold at various ages with little regard for optimal time for marketing.

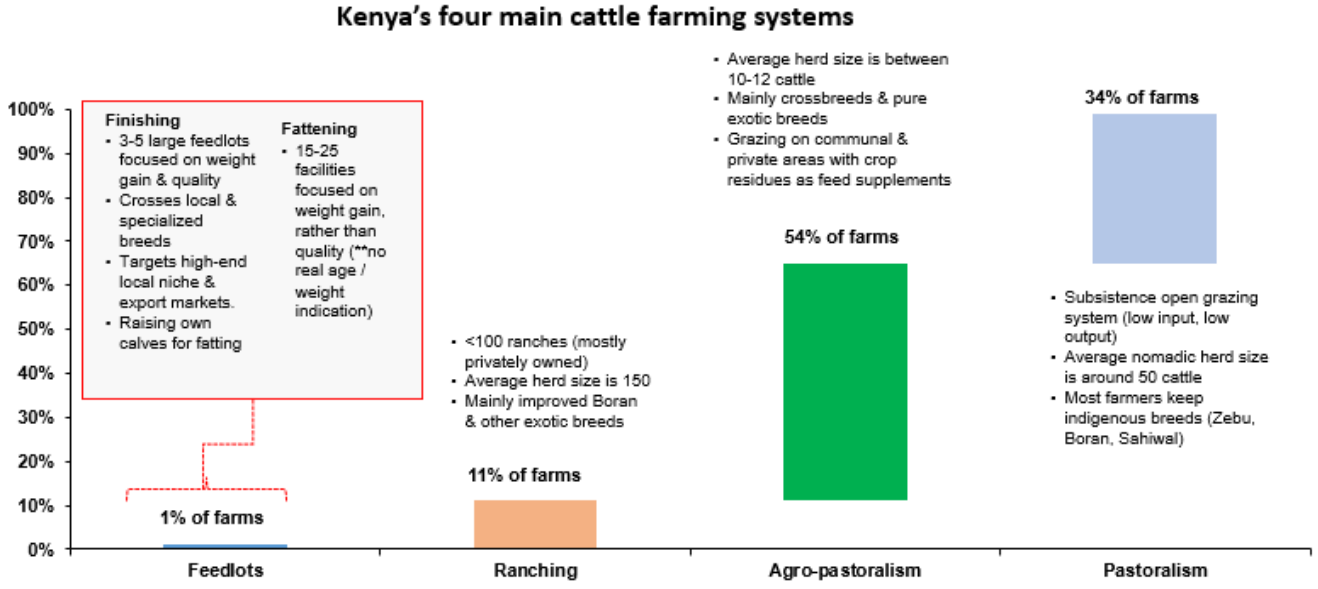

FIGURE 12 Current production structure of Kenya's beef cattle systems

Source: PPVC, 2020

Ranches and feedlots contribute a very small percentage (approximately 2%) to the production of red meat and less than 5% of the marketed animals. Due to the higher quality

meat produced by feedlots and ranches, the meat produced is sold to hotels, restuarants and supermarkets that pay a higher price. A study by the Kenya Markets Trust (2020) found that approximately 30% of ranchers were in the business of finishing animals while 70% had fattening enterprises, although the distinction between the two production systems seemed not to be clear-cut as some operators practised both fattening and finishing. Figure 133 shows the differences in the supply of animals for the two operations. Fattening and finishing enterprises can be characterised in one of three ways: extensive, semi-intensive and intensive. Under the intensive system, animals are confined and trough-fed whilst under extensive systems animals are kept on open pastures, and those under semi-intensive are occasionally confined and provided supplementary feeding to attain market weight.

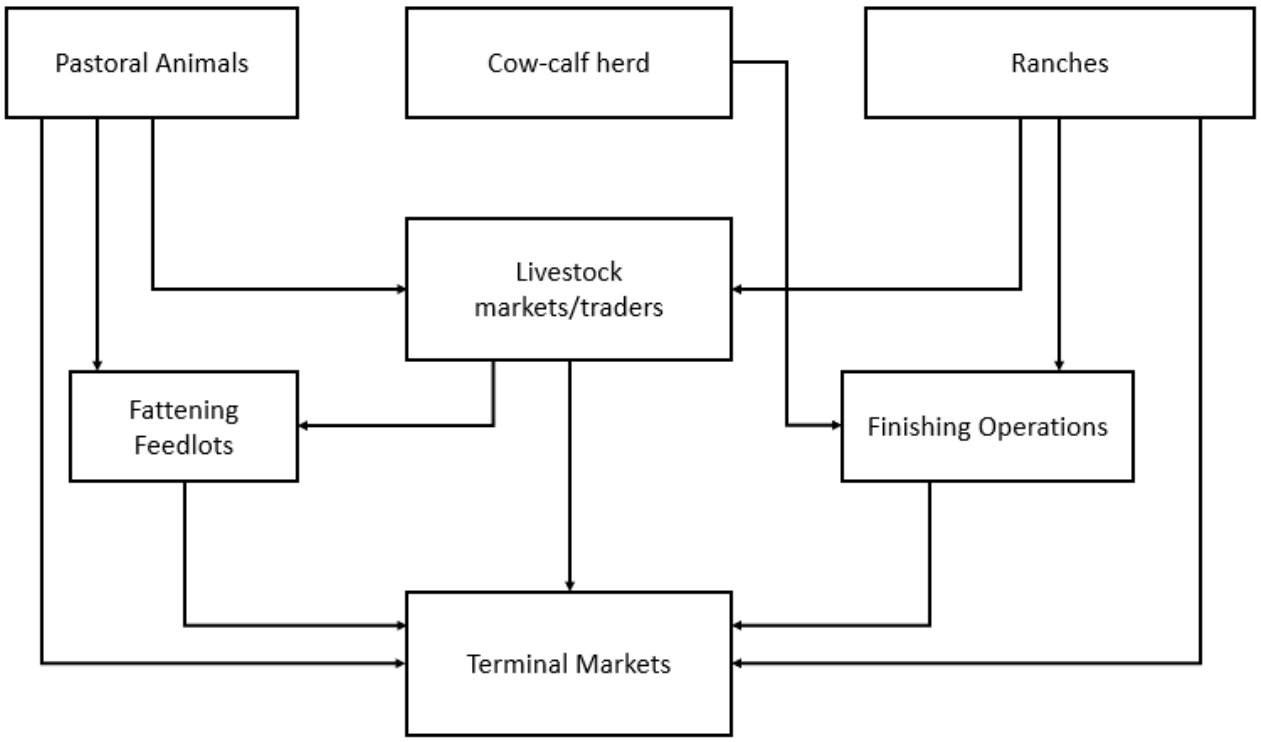

FIGURE 13 DIFFERENT SUPPLY CHAINS FOR FATTENING AND FINISHING OPERATIONS

Source: KMT, 2020

2.2.2 Slaughtering, processing and meat trading:

Alarcon et al. (2016) partitioned the beef markets into three food segment categories: local terminal markets (LTMs), meat markets (MMs), and large processing companies (LPCs).

The LTMs include markets in large urban areas such as Dagoretti, Kiserian, Njiru and Kiamaiko in Nairobi Metropolitan Area. These markets have the following characteristics:

- Live animals are sold, slaughtered and their products traded.

- Operations involve many independent people with no specific person or company dominating any of the activities
- They have clearly documented private standards, although enforcement is limited. Most activities are dictated by the experience and cultural rules of independent operators, such as traders, transporters, or abattoir workers.
- Carcasses are sold and traded with little apparent differentiation between different meat qualities, albeit separate market flows for the offal. The value addition operations are therefore limited, and trade focuses on common raw products that are not branded.

The LPCs represent companies that integrate slaughtering of livestock and the marketing and distribution of products, among other functions. They have private standards (company rules) and company managers are responsible for most of the operations. Value addition of products is extensive and products are often branded.

Meat markets (MMs) involve meat traders owning stalls in the markets from where they dispay the carcasses. These carcasses are often sourced from the LTMs. Meat traders in the MMs are either meat wholesalers who bring to and sell form the market large quantities of meat to businesses, or meat retailers who sell meat in small quantities from onsite butcheries to consumers and restaurants outside the markets.

Most of the animals are slaughtered in slaughterhouses, which can be private or public. Private slaughterhouses belong to individual companies which slaughter animals for the domestic market and/or exports. Public slaughterhouses are found in LTMs, typically in the lagre urban areas as well as in small towns and rural areas. In rural areas, the slaughterhouses are often just slaughter slabs. The Meat Control Act Cap 356 regulates operations of slaughterhouses, including the establishment and sanitary standards in slaughterhouses as well as health standards for animals to be slaughtered. Despite the Meat Control Act, animal slaughterings do occur informally at slaughter facilities.

Most beef traded in Kenya does not pass through processing. Meat processors, i.e. the LPCs, mainly supply the high standard butcheries, supermarkets, hospitality industry and export markets.

2.3. Baseline gross margin analysis

The four production systems that characterise the Kenya beef industry have quite distinctive operations resulting in different market prices, production costs, revenues as well as production margins. The pastoral production system (whether farming with local or cross breeds) has very little production costs compared to the extensive ranching and feedlot systems. Of the four systems, feedlots incur the highest production costs. However, due to the high-quality product produced, a higher market price is also realised. Pastoral producers with local breeds sell their meat at a lower price compared to the other

production systems. As a result, revenues and margins are also different, with the feedlot system realising the highest income and margins. Although pastoralists with cross breeds realise a lower income (turn-over) compared to the extensive ranching system, they still make a higher profit margin due to their minimal costs (Figure 14).

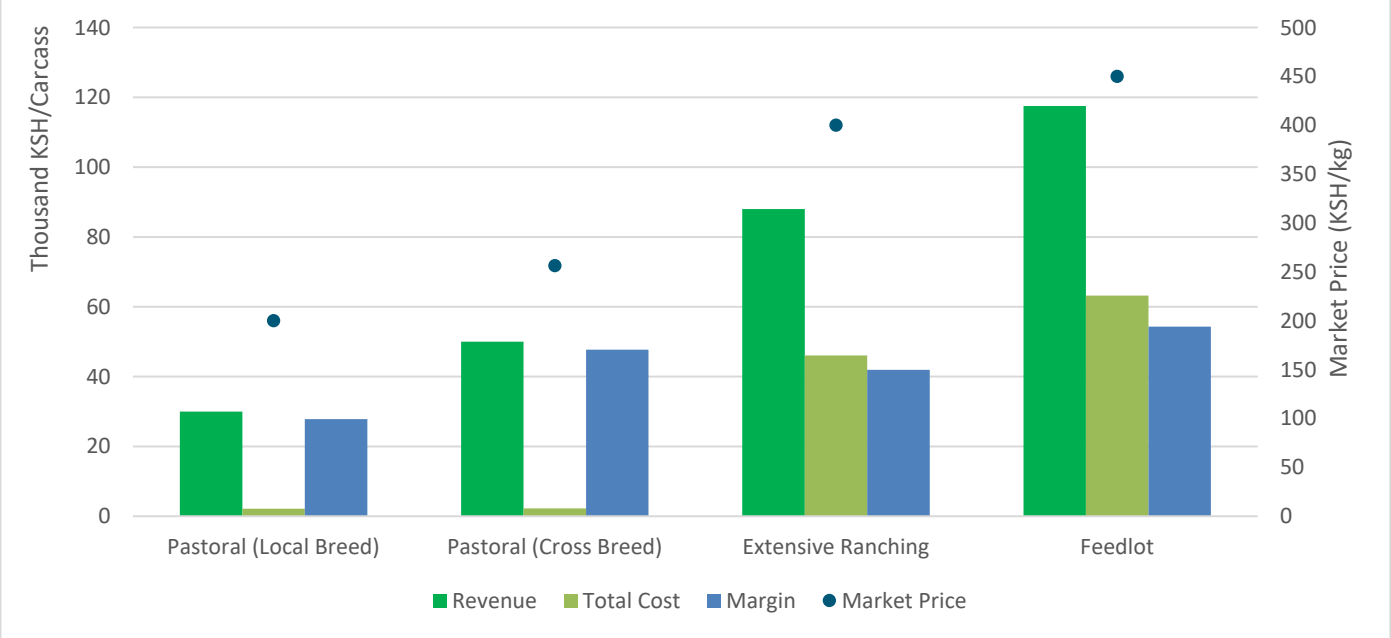

FIGURE 14: INDICATIVE GROSS MARGINS UNDER DIFFERENT PRODUCTION SYSTEMS

Source: PPVC Gross Margin Analysis, 2021

3. VALUE CHAIN ANALYSIS: DESIRED OR IDEAL STATE

The combination of rising beef consumption in Kenya, limited exports, and a substantial share of live cattle imports from neighbouring countries suggests that there is ample opportunity to expand domestic production. Exploiting that opportunity would require not only rising volumes, but also improvements to the quality of animals presented for slaughter, thereby enabling the replacement of currently imported cattle with domestic production, whilst also unlocking additional export opportunities.

3.1. Challenges in the beef sector

Some of the most important constraints in the beef value chain relate to the level of productivity and carcass quality. In terms of productivity, a major limitation is poor genetics

of animals, especially in the pastoralist and agro-pastoralist herds. Over the years, beef cattle producers have been practising negative selection, eliminating the best breeds through slaughter, due to higher prices achieved for better quality animals. The practice is one of the leading contributors to poor breeding stock in the pastoralists and agro-pastoralists' herds. Multiple studies (e.g., Mwangi et al., 2020) have found that over 70% of breeds in the pastoralist and agro-pastoralist herds are East African Zebu. These breeds take at least five years to reach slaughter weight and even then tend to produce a smaller carcass, with weights ranging between 135 – 180kg. Beef from such carcasses is of lower quality and cannot enter export and domestic premium markets. There is also a lack of a structured grading system in a large part of the Kenyan cattle market, and so the market is not segmented or stratified for quality and consistency. Only a few buyers (e.g. Farmer's Choice) are purchasing cattle based on a first order grading methodology. This lack of a grading system does not create an incentive to produce high-quality cattle.

Interventions aimed at enabling export led growth in the Kenyan livestock sector would have to be accompanied by the appropriate **animal health & meat safety standards** as prescribed either bilaterally by the trading partner, or by the World Organization for Animal Health (OIE). In most instances, the ability to trade is dependent on compliance with protocols specified by the importing country, as well as the animal health status of the exporting country, as issued by the OIE. The PVS Gap Analysis report for Kenya (OIE, 2011 and 2018) identified a number of gaps relating to the overall animal health status, and also provided clear guidelines, interventions and funding requirements to address them. Presently, some in-country strategies of intermediate compliance help to mitigate the effect of such gaps. An example is the procurement procedure implemented by the KMC relating to animal health, as well as their quality assurance protocol which is HACCP (Hazard Analysis and Critical Control Points) compliant and meets the requirements of the ISO22000:2005 standards. To date, this has been sufficient to enable trade to the Middle East and some parts of Asia, but for risk mitigation and the longer term sustainability in the Kenyan livestock sector, it is important that the recommendations contained in the PVS report be implemented.

An important constraint mentioned in the PVS report was the lack of a **national livestock identification and traceability system**. Such a traceability system should provide for the identification of animals at birth. At this stage however, identification with earmarks and branding is still rudimentary. Identification and traceability can be facilitated by the Agriculture, Livestock and Fisheries Sector Board within KEPSA. Similarly, the Kenya Bureau of Standards (KNBS) could, within its mandate, facilitate the adoption of standards based on specific market requirements, but industry stakeholders and government would still need to develop these standards and protocols.

The market led interventions prioritized in this report are aimed at unlocking premium markets for high quality products and would therefore require animal & public health, as well as identification and traceability, to be prioritization in the next decade.

Unlocking market access and quality premiums will enhance growth opportunities, but the ability to supply competitively remains critical to unlocking the benefits associated with such opportunities. Presently, production is dominated by extensive systems, but further expansion, both in terms of beef herds, grazing and feed grain production is limited by land constraints in Kenya. Intensive systems currently provide a very small share of production and there is scope to grow such systems, however competitiveness within these systems is inhibited by a number of challenges, which are presented in Table 2. Among these challenges if the cost of feed in Kenya.

TABLE 2 CURRENT CHALLENGES IN THE FEEDLOT PRODUCTION SYSTEM

Challenges	Cause	Effect
High start-up costs and capital investment	• It costs approximately KSh9.5 million to establish a feedlot that produces between 200 to 300 animals per annum.	• High barriers to entry and slower growth of this segment of the production system
High Feed costs	• Kenya is a net importer of maize and soybean, and thus, feed costs are exorbitant. • ASALs are not conducive for fodder production and most feedlots are forced to buy feed instead.	• Kenya would not be able to compete with other global producers on grain-fed beef, due to high feed costs.
Disease outbreaks	• Government has a reactive approach to disease control – vaccinations typically occur when there are outbreaks.	• There are frequent disease outbreaks of FMD, lumpy skin and anthrax. • Increases the risk to production and profitability
Difficulties sourcing of animals of the right weight	• Animals from pastoralists are usually not in good condition and not reaching ideal weights.	• Feedlots and pastoral systems are not integrated. Sale of animals from pastoralists to feedlots is sporadic.

Kenya's challenge of high feed costs affects all intensive livestock sectors and emanates from its deficit in raw material production. Kenya is a net importer of important raw materials used in the manufacture of animal feed, including maize as primary energy source and soybean meal, the major source of protein in rations. This results in increased prices. While the raw maize and soybean meal can be procured at significantly lower cost elsewhere, factors such as transport costs (both sea freight and inland), port and handling costs and tariffs all add to the import parity levels (Figure 15). Both soybean meal and maize sourced from outside the East African Community carry significant tariffs (of 10% and 50%

respectively). In the case of maize, this is further exacerbated by the premium payable for non-GM maize.

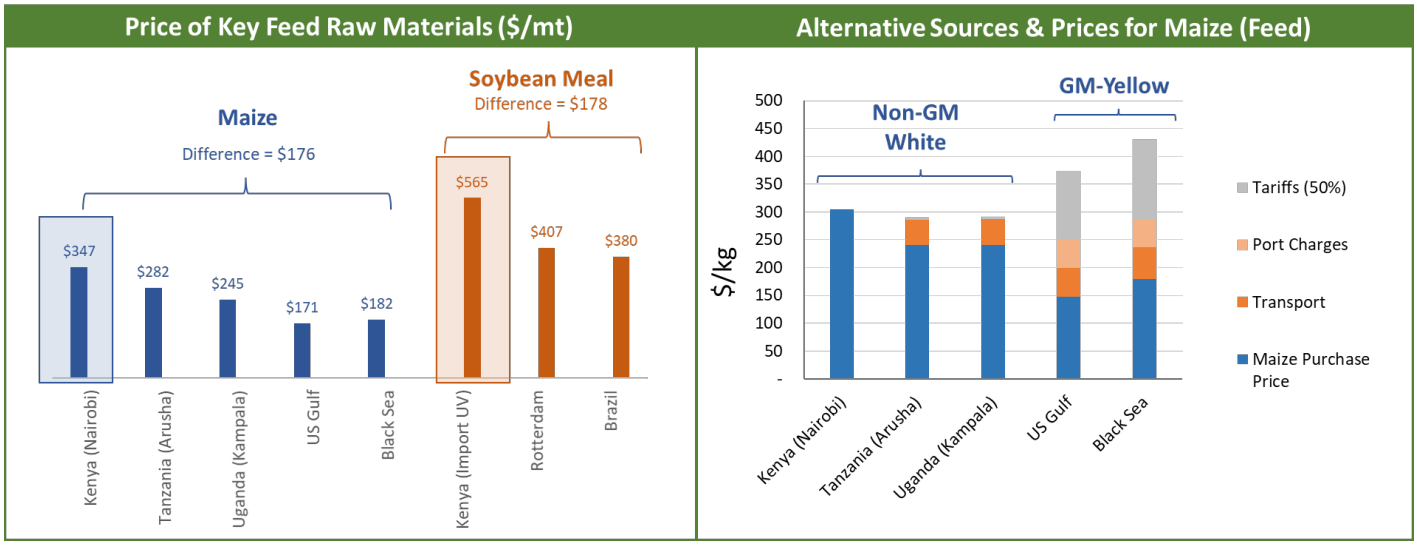

FIGURE 15: PRICES AND COST DRIVERS OF KEY RAW MATERIALS FOR ANIMAL FEED PRODUCTION

Source: PPVC Gross margin analysis

3.2. Proposed interventions

In order to address the challenges faced by the sector, a number of interventions and investment priorities have been identified. These have been grouped into three broad categories below.

3.2.1 Introduction of a grading and classification system

Introduction of a grading and classification system, based on factors such as age, body condition and fat score, can unlock additional value by incentivizing production of quality animals. This will not only improve marketing, but also enable further processing and value addition, enabling exports of premium products. Such exports can in turn enable carcass optimisation strategies, with a premium for high value cuts, enabling better affordability on the balance of the carcass in the domestic market.

3.2.2 Expanded use of finishing and fattening systems

Unlocking premium markets enables a drive to expand feedlot productionand so to increase supply of top-quality products. These can be marketed in premium domestic or export channels, but competitiveness is critical. Consequently, a competitive feed sector is a key enabler of growing output from feedlotting systems. Furthermore, such systems make use of improved breeds and so a consistent supply of improved breeding stock is critical to the sustainability of expanded feedlotting. The rationale for driving feedlot production is

summarized in Table 3, while Table 4 presents interventions that would unlock the opportunities that they create. Figure 16 presents the location of existing and proposed feedlots.

TABLE 3 RATIONALE FOR FEEDLOTS

Reason	Description
Unlocking economic potential in ASALs	Could raise quality standards and production practices in entire beef industry through: • Standard operating procedures (e.g. appropriate health protocols for disease management and control systems) • Quality assurance systems and higher product standards • E.g. Purchasing, fattening, and finishing younger livestock • Mitigate effects of drought on livestock and livelihoods
Traceability systems for livestock and meat	Could help in disease surveillance and control, and build confidence of high-end importers and consumers in Kenyan beef
Grow local feed industry	Demand pull could increase production of higher quality locally produced feed
Access export markets	Contract models to secure/guarantee markets locally and abroad. This could also help support fair pricing and higher farm incomes
Better genetics	Improve national herd, allowing for better feed conversion and higher productivity

TABLE 4 OPPORTUNITIES IN THE FEEDLOT PRODUCTION SYSTEM

Intervention	Opportunity	Impact
Access to more export markets	• Industry wants the Kenyan Government to negotiate free trade agreements and preferential market access in Asia and the Far East	• Access to new export markets could provide new opportunities for the feedlot system to increase production and grow

Organizing the industry through an Association	• Feedlots are currently forming an Association that can support and encourage production from new entrants. • Propositions of forming cooperatives to displace unscrupulous traders	• (New) farmers have good technical support that can help them produce more efficiently • Farmers take a higher margin if marketing of animals is done through coops. • Also builds economies of scale and predictability in supply
Disease management and control	• A proactive strategy to disease control through structured and continuous vaccination programmes	• Eradication of diseases with frequent outbreaks • It can become possible to establish disease-free zones that can be used to produce meat for exports in key new markets
Coordination and structure in production systems	• Integration of the pastoral and feedlot systems through structured contracts and target ideal animals	• A "demand-pull" of pastoral production systems into feedlots can increase quantity and quality of beef in the market. • Increases in farm incomes due to improved production practices form pastoral animals.
Lower Feed costs	• Explore the feasibility of grass-fed beef in certain regions, where possible.	• Grass-fed beef fetches a premium in certain overseas markets. This can lead to increased exports

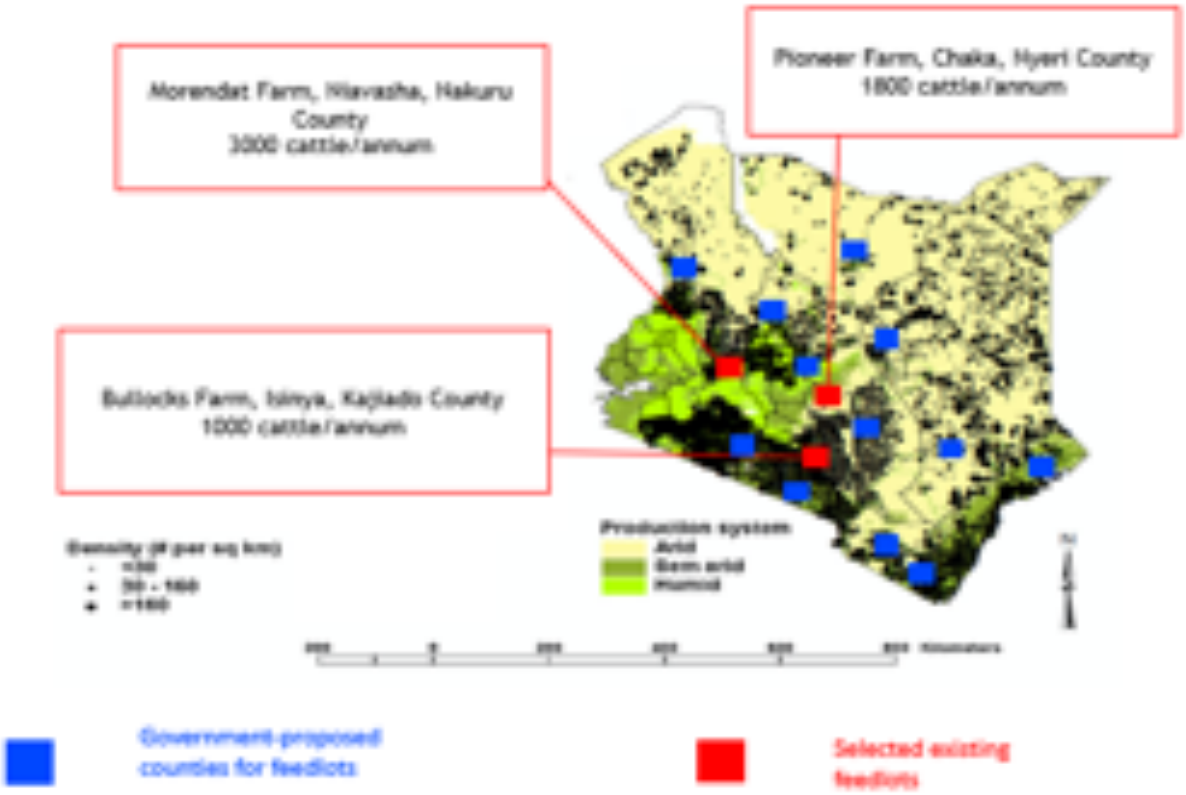

FIGURE 16: Location of existing and proposed feedlots

Source: Compiled from stakeholder engagements, 2020

3.2.3 Enabling genetic improvements in the patoralist herd

Introduction of improved genetics into pastoralist systems will increase calving rates and shorten the growth cycle, raising both marketed volumes and carcass weights, while also resulting in improved quality. Consequently, it will result in substantial improvements in pastoral producer margins, whilst also increasing the supply of improved breed calves into intensive production systems. This enables substantial value addition as a result of improved carcass quality.

3.3. Quantitative assessment of proposed interventions

The impact assessment has three aspects: It starts with a gross margin analysis, which illustrates the impact of specified actions and interventions on margins within different production systems. Secondly, simulations were conducted using BFAP's multi-market partial equilibrium simulation model, which is described in Box 2. This enables quantification

of the impact in terms of prices, revenue and returns, as well as the dynamic supply response that results from improved margins. Thirdly, this supply response, along with the gross margin impacts, are introduced into IFPRI's general equilibrium RIAPA model, detailed in Box 3, which simulates the economywide and development impacts.

Box 2: BFAP Africa multi market partial equilibrium model

The multi-market Partial Equilibrium (PE) model used in this analysis has been developed by the Bureau for Food and Agricultural Policy over a number of years. After initially starting with an ad hoc combination of country and commodity coverage that emanated from specific research requests for forward looking analysis in the region, the first comprehensive structure for grains and oilseeds in 8 countries was established in 2012. Over the period 2012-2015, BFAP also introduced the PE modelling methodology to the ReNAPRI network and researchers from in-country think-tanks received training in the application of these analytical tools. Over time, the model has been utilised in various research projects and expanded to the point where it now covers 12 countries, with commodity coverage in each country ranging from 1 to 15. The Kenyan module currently covers fifteen commodities, with relevant sectors linked through both competition for resources and input output relationships. For instance, livestock is linked to grains through animal feed and so scenarios that impact the livestock sector spill into grains and vice versa.

The multi market model is a dynamic, recursive partial equilibrium framework, based on balance sheet principles to establish equilibrium, where total supply (production, imports and stocks) must equal total demand (consumption, export and ending stock) for any given product. This approach, together with the analyses of market prices, provides the backbone for detailed market analysis that forms that foundation for the market-led approach of this project. The strengths of the partial equilibrium framework lie in the ability to capture intricate market and policy details, that closely mimick the situation for specific commodities. This also enables detailed scenario analysis when changes occur in any of the existing variables or relationships.

Model specification is generally based on well accepted structures and specifications of supply and demand, with prices based on a combination of import or export parity, and domestic supply and demand dynamics, depending on the market situation for each commodity. In commodities such as maize, where regional trade dynamics are important, the model also captures trade and pricing relationships within the region in an innovative trade specification detailed in Davids, Meyer and Westhoff (2018). The modelling framework ensures consistency in supply and demand relationships and is able to provide price impacts of alternative scenarios, as well as a dynamic supply and demand response over time.

Parameterisation is based on a combination of econometric estimation and elasticity assumptions based on literature review, theoretical consistency and specialist judgement. The model is calibrated based on historic data, with the period dependant on data availability and consistency. For the bulk of the commodities, the calibration

period ranges from 2005 to 2019, but data limitations resulted in a calibration period of 2012 to 2019 for others.

The dependence on historic data, both for estimation and calibration purposes, implies that significant emphasis must be placed on the quality of the historic data feeding into the model. Initial commodity balance sheets were compiled based on a range of secondary data sources. While the official national data provided the starting point for balance sheet compilation, complementary data from the other listed sources provided opportunities for validation and alternatives where required.

BOX 3: IFPRI's economywide RIAPA model

IFPRI's Rural Investment and Policy Analysis (RIAPA) model is a dynamic economy-wide (or CGE) model that captures the interactions between all producers (sectors) and consumers (households) in the economy. RIAPA separates the Kenyan economy into 86 sectors (half within the agri-food system) and the Kenyan population into 15 household groups (i.e., urban, rural nonfarm, and rural farm, each further divided by per capita expenditure quintile). Producers in each sector combine intermediate inputs (e.g., fertilizers, seeds, fuels) with factor inputs (i.e., land, labour and capital) to produce a level of output, which they either consume within the household or supply to markets where they are combined with imports. Marketed products are either purchased by domestic agents (producers, households, government, investors) or exported to foreign markets. The decision to purchase domestic or imported goods and supply domestic or foreign markets depends on changes in relative prices in these different markets. Producers seeks to maximize profits and consumers seek to maximize utility (e.g., consumption). RIAPA, therefore, provides a comprehensive picture of the workings of the Kenyan economy, while also ensuring that macroeconomic consistency and resource constraints are respected.

Finally, the economy-wide model is linked to a survey-based microsimulation module that tracks changes in household incomes, consumption and poverty. The 2015/16 Kenya Integrated Household Budget Survey is used to build the CGE model's social accounting matrix (SAM) as well as the microsimulation module. The SAM captures the structure of the economy in 2017 using data compiled from the national statistical agency (e.g., national accounts) as well as other international sources, including the IMF (i.e., balance of payments and government financial statistics).

The RIAPA model is used to simulate the effects of expanding farm production within existing agricultural value-chains. Total factor productivity (TFP) growth in the farm component of each value-chain is accelerated beyond baseline growth rates, such that, in each value-chain scenario, total agricultural GDP is one percent higher in 2028 than it is in the "business-as-usual" baseline scenario. Expanding farm production increases the supply of raw agricultural products to downstream processing activities and generates demand for trade and transport services. Agricultural subsectors differ in size. To achieve the same absolute increase in total agricultural value-added (i.e. GDP), it is necessary for

smaller value-chains to expand more rapidly than larger ones. Smaller subsectors need larger productivity gains to match the effects of bigger subsectors. While such rapid growth for these smaller subsectors may be difficult to achieve, targeting the same absolute increase in agricultural GDP permits comparisons across value chain growth scenarios.

3.3.1. Gross margin implications

Figure 17 presents a summary of gross margins for primary producers in different production systems in Kenya. It indicates that, when pastoral producers incorporate improved breeds into their herds, the productivity gains result in a 72% increase in gross margins relative to producers that continue to rely on traditional breeds, such as the East African Zebu. Similarly, when calves are fattened and finished in a ranching or feedlotting system, margins can improve by 51% and 95% relative to the traditional pastoral system.

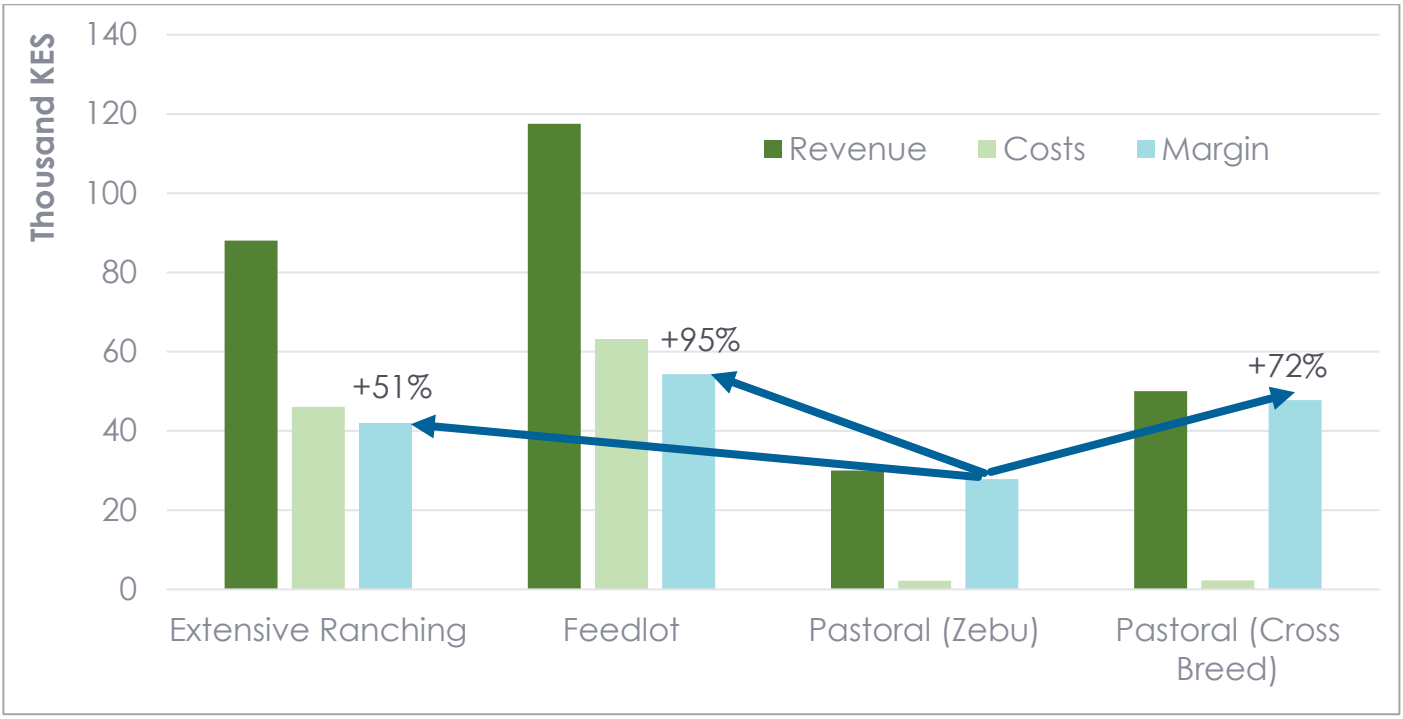

FIGURE 17: GROSS MARGINS UNDER VARIOUS PRODUCTION SYSTEMS IN KENYA

Source: PPVC Gross Margin Analysis

The proposed interventions are centred around unlocking premium markets and enabling productivity gains for pastoral producers through the introduction of improved genetics. Essentially, this entails a shift in the composition of the national herd. Figure 18 indicates that presently, and under the baseline outlook, traditional pastoralists with indigenous breeds

contribute 75% of national beef production, pastoralists who use improved genetics through cross breeds contribute 17%, whilst ranching and feedlots constitute 6% and 2% respectively. Under an improved state, where all the interventions are introduced incrementally, the contribution from pastoralists using improved breeds can be increased to 25%, with traditional breeds from pastoral systems declining to 60%. Increased availability of improved breed calves also results in ranching contributing an increased share of 10% to domestic production, with 5% coming from feedlot systems.

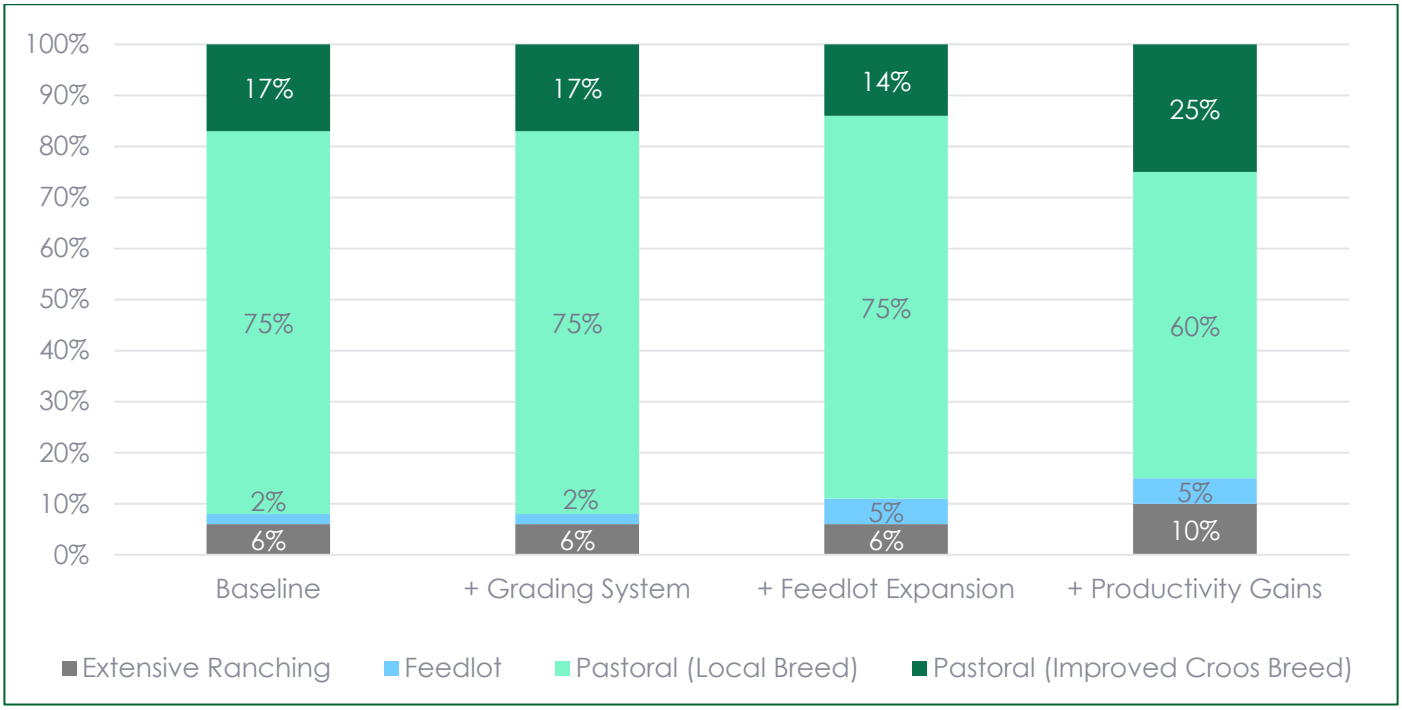

FIGURE 18: Changes in the composition of beef production in Kenya under an improved state

Source: PPVC Gross Margin Analysis

3.3.2. Market impact: Partial equilibrium market model simulations

Improved genetics will enhance carcass quality as well as productivity through increasing calving rates, shortening the growth cycle for animals and increasing average carcass weight – all of which combine to increase the quantity and quality of beef output. Figure 19 presents the extent of such gains in terms of slaughter volumes and average carcass weight. It is acknowledged that the pursuit of genetic improvements in the pastoral herd is a long term intervention, which will require ample time for its effect to be evident in the broader pastoralist herd. By 2030, annual slaughter volumes increase by 162 000 units, or 4% above the baseline. Similarly, average carcass weights reach 173kg by 2030, a 10kg increase from the 163kg achieved under the baseline. This is not reflective of the full gain achieved by an individual producer when adopting improved breeds. Average carcass

weights amongst improved cross breeds are estimated at 195 kg, a 30% improvement from the 150kg carcass typically delivered by indigenous breeds. However, the average carcass weight amongst the pastoral herd also reflects the relative shares of indigenous and cross breeds within the total herd and so the average impact also reveals the fact that all indigenous cattle will not be replaced by improved cross breeds over a 10 year horizon.

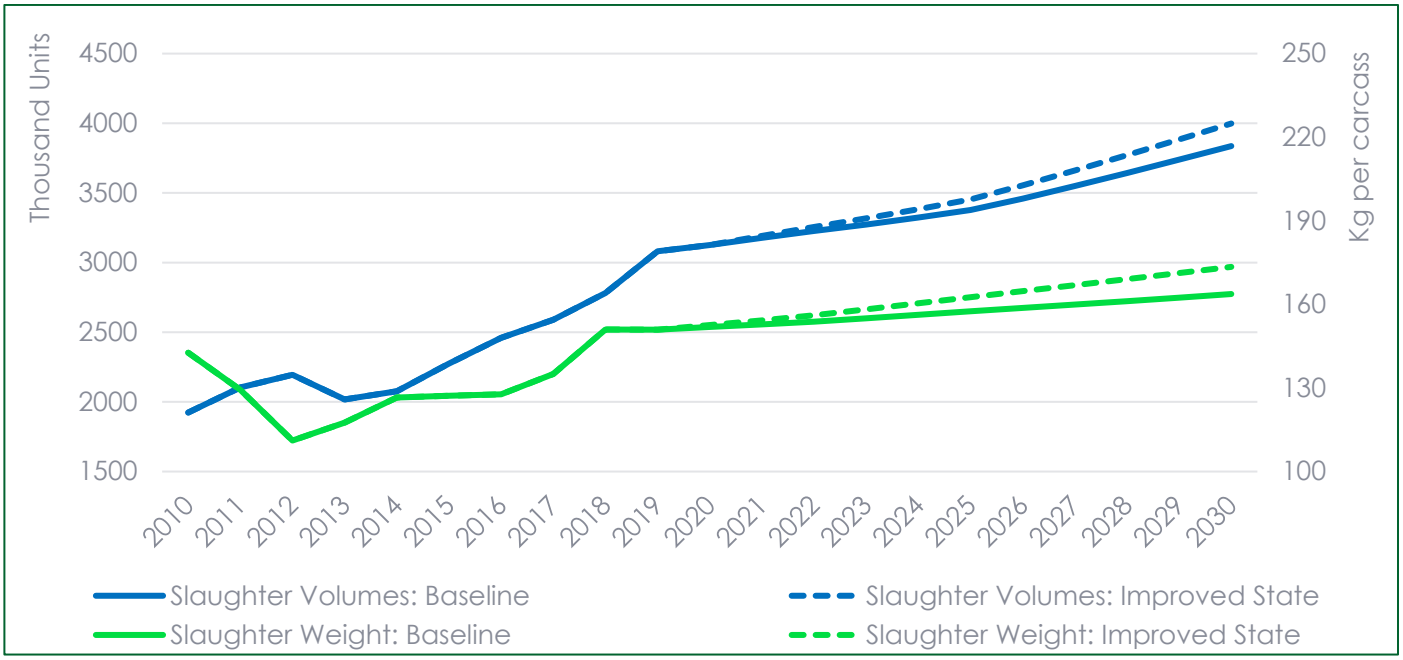

FIGURE 19: Improvements in slaughter volumes and carcass weights

Source: PPVC Deep Dive Analysis & BFAP Multi-Market Partial Equilibrium Model

The proposed interventions have the potential to raise beef production volumes substantially, as indicated in Figure 20, which compares production volumes in 2030 attained from incremental introduction of the stated interventions to 2019 volumes, as well as the baseline projection for 2030. It should be noted however that, while the productivity gains in the pastoral herd arguably yield the biggest impact, the sequence of interventions also matters, particularly when considering the price effect. When market based interventions, such as the grading and classification system, are introduced first, it creates opportunities to expand production without inducing a significant decline in prices. This is evident in Figure 21, which presents the price changes induced by the combination of proposed interventions relative to baseline projections. Price changes are illustrated in two ways, accounting for both the direct impact on price levels, as well as the effect on average prices of changes in product composition, with a greater share of higher quality carcasses in the total market also contributing to higher average prices. When productivity gains are introduced alone, without the market based interventions, carcass prices decline by almost 5% relative to the baseline. However, if additional production is accompanied by the introduction of a grading and classification system, along with expanded production of

higher quality products in feedlots, carcass prices remain stable, despite additional volumes. Once accounting for the increased share of premium products in the market, the average price of all carcasses sold is actually higher, even if the price of each individual carcass type remains constant. This further contributes to increased value attained from beef production at a national level.

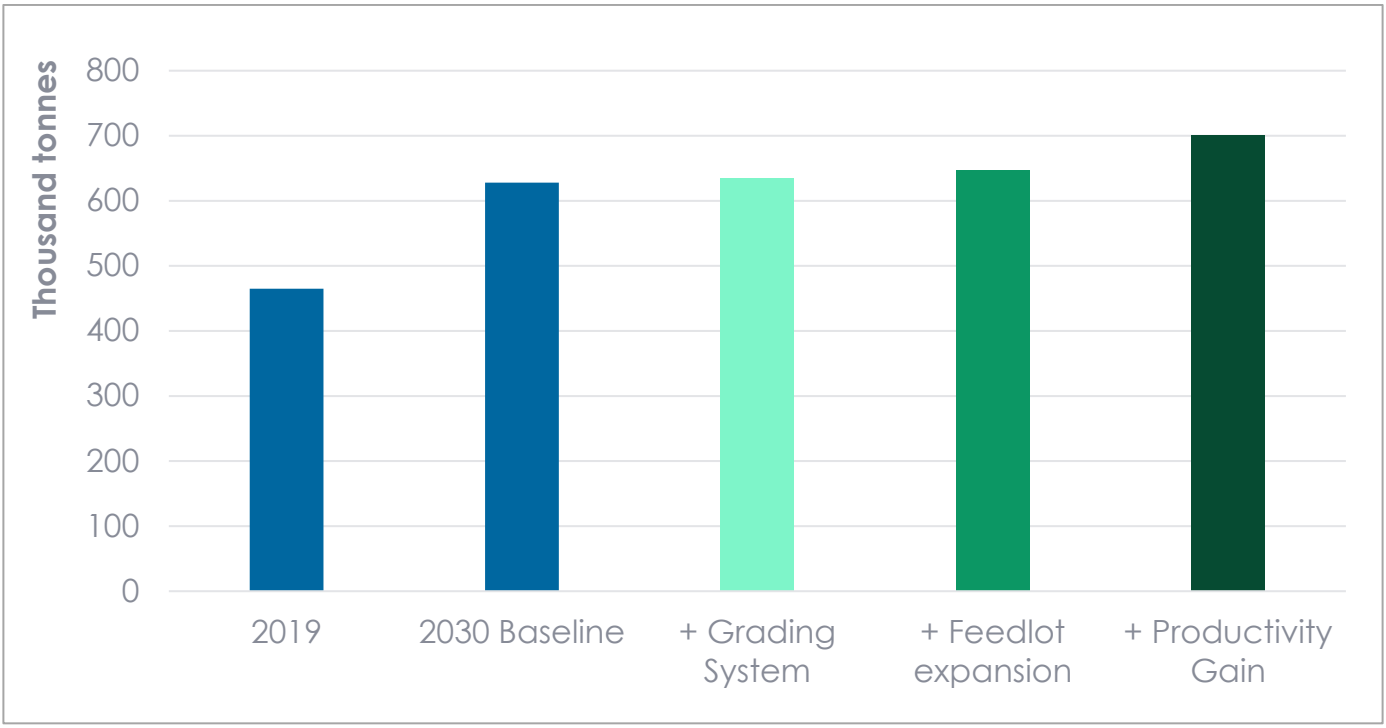

FIGURE 20: FUTURE SCENARIOS OF BEEF PRODUCTION VOLUME WITH INTERVENTIONS

Source: BFAP Multi-Market Partial Equilibrium Model

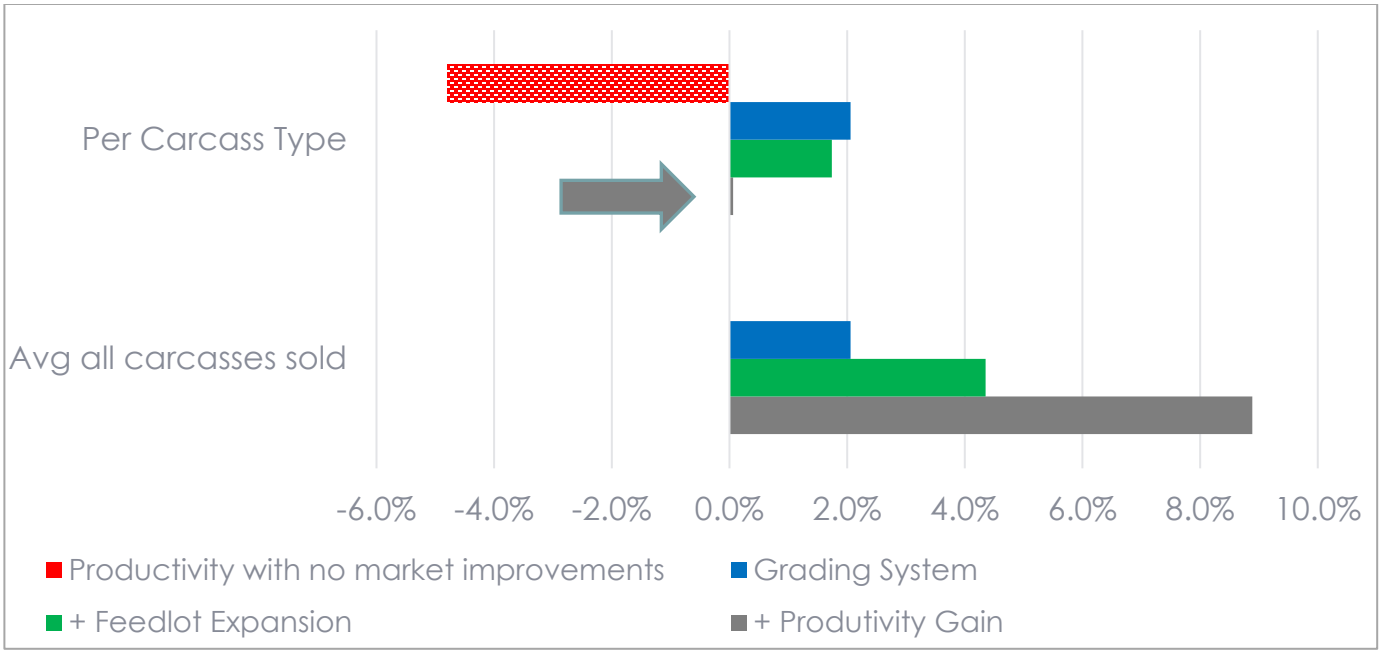

FIGURE 21: IMPACT OF INTERVENTION SEQUENCING ON PRICE LEVELS: IMPROVED STATE VS. BASELINE

Source: BFAP Multi-Market Partial Equilibrium Model

Figure 22 presents the combined outcome of volume and price changes in the form of gross production value, or revenue from beef production. Under the improved state, which includes all three modelled interventions, the gross value of beef production is elevated 21% above baseline levels by 2030. This implies a revenue contribution of more than 650 Billion KES per annum, compared to 540 Billion KES per annum under the baseline.

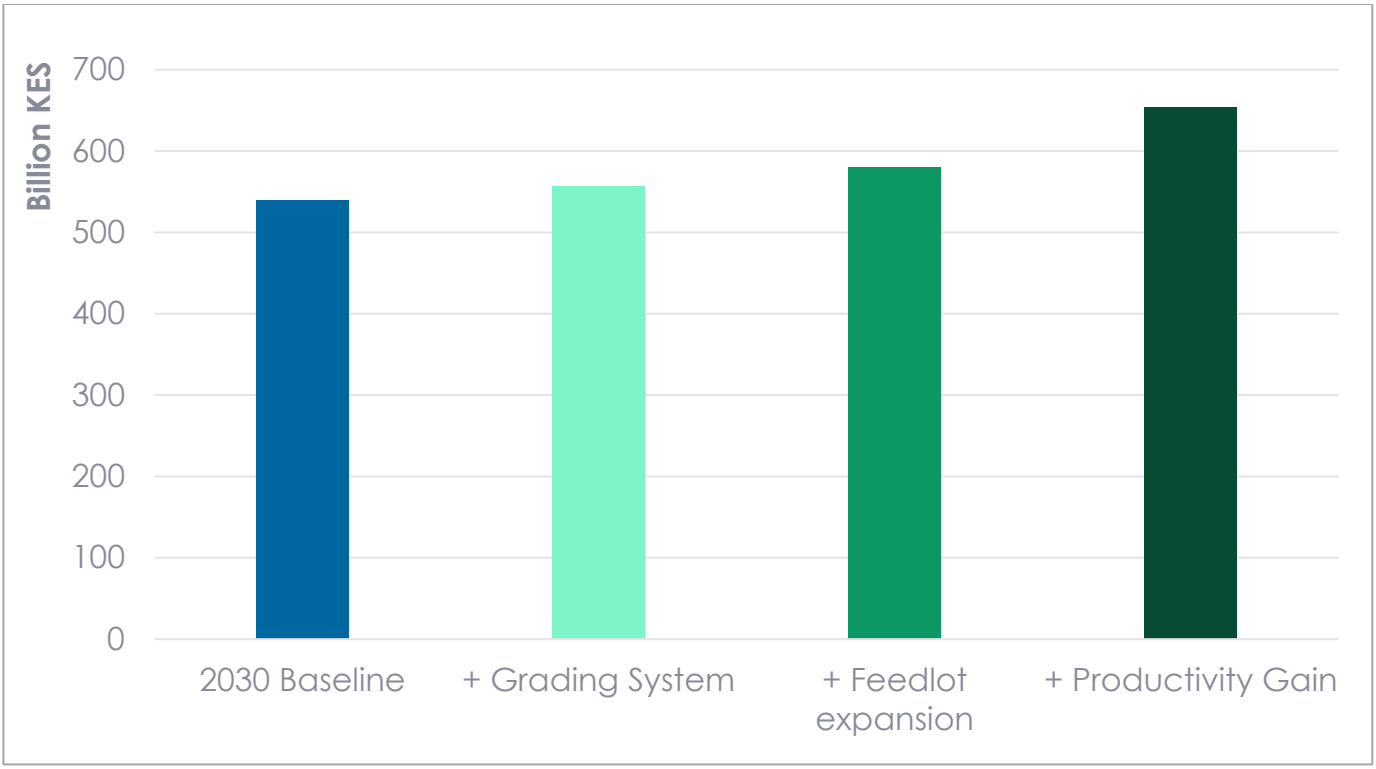

FIGURE 22 FUTURE SCENARIO OF BEEF PRODUCTION VALUE WITH PROPOSED INTERVENTIONS

Source: PPVC Gross Margin Analysis

Increasing the share of national beef production attained from intensive production systems will also have cost implications, but Figure 17 indicated that producer margins in these systems are higher relative to extensive systems. This implies that revenue gains will outweigh additional costs incurred and an increased production share from these systems will contribute to additional value addition (GDP) from beef production.

Figure 23 presents the implications of differences in margins amongst the various systems (Figure 17), along with the changes in herd composition (Figure 18) in the form of total value addition (GDP) attributed to various production systems at national aggregate level in 2030. It compares the various increments of the improved state to the baseline projection. The introduction of a grading and classification system can increase total value addition from beef production by almost 5 Billion KES annually by 2030 relative to the baseline, with a further 1.3 Billion KES attainable through expanded feedlot production and an additional 12.5 Billion KES that can be unlocked through the introduction of improved genetics into pastoral herds. Under an improved state that includes all 3 interventions, the value attained from traditional pastoralist systems is reduced, while significant growth is evident from all 3 alternative systems. In terms of contribution to the economy, the complete combination of proposed interventions are estimated to contribute **KES 18.4 billion additional value added (GDP)** in beef production alone over and above the business-as-usual baseline (Figure 23).

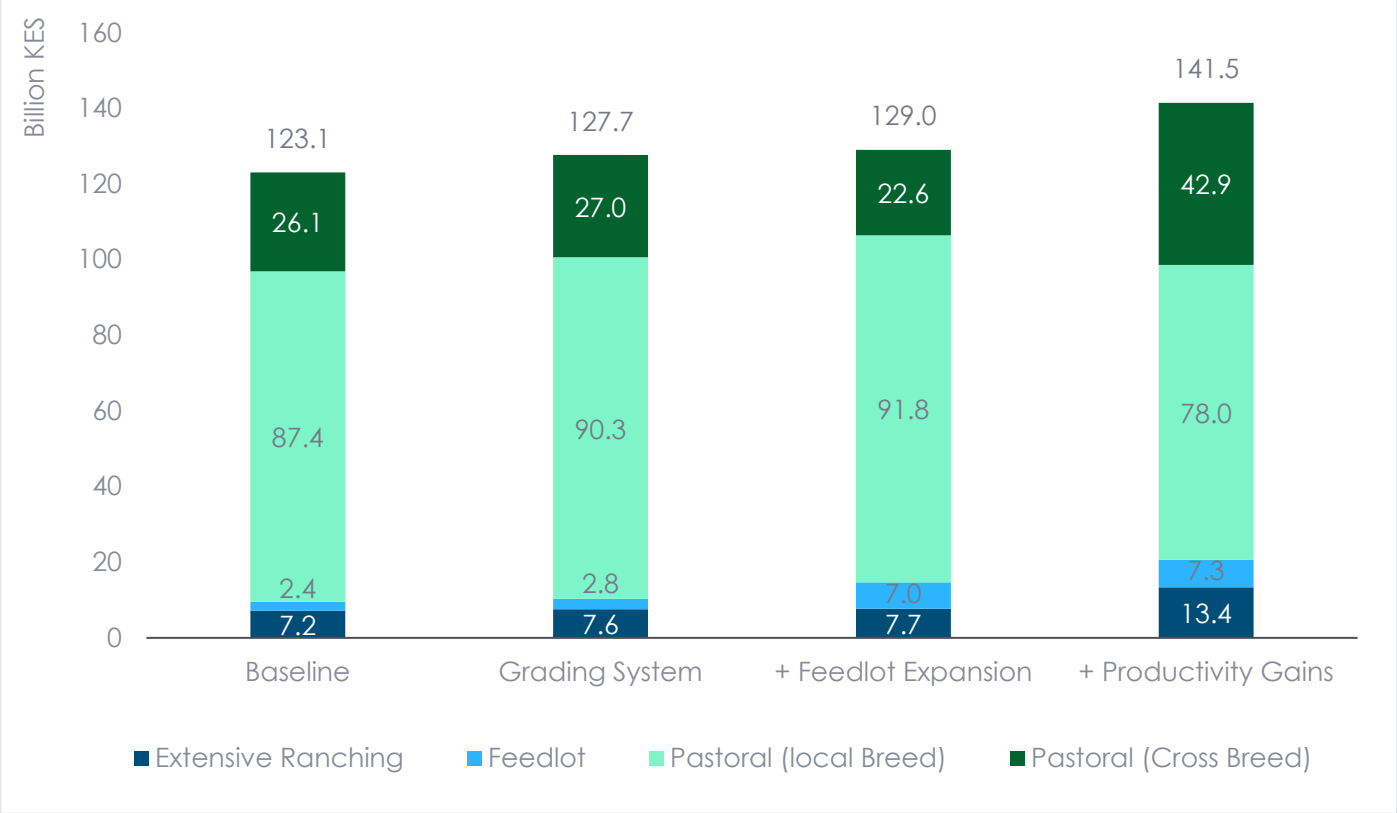

FIGURE 23 CHANGES IN TOTAL VALUE ADDED WITHIN FARMING SYSTEMS IN 2030

Source: PPVC Gross Margin Analysis

3.3.3. Economywide impact: RIAPA general equilibrium simulations

Considered within the broader agri-food system, which includes additional off-farm value addition and associated impacts on other related sectors, the combined impact of the interventions are even greater. Figure 24 indicates that the combination of interventions together are estimated to lead to an agri-food system GDP gain of KES 30.8 billion or US$285 million. Almost two thirds of this gain is attributed to the beef sector, with a further US$55 million attributed to off-farm activities in the agri food system and US$ 37 million other non-beef agricultural sectors, such as feed grain and alterative livestock production. Further to the substantial contribution to GDP in the agri-food system, the combination of interventions under the improved state has the potential to create 42 000 jobs and reduce the number of poor people in Kenya by 121 000 (Figure 24).

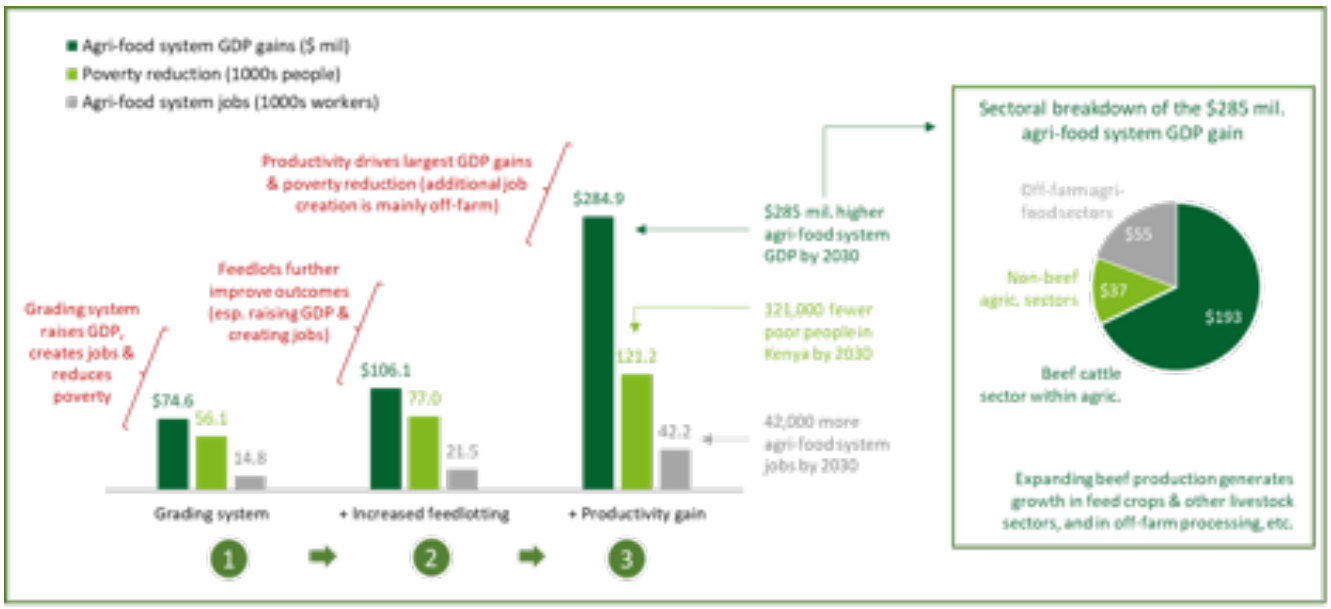

FIGURE 24 IMPACTS ON AGRI-FOOD SYSTEM GDP, EMPLOYMENT & POVERTY BY 2030

Source: IFPRI RIAPA Kenya Economy wide Model

IN CLOSING

4. CONCLUDING REMARKS

Kenya's beef sector has untapped potential to make significant contributions towards improving the livelihoods of farmers and contribute to economic growth. However, realizing that potential requires confronting several challenges that currently hinder progress in the sector.

Three key areas of intervention are particularly promising. First, introducing a grading and classification system which generates incentives for cattle producers to raise higher quality animals and at the same time creates the objectivity in the market to remunerate such efforts in breeding quality animals. This will support higher producer prices and better quality beef to serve the growing premium beef market and export market opportunities. Secondly, expansion of feedlots will increase the capacity of the sector to increase and improve the consistent supply of better quality beef for the domestic premium market and the largely unexploited export market. But expansion of feedlots will require a competitive feed sector, since feeds are a critical cost component in the operation of feedlots. Finally, there is a need to improve cattle genetics in the pastoral production system to increase productivity and overall animal quality.

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6. ANNEXURE A: OVERVIEW OF PPVC METHODOLOGY

In most developing countries, the formulation of sound economic policies that establish a framework and enabling environment for agricultural transformation and inclusive economic growth is high on the agenda. However, appropriate and effective public policies and investments require strategies that are targeted and recognise budgetary constraints. To this end, many governments develop national agricultural investment plans (NAIPs) or strategic reforms that outline the Ministry of Agriculture's policy and investment priorities. While these initiatives are a positive step towards formalising the process of priority-setting and budgeting, they can often lead to long lists of policy ambitions and substantial increases in proposed levels of public agricultural expenditure.

Against this backdrop, the Bill and Melinda Gates Foundation (BMGF) is supporting a replicable, market-led, evidence-driven Policy Prioritisation through Value Chain Analysis (PPVC) project. The project is implemented by the Bureau for Food and Agricultural Policy (BFAP) in partnership with the Alliance for a Green Revolution in Africa (AGRA), the International Policy Research Institute (IFPRI), and in-country think tanks. The PPVC approach was developed by BFAP and IFPRI during a pilot project in Tanzania in 2017 and 2018 that was executed in collaboration with Sokoine University of Agriculture, Morogoro, Tanzania. The approach was developed to (1) identify value chains that can increase incomes, ensure food and nutrition security, attain higher agricultural GDP growth, create jobs and employment and other outcomes related to inclusive agricultural transformation (IAT); and (2) prioritise and implement policies and public investments for upgrading the identified value chains. The initiative is set up to follow a demand driven approach in relation to the identification and prioritisation of policy options, and upon the explicit request from national governments and other relevant stakeholders, and focuses on capacity building of in-country think-tanks. The project has been implemented in Tanzania, Kenya, and the first set of outputs have been developed for Ethiopia and Nigeria.

This project does not replace the national plans or any ongoing value chain and policy prioritisation activities, but rather augments the process by providing a unique combination of empirical tools within a market-led approach. The broad activities or interventions to be delivered by the Project include:

- **Market-led analysis to identify value chain priorities.** On-the-ground value chain mapping, and partial and computable general equilibrium modeling to generate a market outlook and identify and assess priority value chains that align to national strategies and that have the potential to drive IAT.
- **Policy and public investment reform identification, prioritisation and design.** Articulation and sequencing of policy and public investment reforms for upgrading each prioritised value chain.
- **Technical assistance on implementation of reforms.** Provision of ongoing technical assistance to governments on the implementation of policy and public investment recommendations, as follow-up support for ensuring that recommendations are implemented after technical findings are presented.

Broadly, the PPVC approach covers two key aspects, which can run concurrently, each with multiple phases. The first aspect relates to **cross-cutting sectoral priorities** and the second is focussed on **value chain specific priorities**. Under the various phases, the approach combines a number of qualitative and quantitative assessments. Figure 1 presents the overall framework where a combination of market-led and economy-wide outcomes inform the selection and analysis of priority value chains and cross-cutting policies and investments that are most effective at driving sustainable inclusive agricultural transformation.

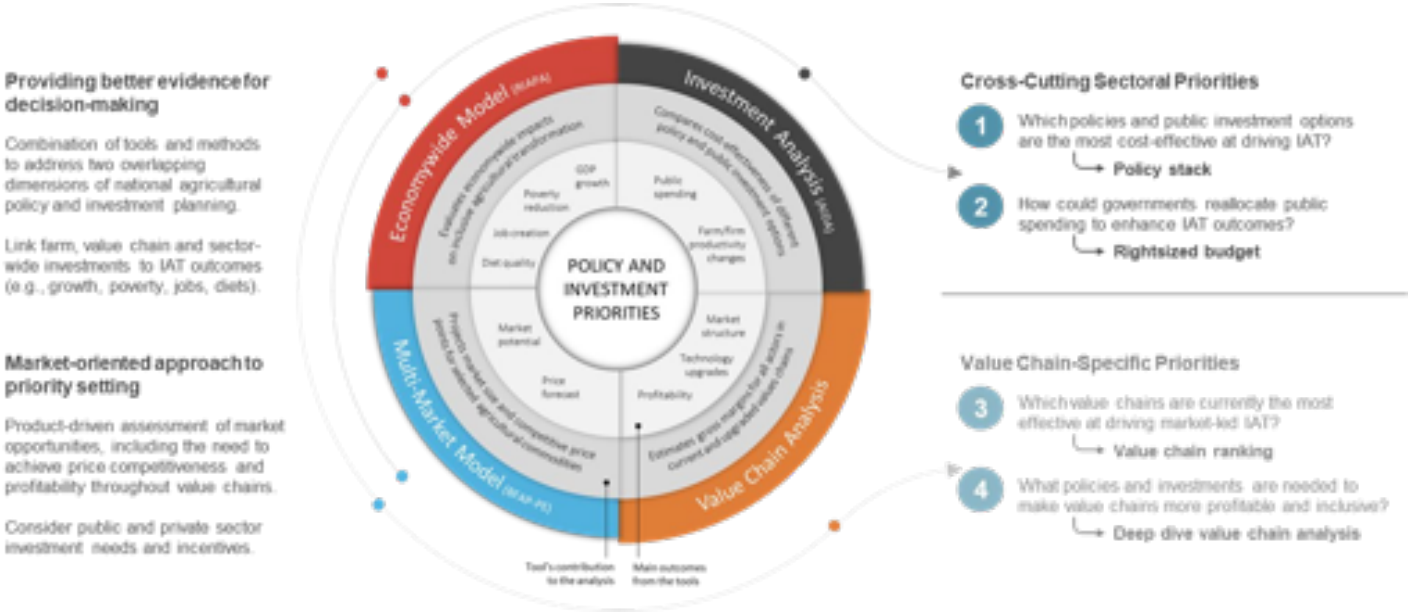

Figure A1: Overview of the tools utilised in the PPVC approach.

1. Cross Cutting Sectoral Priorities

The cross cutting sectoral priorities is an investment analysis conducted by IFPRI using the RIAPA-AIDA framework. It comprises two phases designed to compare the cost effectiveness of various relevant policy and public investment options. It considers the quantum of government expenditure, as well as the farm and firm level productivity gains that the expenditure is expected to unlock. The first phase develops a policy stack, based on the cost effectiveness of various options in driving inclusive agricultural transformation (IAT). The second phase develops a rightsized budget, which considers expenditure constrains and therefore reallocates public expenditure in order to optimise and enhance IAT outcomes.

AIDA requires information on investment impacts, unit costs and public spending. Econometric analysis of farm and household survey data is first conducted to analyze household-level investment impacts. This is combined with information from secondary sources, including monitoring and impact evaluation (M&E) studies of past investments and programs, and/or from spatial crop and infrastructure modeling. AIDA then decomposes and analyzes government budgets using public expenditure data, and projects future changes in spending allocations and investment impacts. This information is fed into RIAPA, which analyzes the economywide impacts of AIDA's investment

spending forecast, alongside changes in market and macroeconomic policies. Finally, RIAPA's microsimulation module estimates household-level poverty and dietary impacts differentiated by gender.

The estimates of the returns to different investments is then used to prioritize the allocation of public spending given resource constraints (i.e., budget rightsizing). This is an iterative process in which investment impacts and returns are re-estimated over time, allowing the prioritized budget to evolve over the planning period in response to changes in investment outcomes and costs.

2. Value Chain Specific Priorities

Value Chain Specific Priorities involve research undertaken by BFAP, IFPRI and in-country think tanks with AGRA facilitating discussions with key in-country stakeholders. The analytical work also comprises two phases, designed to prioritise specific value chains to maximise impact on IAT outcomes, as well as specific actions within these value chains to ignite inclusive growth.

2.1 Value Chain Ranking

The first phase of the value chain specific priorities is the development of a ranking report. The ranking exercise considers current policy initiatives and therefore typically, but not exclusively, starts with a shortlist of value chains identified in existing policy documents such as the National Agricultural Investment Plans. The value chains included in this short list is then ranked based on a selection of quantitative indicators, informed by historic data and the modelling framework, related to market led potential, inclusiveness, transformation and a qualitative scan of the value chains that considers four key elements for each chain: (1) The current and potential investment level of each value chain; (2) the scalability of a value chain taking account of potential in regional markets and in downstream or complementary value chains; (3) the existing level of policy support; and 4) Agro-ecological resource potential related to the specific chain. Table 1 provides a summary list of indicators.

Table A1: Summary of Value Chain Ranking Indicators

Indicator Category	**Indicator Sub-Category**	**Indicator Name / Description**	**Analytical Framework**
Market-led potential	Market Potential	Potential for intensification	BFAP Africa PE Model
		Domestic consumption growth	BFAP Africa PE Model
		Regional Export Potential	Historic Data
	Competitiveness	Relative Trade Advantage (RTA)	Historic Data
		Input cost to use ratio	Historic Data
Inclusiveness		Poverty Reduction	RIAPA CGE Model
		Agri-food System Employment	RIAPA CGE Model
Transformation		Agri-food system growth	RIAPA CGE Model
		Diet Quality	RIAPA CGE Model
Value Chain Scan		Level of Policy Support	
		Private sector investment levels	

	Qualitative Feedback in country	Scalability and interlinkages with additional value chains	Qualitative Ranking through Stakeholder Engagement
		Agro-econological Resource Base	

The various indicators are combined using a Garrett Ranking technique. The indicators inform a ranking outcome for each category. These can be regarded as orders of merit assigned to value chains through the indicators. Orders of merit are transformed into units of scores by converting orders of merit to percentage positions and converting percentage positions to scores using the Garrett table (Garrett & Woodworth, 1985). Finally, scores are added for each factor (value chains in our case) and divided by the total number of indices used. The final ranking of value chains is assigned according mean scores: highest mean score ranking first and lowest mean score ranking last.

Value chain selection is informed by the ranking, but occurs in collaboration with stakeholders and policy makers in country. In the various countries where the approach has been rolled out to date, the ranking was a key consideration in choosing relevant value chains, but the choice was also informed by urgency and need for actions from policy makers. Consequently, while higher ranking value chains have been chosen, it has not simply come down to choosing the highest ranking value chains for deep dive analysis.

2.2 Value Chain Deep Dive

The deep dives provide an in depth analysis of specific value chains and follows the initial selection process. Essentially, it aims to inform which policies and investments are needed to unlock improved profitability, inclusivity, efficiency and therefore growth from these value chains. The value chain deep dive process proceeds sequentially as follows:

- Firstly, it aims to establish the current state, as well as the baseline, or "business as usual" outlook for the specific subsector. This provides an overview of historic and expected supply and demand trends (including trade flow and prices), identifies critical stakeholders throughout the value chain, and establishes associated market shares, operational costs, capacities and constraints. This all informs a summary of major challenges and constraints faced by the various value chain actors.
- Secondly, it defines an "ideal or improved state" for the value chain, in which key bottlenecks and constraints are addressed using specific levers of change, including but not limited to value chain investments (public and private) and policy levers. In order to reach the ideal state, a combination of investments and policies are formulated at specific nodes of the value chain aimed at unlocking more value out of the market system and to boost the level of participation/inclusiveness.
- Thirdly, the impacts of the changes are quantified in three ways.
    - Changes are translated to gross margin impacts at the various nodes of the value chain.
    - The impact of interventions is modelled over a medium-term horizon (10 years), using BFAP's multi-market partial equilibrium model, which informs the projected product flow through the value chain.

- The broader economic and socioeconomic impacts of improved margins and expanded production is simulated using the economy-wide RIAPA general equilibrium model.

2.3 Quantitative tools utilised in the analysis

The value chain specific analysis relies on a package of empirically-grounded tools designed to answer key questions at different stages of the policy process. These tools include four main components, namely a multi-market model (BFAP); an Integrated Value Information System (IVIS); an economy-wide model (RIAPA-AIDA); and value chain mapping and gross margin analysis. The Integrated Value Information System provides a platform that integrates global spatial datasets with the empirical output of the other tools. The Value Chain Analysis identifies key actors and products flows and provides gross margins at various points of the chain to inform investment needs and feasibility. The BFAP multi-market partial equilibrium model projects market space and competitive price points for the specific commodities, whereas the RIAPA economywide model evaluates broader economic and socioeconomic impacts on inclusive agricultural transformation. The specific tools are detailed below. While each tool has its own merits, the strength of the PPVC approach rests in the combination, which is ultimately used to assess impact and prioritise actions. The combination of the multi-market PE model, IVIS and value chain analysis enables the identification and costing of public and private investments in agriculture and downstream agro-processing. The value chain analyses adopts a product-driven or market-led approach which extends from local farmers to final consumers or export markets, and the farm component of each value chain is situated within the broader agricultural sector (but not the economy as a whole). IVIS highlights where value chains could potentially be located in a country and the PE model assesses impacts on agricultural production and prices. In turn, RIAPA captures the whole economy, including both agricultural and downstream subsectors, and how these combine to form a country's agri-food system (AFS).

Integrated Value Information System (IVIS)

IVIS was developed to integrate economic, statistical and spatial modelling approaches into a single system designed to answer the kinds of policy and business questions needed to design a feasible public-private investment plan. IVIS is hosted in a secure web-based geographical information system that facilitates better project governance, including real-time monitoring and evaluation using BFAP's economic models and databases.

BFAP Multi Market Partial Equilibrium Model

The multi-market Partial Equilibrium (PE) model utilised in this analysis has been developed by the Bureau for Food and Agricultural Policy over a number of years. After initially starting with an ad hoc combination of country and commodity coverage that emanated from specific research requests for forward looking analysis in the region, the first comprehensive structure for grains and oilseeds in 8 African countries was established in 2012. Over the period 2012-2015, BFAP also introduced the PE

modelling methodology to the Regional Network of Agricultural Policy Research Institutes (ReNAPRI) and researchers from in-country think-tanks received training in the application of these analytical tools. This training is repeated and strengthened in countries where the PPVC project is implemented, for example Tanzania and Kenya. Over time, the model has been utilised in various research projects and expanded to the point where it now covers 12 countries, with commodity coverage in each country ranging from 1 to 15. The model typically covers ten to fifteen main commodities, with relevant sectors linked through both competition for resources and input output relationships. For instance, livestock is linked to grains through animal feed and so scenarios that impact the livestock sector spill into grains and vice versa.

The multi market model is a dynamic, recursive partial equilibrium framework, based on balance sheet principles to establish equilibrium, where total supply (production, imports and stocks) must equal total demand (consumption, export and ending stock) for any given product. This approach, together with the analyses of market prices, provides the backbone for detailed market analysis that forms that foundation for the market-led approach of this project. The strengths of the partial equilibrium framework lie in the ability to capture intricate market and policy details, that closely mimic the situation for specific commodities. This also enables detailed scenario analysis when changes occur in any of the existing variables or relationships.

Model specification is generally based on well accepted structures and specifications of supply and demand, with prices based on a combination of import or export parity, and domestic supply and demand dynamics, depending on the market situation for each commodity. In commodities such as maize, where regional trade dynamics are important, the model also captures trade and pricing relationships within the region in an innovative trade specification detailed in Davids, Meyer and Westhoff (2018). The modelling framework ensures consistency in supply and demand relationships and is able to provide price impacts of alternative scenarios, as well as a dynamic supply and demand response over time.

Parameterisation is based on a combination of econometric estimation and elasticity assumptions based on literature review, theoretical consistency and specialist judgement. The model is calibrated based on historic data, with the period dependant on data availability and consistency. For the bulk of the commodities, the calibration period ranges from 2005 to 2019, but data limitations resulted in a calibration period of 2012 to 2019 for others.

The dependence on historic data, both for estimation and calibration purposes, implies that significant emphasis must be placed on the quality of the historic data feeding into the model. Initial commodity balance sheets were compiled based on a range of secondary data sources. While the official national data provided the starting point for balance sheet compilation, complementary data from the other listed sources provided opportunities for validation and alternatives where required.

IFPRI Economywide RIAPA Model

IFPRI's Rural Investment and Policy Analysis (RIAPA) model is a dynamic economy-wide (or CGE) model that captures the interactions between all producers (sectors) and consumers (households) in the economy. RIAPA separates the Kenyan economy into 86 sectors (half within the agri-food system) and the Kenyan population into 15 household groups (i.e., urban, rural nonfarm, and rural

farm, each further divided by per capita expenditure quintile). Producers in each sector combine intermediate inputs (e.g., fertilizers, seeds, fuels) with factor inputs (i.e., land, labour and capital) to produce a level of output, which they either consume within the household or supply to markets where they are combined with imports. Marketed products are either purchased by domestic agents (producers, households, government, investors) or exported to foreign markets. The decision to purchase domestic or imported goods and supply domestic or foreign markets depends on changes in relative prices in these different markets. Producers seeks to maximize profits and consumers seek to maximize utility (e.g., consumption). RIAPA, therefore, provides a comprehensive picture of the workings of the Kenyan economy, while also ensuring that macroeconomic consistency and resource constraints are respected.

Finally, the economy-wide model is linked to a survey-based microsimulation module that tracks changes in household incomes, consumption and poverty. Integrated Household Budget Surveys are used to build the CGE model's social accounting matrix (SAM) as well as the microsimulation module. The SAM captures the structure of the economy using data compiled from the most recent national statistical agency (e.g., national accounts) as well as other international sources, including the IMF (i.e., balance of payments and government financial statistics).

The RIAPA model is used to simulate the effects of expanding farm production within existing agricultural value-chains. Total factor productivity (TFP) growth in the farm component of each value-chain is accelerated beyond baseline growth rates, such that, in each value-chain scenario, total agricultural GDP is one percent higher in 2028 than it is in the "business-as-usual" baseline scenario. Expanding farm production increases the supply of raw agricultural products to downstream processing activities and generates demand for trade and transport services. Agricultural subsectors differ in size. To achieve the same absolute increase in total agricultural value-added (i.e. GDP), it is necessary for smaller value-chains to expand more rapidly than larger ones. Smaller subsectors need larger productivity gains to match the effects of bigger subsectors. While such rapid growth for these smaller subsectors may be difficult to achieve, targeting the same absolute increase in agricultural GDP permits comparisons across value chain growth scenarios.

Value Chain Analysis

The value chain analysis encompasses the entire deep dive process, combining gross margin assessments, product flow, processing and handling capacity, trading volumes and platforms, partial and general equilibrium modelling frameworks and spatial dimensions. The final outcomes provide a granular view of all products and actors, as well as the economics of the value chain, including operating margins derived from input costs and output and import/export parity prices. A key feature is the development of the potential state, which considers how the value chain could be restructured and optimised to enhance competitiveness, profitability and transformational outcomes. Identifying the potential state of the value chain is made possible by engaging industry specialists and private sector actors with local and international knowledge and expertise.