



Better Markets, Better Lives



The Economics of Modernising the Meat Industry in Kenya: Untapped potential of meat industry in Kenya.

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Acronyms

ASAL	Arid and Semi-Arid Lands
ATP	Adenosine Triphosphate
CoT	Certificate of Transport
OC	Degrees Centigrade
EBIT	Earning Before Interests and Tax
EBITDA	Earnings Before Interest Tax Depreciation and Amortisation
FAO	Food and Agricultural Organisation
FGD	Focused Group Discussion
IIRR	International Institute of Rural Reconstruction
ILRI	International Livestock Research Institute
ICT	Information and Communication Technology
IRR	Internal Rate of Return
KARLO	Kenya Agricultural and Livestock Research Organisation
KES	Kenya Shilling
KII	Key Informant Interview
KMC	Kenya Meat Commission
KMT	Kenya Markets Trust
NPV	Net Present Value
RoI	Return on Investment
RoE	Return on Equity
SFVCF	Sustainable Food Value Chain Framework
SNV	Netherlands Development Organisation
ToR	Terms of Reference
TV	Television
UAE	United Arab Emirates

Glossary of Terms

Break-even Point: the point at which a company's total cost and total revenue are equal, i.e. "even". There is no net loss or gain.

Capacity Utilisation: refers to the manufacturing and production capabilities that are being utilised by an enterprise at any given time. It is the relationship between the output produced with the given resources and the potential output that can be produced if capacity was fully used.

Cost Drivers: a unit of activity that causes a business to endure costs.

Gross Margin: the sales revenue a company retains after incurring the direct costs associated with producing the goods it sells and the services it provides.

Net Present Value: value of all future cash flows (positive and negative) over the entire life of an investment discounted to the present, by looking at all of the money expected to come from the investment and translating those returns into today's Kenyan Shillings, in order to decide whether the investment is worthwhile.

Overhead Costs: overhead costs are ongoing business expenses that support a business but do not generate revenue. They are indirect costs which are not related to specific business activities that generate money.

Return on Capital: measures how effective a company is at turning capital into profits.

Return on Equity: measures how good the company is in generating returns on the investment it received from its shareholders.

Return on Investment (RoI): measures efficiency of an investment, by trying to directly measure the amount of return, on a particular investment relative to the investment's cost.

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Executive Summary

The study analysed the cost, returns and feasibility of meat industry modernisation in Kenya. The study sought to generate evidence on the value of the untapped domestic meat market that will then incentivise meat businesses to invest in modernisation of the sector.

The assessment covered the role of modernising activities by key nodes in the meat supply chain, including meat traders, slaughterhouses, butcheries (processors), and manufacturing, promoting meat quality and safety with focus on small-scale, medium-scale, and large-scale actors.

The assessment included detailed financial evaluation based on different scenarios that produced detailed financial outcomes including projected income statements, balance sheets and cash flow statements for the different scenarios.

Assessment on animal and meat trade included an evaluation of the impact of modernising the trade with specific areas considered, including investing in modern transport of the animals, acquiring refrigerated transport that will deliver carcasses to consumer outlets, and introducing electronic tagging system for the animals to support traceability from the slaughterhouses to retail outlets.

Assessment on modernising of operations evaluated the role of slaughterhouses in promoting availability of quality and safe meat by mechanising the slaughter processes, installation of a traceability system, investing in the inventory management system, operationalising the cold rooms, and adopting appropriate waste management systems.

Assessment on meat processing evaluated the role of modern butcheries in promoting primary processing of meat to include selling

of prime cuts, and in enhancing the quality and safety of meat through the cold chain facilities. Interventions identified included investment in cold chain facilities such as chillers and freezers, purchasing of modern butchery equipment, investing in inventory management systems including software, and capacity building of the workers. Assessment on meat manufacturing considered the potential of producing affordable meat products targeting the low-income markets. Areas of focus included identifying viable formulation for the meat products and estimating capital investment processing equipment and other assets.

Key Findings



Modernisation of slaughterhouses will involve investment in process mechanisation to replace the current manual processes; investment in animal traceability system and inventory management systems, utilisation of cold chains to enhance quality, reduce shrinkage and preserve the meat as well as investment in more skilled employees to manage the operations. An economic analysis revealed positive gross and break-even safety margins especially for the medium to large scale operations. The small-scale operations revealed a negative gross margin, with growth a potential which may surpass the performance of non-modernised slaughterhouses, contingent on capacity utilisation and efficiency. As a result of other services like sale of manure, cold room service and slaughter services, the study shows that the slaughter fee charges would be increased by about 100 Shillings (KES) in exchange for high food safety standards, efficiency from

mechanised services as well the assurance of traceability of meat purchased. A Modernised slaughterhouse will require an investment period of two – four years. With the expected positive financial performance, the business will guarantee investors good returns on exit, and will support expansion of operations over the period. Supported by economies of scale, modernised slaughterhouses will generate significant free cash flow from operating activities with adequate cash flow to repay commercial funds borrowed to finance capital expenditure while creating a reserve for rewarding the investors.



Modernisation of live animals transport and meat trade will need an investment of approximately eight million shillings (KES 8,000,000) on high capacity, efficient, safe and pre-slaughter stress free transport for animals.

Modernising this segment of the meat supply chain further involves investment in the traceability an inventory management system, as well as refrigerated vans for meat transport. The economic analysis indicates that modernisation of live animal/meat trade is not economically viable for small scale and medium scale operations. Although analysis of large-scale operations shows positive margins starting from year one, an overall analysis reveals that the investment will require a long-term payback period irrespective of the scale of operations. Compared with the level of investment required, live animal and meat trade will record weak free cash flows, from operating activities, as well as cash and bank balances that will not be adequate to repay commercial funds raised, to finance capital expenditure as well as create a reserve to reward the trader and any other investor.



Modernisation of the processing segment of the value chain aims at increasing value of meat through production of differentiated meat cuts, use of health and hygienic

equipment, investing in a traceability and inventory management system and engagement of skilled personnel. The use of the cold chain will be a key enabler for processing. It will create a high value potential through reduced shrinkage and maintenance of meat quality. The greatest value will be extracted by targeting high quality animals that can yield at least 38 percent primal meat and about 52 percent dressing percentage. The analysis further shows that a modernised slaughterhouse will yield a good profit margin even at a retail price of KES 495 per Kg of prime beef. A higher price potential per kilo exist depending on the type of differentiated and value-added products, that a modernised butchery has, with some cuts fetching between KES 800-1200 per Kg. Projected good returns on investments from modernisation is a motivation for butcheries to invest in modern equipment that will promote meat quality and safety. Supported by economies of scale, modern butcheries will generate significant free cash flow from operation activities and significant cash to repay funds borrowed to finance capital expenditure as well as create a reserve to reward the owner and any other investor.



Modernisation of manufacturing practices is aimed at presenting a value proposition for more innovations, in meat manufacturing,

to produce a variety of safe products that target consumers in all the market segments. The bottom of the pyramid, which constitutes approximately 60 percent of consumers, presents a large market that if reached with quality and affordable products, would significantly increase the meat market the country. Bringing in more actors in manufacturing of quality and safe products will also make the industry more competitive. The process will replace expensive meat methods with cheaper elements to reduce costs and increase volumes. Along with meat, a wide range of non-meat ingredients including, meat extenders and fillers will form an important part of the manufacturing

process for the meat products. Use of cold chain and enhanced application of food safety standards will be a key enabler for safe and efficient manufacturing process. The analysis further shows positive margins and an 18-40 per cent price improvement of manufactured products in the market. Meat manufacturing will, however, require a long-term investment period, to facilitate processing equipment installation, and renovation of production premises. With the expected financial gains, the business will guarantee investors good returns on exit, and support expansion of the asset base over the period.

The analysis shows that meat modernisation has potential to trigger other business opportunities. These include, livestock finishing and feedlots for quality animals with high primal cuts and dressing percentages, hence bringing more value to the meat traders, meat processors and consumers. Secondly there are opportunities for commercial holding grounds where investors provide meat traders with space to rest their animals, especially those that have travelled long distances. Slaughterhouses have an opportunity to set up places for cleaning meat carriers, as a way of shifting the current practice by some meat transporters who clean the carriers in the carwash facilities.

Results of the economic analysis shows that there are strong business cases for meat processing, slaughterhouses and manufacturing, strongly justifying investment in modernisation of the sector. Cold chain system is a key enabler for meat industry modernisation by enhancing safety, quality and scale. Other enablers include supportive policy and legal framework and enforcement of the same, consumer education and sensitisation; increased private sector investments in the meat industry for instance in provision of quality equipment and financing the modernisation. In addition, there is need for mechanisms to be put in place to organise the sector to come up with self-regulating mechanisms.

Recommendations

The study has proved business cases for modernisation of slaughter, processing and manufacturing that have potential to trigger growth of the industry. The following need to be done to ensure that the investments are easily adopted by the private sector:

1. Review of policy and regulatory framework, to effectively regulate meat sector. This will create a favourable environment for investors in the meat industry
2. The study shows that modernisation will be required investment in equipment, machinery and software. There is need to come up with forums that can link the investors in slaughterhouse, manufacturing and processing with appropriate equipment and machinery. There is need to engage with financial institutions to come up appropriate products for investors in the meat industry
3. As an incentive to the investors, the government should consider zero rating the tax on the equipment and machinery required for the sector modernisation.
4. Given the unstructured market system in which meat industry operates, there is need to come up with mechanisms for self-regulations over and above the formal rules. Self-regulating mechanisms include establishment of meat industry council, which will bring together the industry actors and come up with rules to promote modernisations, other options include supporting business models like franchised meat outlets.
5. There is need to stratify butcheries modelling on the slaughterhouse classification and licensing. This will help consumers differentiate butcheries that are fully compliant with industry modernisation standards from those that have not.

6. There is need to promote livestock feedlots and other finishing models in order to increase supply of quality animals required especially by the processors.
7. Consumer education is highly recommended, to not only counter negative publicity on red meat, but also to educate retailers on important food safety measures which they ought to demand from the retailers for instance traceability systems, checking for the roller mark on carcasses, use of cold chain as quality enhancement and food safety tool, as well creating awareness on differentiated products in the market.



01

Introduction and Background

1.1 Background to the study

Kenya's meat sub-sector is hugely fragmented and about 96 per cent informal. Livestock trade is dominated by middlemen with very few organised processors buying directly from livestock producers. Nairobi and Mombasa cities remain the key terminal markets accounting for 75 per cent of the country's meat consumption. Interviews with traders at the livestock markets indicated that traders are keen to buy animals that are well finished and fattened so they can get better returns but, in most cases, they don't get the quality they want especially during the dry season. As a result, they have to make trips to different livestock markets in order to get quality animals.

As a country, Kenya has a supply deficit in tunes of 300,000 metric tons (I Dev report – Meat Sector in Kenya, 2014). Kenya's growing population of the middle class with majority of them aged between 18 years and 40 years have not triggered the meat industry players to take advantage of the growing demand for quality meat and meat products. There is evident change in preference by consumers preferring fish to beef, mutton and chevron. The consumer's perception on meat quality, hygiene and use is changing with more preference to health and hygiene. (KMT Livestock Deep Dive report, 2016).

Despite this fact, the meat industry is very inefficient with huge post-slaughter losses occasioned by hot meat retail chain, low value addition, poor processing skills, lack of understanding of the changing consumer preferences and worst of all wanting food safety standards.

Interviews with managers of export slaughterhouses indicated that there is high demand for sheep and goats, in the Middle East countries, especially those at the yearling stage.

KMT livestock sector is therefore seeking to catalyse an enabling environment for improved and reliable demand for differentiated, affordable and safe livestock products by retailers. Lack of accurate information, about the size and the composition of the consumer meat market, has been a major barrier to recommending strategies to meat traders and consumer voice groups seeking to diversify their marketing strategies.

A survey by KMT on meat markets trends and patterns, identified extremely low investments in the meat subsector towards tapping the growing demand for quality and affordable products. The study seeks to generate evidence on the value of the untapped domestic meat market as an incentive for Modernisation of the sector.



Kenya's meat sub-sector is hugely fragmented and about **96% informal**



Nairobi and **Mombasa** cities remain the key terminal markets accounting for **75%** of the country's meat consumption

1.2 Objectives of the study

This assessment is intended to achieve the following objectives:

- a. To **assess the economics and value** of the meat sector in adopting technologies for value addition and growth.
- b. To **establish the economics of adapting cold chain supply system** and how this will impact prices of the meat and also provide detailed insight of the opportunities available.
- c. To **establish the economics of adoption of food safety** across the meat industry.
- d. To **establish the value proposition of the untapped domestic market** taking into consideration the proposed modernisation and industry self-regulation.
- e. To **generate a critical economic analysis** on the meat market intervention and a business case that will spur sector

modernisation by the actors in the meat industry.

1.3 Scope of the study

This study involved a thorough desk review of existing information on the economics of the sector's modernisation in Kenya and other countries, the guiding principles and key practices. The study interviewed meat businesses (along the supply chain), that have already invested (early adopters), in modernised meat outlook and compared their business with those that have not adopted modern sector practices. The scope further included projection of the demand in line with population and economic growth, urbanisation and consumer patterns and trends. In terms of geographical coverage, the study focused on Nairobi, Mombasa and Laikipia Counties, tracing businesses that have adopted the slaughter, processing and manufacturing practices at different scales of operations and for different market segments.





02

The Concept of Meat Industry Modernisation

2.1 Rationale

In the context of this study, meat industry modernisation means,

the industry adopting technologies for value addition for sector growth. The system includes but not limited to

- use of manufacturing technologies,
- livestock identification and traceability,
- meat inventory management,
- value addition and processing among others.

In addition, meat industry Modernisation means,

the industry incorporating food safety measures to protect consumers and sustain consumption leading to sector growth.

Cold chain systems in Modernisation are considered as key enablers for processing, food safety and manufacturing processes. The study will focus on Modernisation at the slaughter, processing, and manufacturing nodes of the meat supply chain.

The demand for meat in Kenya is higher than supply, with an annual deficit of 300,000 metric tons (I Dev report – Meat Sector in Kenya, 2014). Discussions with the live animal traders revealed that the market systems in Kenya and neighboring countries (South Sudan, Eastern Uganda, Southern Ethiopia, Northern Tanzania and Somalia), are interconnected, which allows traders to draw animals from these countries, to meet the supply gaps in the domestic market. The demand for meat is expected to increase, as the country moves to the middle-income status, coupled with the high meat-eating culture of Kenyans. This shows that the meat industry has potential to contribute to employment creation in the country through private sector investment along different nodes of the supply chain.



The demand for meat in Kenya is **higher than supply**, with an annual deficit of

300,000
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(I Dev report – Meat Sector in Kenya, 2014)

While Kenyans are known to be high consumers of meat which is exemplified by the bulging Nyama Choma culture, in major cities and towns, meat consumption and industry growth is threatened by the increased food safety and quality concerns. A recent study by KMT on the end market meat trends in Kenya, coupled with media visibility on the same, revealed increased health and food safety concerns by consumers of red meat triggering increased to white meat over red meat. During a visit to one of the slaughterhouses, it was observed that, retailers were streaming in to buy meat from source. The management confirmed that an upward trend was noted after the media exposé. In addition to health concerns, the industry is very inefficient with huge post-slaughter losses occasioned by hot meat retail chain, low value addition, poor processing skills, lack of understanding of the changing consumer preferences and poor food safety standards.



Figure 1: A screenshot of a Daily Nation publication published on July 15, 2019.

While efforts are being made to address gaps in the regulatory framework and enforcement improvement by government, there is a growing recognition of best practices from countries where food industry players have a broad array of incentives to implement enhanced food safety controls. For example, the potential reaction by consumers to real and/or perceived food safety risks, may motivate actors in the meat industry, to enhance controls in their processes regardless of what they are required to do by law (Henson and Caswell, 1999). The food economics literature identifies three elements that create incentives for firms to adopt enhanced food safety controls: market forces, food safety laws and regulation and product liability laws (LL) (Buzby, 2001; Loader and Hobbs).

In a study on Economic Incentives for Firms to Implement Enhanced Food Safety Controls in the Canadian meat and processing sector, Udith and Spencer (2006) established that firms are likely to be most responsive to the need to upgrade their food safety controls when there are potential gains in terms

of increased market revenue. This implies that market incentives can play a key role in promoting industry self-regulation and adoption of best food safety practices in the supply chain. In some countries like Zambia, companies like Zambeef, taking advantage of market incentives with replicable business models allow integration of a wide range of food safety measures. As such the company has emerged one of the largest integrated agribusinesses in Zambia, with operations in other West African countries, and annual gross revenues of approximately \$255 million USD (Lal and Obembe, 2014). Zambeef's success lies in the vertical integration of its activities, from primary production to the end user through extensive retail networks, which provides systems for incorporating the food safety along the entire supply chain. A similar model is operating in the broiler industry in Kenya through Kenchick's, fully integrated, farm to fork broiler model. This shows that there is potential for actors in the Kenyan red meat industry, to achieve self-regulations, by learning from successful models. This study will determine the economic viability of

industry modernisation interventions, with a view to providing evidence for investment in appropriate self-regulating business models, by the private sector in the Kenya's meat industry. activities, from primary production to the end user through extensive retail networks, which provides systems for incorporating the food safety along the entire supply chain. A similar model is operating in the broiler industry in Kenya through Kenchick's, fully integrated, farm to fork broiler model. This shows that there is potential for actors in the Kenyan red meat industry, to achieve self-regulations, by learning from successful models. This study will determine the economic viability of industry modernisation interventions, with a view to providing evidence for investment in appropriate self-regulating business models, by the private sector in the Kenya's meat industry.

2.2 Scope and Purpose of Economic Analysis of Meat Industry Modernisation

The goal of the study objectives is to inform meat industry players' investment decisions in Modernisation in the untapped domestic meat market in Kenya. who carried out the ground work.

Objective 1: To assess the economics and value to the meat sector in adopting value addition technologies for sector growth

The thrust of this objective was to determine the value capture if meat sector actors invested in technologies for value addition and the opportunity cost if meat sector actors do not invest in technologies for value addition. The value adding systems include but not limited to, use of manufacturing technologies, livestock identification and traceability, value addition and processing, meat inventory management among others. The next section describes each of these systems in order to bring out an interpretation that will be applied in the rest of the report.



a. Manufacturing Technologies

Manufacturing involves converting raw materials, components, or parts into finished goods that meet a customer's expectations or specifications. In the context of the meat industry manufacturing refers to the process of adding non-meat ingredients into meat and developing a new product. The non-meat ingredients are added to meat in the manufacturing process for quality economy and to improve products' characteristics such as texture, fat content, bind strength, and shape.

Modernisation through increased manufacturing require investments in technology, skills and infrastructure. The study sought to identify the costs-benefits of such investments for businesses, that target different consumer segments and also to understand drivers i.e., what is feasible with different consumer segments as well as the economics of manufacturing.



b. Livestock Identification and Traceability

Livestock identification and traceability are key quality enhancement and food safety enablers, at a time when the industry is experiencing an onslaught of negative publicity, associated with food safety concerns. As a result of this, businesses that invest in traceability mechanisms are likely to earn more consumer loyalty which translates to more demand for their products. Based on this interpretation, the study therefore sought to analyse the economics and value creation potential in adoption of traceability and identification systems. For instance, if meat traders, processors and manufactures invested in traceability systems, what is the implication on the price of meat? Is it feasible? Would this action incentivise consumers to buy more meat etc.



c. Value Addition and Processing

The study sought to assess the economics of value addition and processing practices. These processes are used to produce value added products and provide variety of meat products, to increase demand and marketability as well as meet life style requirements. The study identified the food safety concerns, in processing as well as inefficiencies, under the existing practices and thereafter determined the most appropriate measures that need to be undertaken, to address the concerns and also reduce the inefficiencies. The opportunity costs of not engaging in processing and food safety measures were analysed.



d. Meat Inventory Management Systems

The current stock inventory in meat retail outlets shows irreconcilable variations between the stock in and stock out. For instance, at the livestock market, the traders buy live animals based on eye appraisal and experience. From slaughter house to the retail outlet, stock is usually bought based on carcasses, but sold (stock out) in Kilograms weight; this scenario does not show the basis for buying and pricing decisions. When consumers are buying, they pay for weight and not the specific meat they want; the retailer has to balance meat from different parts and bones in order to avoid loses. This has been the major hindrance to value addition, especially differentiation, since the retailers have to find a way of selling even the non-edible parts like bones, fat and connective tissues.

An inventory management system would enable buyers of live animals to predict the yields of high value differentiated cuts and use this to make purchase decisions, depending on the needs of his customers. A meat processor at the butchery on the other hand can predict

how much high-quality cuts and low-quality meat yield from his stock and use this to predict the returns. This would go a long way in reducing inefficiencies and increasing value to the consumers.



Objective 2: To establish the economics of adapting cold chain supply system and how this will impact prices of the meat and also provide detailed insight of the opportunities of adapting cold chain in terms of meat quality, preservation and value addition.

The thrust of this objective was to:

- a. Determine the value add in economic terms for investing in cold chain along the meat supply chain. The current narrative is that investment in cold chain will lead to increase in pricing. The assessment sought to establish the value add in adoption of cold chain in the supply chain.
- b. Determine the opportunity cost for not investing in the cold chain: The opportunity costs range from product quality, preservation and food safety. This involved assessing whether non-adoption of cold chain has some opportunities when comparing with the adopters and if so by how much.
- c. This objective further tackled the current narrative of muscle verses meat; what is the opportunity cost in terms of health concerns when consumers go for muscles and not meat and what value does the cold chain bring as far as quality enhancement.
- d. Assessing how investment in cold chain will impact on the price of meat. This will mean costing the investment and determine the implication on unit price of meat, then comparing whether the price difference is significantly different from those who are not using cold chain (after costing the opportunity cost).

-
- e. Benefits (e.g. quality/value enhancement) that will be realised after adopting cold chain for different categories of meat traders.

» **Objective 3: To establish the economics of adoption of food safety across the meat industry. This will clearly provide several models for missed opportunities**

This objective is closely linked to the first two. It involved:

-
- a. Costing of the food safety measures/interventions at different levels of the supply chain, for instance:
- Investments that will enhance food safety at pre-slaughter stage e.g. live animal weighing scales, stunning boxes, lairages etc.
 - Slaughter processes in most of the slaughterhouses are heavily manual, in some cases compromising the hygiene of the products. So, the study assessed how investment in modern slaughter technologies, infrastructure and skills impact on the process efficiency and food safety and the implication of this investment on price of meat.
-
- b. Defining the benefits (monetary and non-monetary) for adopting safety standards, including the incentives for consumers to demand quality.
-
- c. The cost of not investing in food safety along the supply chain; looking at the cost benefits of investment in food safety as an industry and as businesses.

» **Objective 4: To establish the value proposition of the untapped domestic market taking into consideration the proposed modernisation and industry self-regulation**

Answers to this objective were derived from analysis of the first three objectives i.e. the value creation from modernisation (investment in technology, cold chain and food safety) and missed opportunities. To respond to this objective, the following were considered:

- a. What is the present value created in monetary terms by modernising the meat sector through investments in technologies, food safety and cold chain system?
- b. How much of the domestic market is actually tapping this value?
- c. What is the value of untapped potential in the domestic market as a result of not adopting modernisation?
- d. What is the implication as far as incomes are concerned if a certain proportion of non-adopters actually began investing in Modernisation approaches?

» **Objective 5: To generate a critical economic analysis on the meat market intervention and a business case that will spur meat industry modernisation by the actors in the meat industry**

This objective sums up the first four by providing practical and actionable models to spur the meat industry modernisation. As such the study has developed business cases for different modernisation approaches. These models will give insights into various ways into which the untapped domestic meat industry can be modernised thus enabling players to grab opportunities in the untapped market.



2.3 Food Safety as an enabler for meat industry modernisation

Food safety standards holds every actor in the supply chain to high standards in avoiding contamination of meat with any biological, physical or chemical hazards. There are built-in safeguards in the meat industry contained in the meat control act and the public health act. Gaps in the regulatory framework and limited capacity for enforcement are among the key factors that have created loopholes for the increasing food safety concerns in the industry.

Food safety measures are therefore key enablers of meat industry modernisation and should operate along the following three principles of meat hygiene, which are crucial for meat processing operations.

- Prevent adulteration
- Prevent microbial contamination
- Minimise microbial growth
- Reduce or eliminate microbial contamination

The following are critical consumer concerns that can potentially limit the consumption of meat and therefore curtail the growth of the industry in Kenya and which can be addressed through effective food safety measures:

- 1. Lack of traceability systems:** These systems address the concerns of whether the meat in the retail outlets is genuine, arising from concerns that some outlets could be selling meat from non – classified animals like game animals, dead animals, sick animals or stolen animals whose health may be unknown.
- 2. Adulteration of meat:** This is not one of the major concerns, after media investigations revealed that some of the retail outlets are

adding sodium Metabisulfite to preserve meat and give it a fresh red colour. The Kenya meat end market study revealed that consumers too have concerns over the drug residues in meat, given that producers do treat animals for themselves.

- 3. Hygiene and sanitation practices to prevent cross contamination:** These include procedures for slaughter (relating to abattoir standards); cross-contamination of meat during slaughter and processing (location and techniques of evisceration, etc.), amount and quality of water available, use of appropriate equipment (stunning, splitting etc.), waste management systems and separation of clean from dirty areas among others.
- 4. Pre-slaughter handling of animals** to minimise stress on animals which negatively affects meat quality
- 5. Degree of exposure to microorganisms** due to limited use of cold chain.

2.4 Literature Review

2.4.1 Cold Chain as an Enabler for Meat Industry Modernisation

Cold chain is a well-known system for reducing food losses and food waste (Post Harvest education Foundation, 2013). Several authors have reported that chilling is a key enabler of food safety enhancement, meat processing and manufacturing because of its role in the control of potential wastage from shrinkage and spoilage as well as quality enhancement required for good processing and manufacturing processes (Emad et al, 2014; The Postharvest Education Foundation, 2013; Rani et al. 2017). The following are 4 main ways in which chilling directly affects meat quality and contributes to food safety as reported by these authors:

» Influence meat quality in respect of toughness and tenderness;

Chilling has two critical roles in meat tenderness. One is in the prevention of muscle shortening in the period immediately following slaughter. The second is in the conditioning of the meat so that the desired degree of tenderness is obtained. Under proper conditions, tenderness is well maintained throughout the chilled/frozen storage life, but improper chilling/freezing, can produce severe toughening of meat. Chilling has negative effects on the tenderness of meat if it is carried out rapidly when the meat is still in the pre-rigor condition, (before the meat pH has fallen below about 6.2 (Bendall, 1972)). In this state, the muscles contain sufficient amounts of the contractile fuel, adenosine triphosphate (ATP), for forcible shortening to set in as the temperature falls below 11°C, the most severe effect occurring at about 3°C (James 2002). The major increase in tenderness has been shown to occur in less than 14 days in beef (James 2002).

During the first twenty-four to forty-eight hours post-mortem, muscle undergoes an array of biochemical and physiological changes in the process of becoming meat. It is during this period that refrigeration is applied to chill the carcass because the chilling process has a profound effect on these changes and therefore on the final product. A great deal happens in that short time. At the end of the forty-eight-hour period the fate is sealed for the carcass in respect to the attributes of chilling described in this section. In this case, the only on-going task for the cold chain system following the initial forty-eight-hour chill, is the preservation of the meat (Bendall, 1972).

» Affects product yield in relation to weight loss

Beef carcass weight losses during conventional overnight chilling have been reported to vary from less than one per cent to up to nearly three per cent. Weight loss is restricted to surface tissues which may be trimmed off.

Table 1 below presents the projected losses due to lack of refrigeration. On the other hand, if refrigerated immediately after slaughter, no spoilage is recorded for the first 10 days.

» Determine the ultimate intensity and stability of meat colour

Meat colour, together with fat colour, is possibly the single, most important, attribute of meat quality in terms of visual appraisal. The animal largely determines fat colour itself, whereas the chilling environment has a profound effect on the colour of red meat tissue. In the absence of oxygen, meat is purple-red in colour. This is the colour of freshly-sliced meat and it is due to the pigment myoglobin. On exposure to air the myoglobin absorbs oxygen and is converted to its bright red form, oxymyoglobin. This is the colour associated with fresh meat. Prolonged exposure to air produces the oxidised form of the pigment, metmyoglobin, which is brown to grey and is the colour associated with stale meat near the end of its shelf life. In the case of the oxygenation of myoglobin to oxymyoglobin, low temperature slows down rates of the change, but will enhance the intensity of the result. At least 30 minutes is necessary to achieve a fully bloomed colour with well-chilled meat at 0°C. As well, the oxymyoglobin pigment extends to a depth of 5mm in meat at this temperature, thus enhancing the intensity of the colour. Rapid chilling in the first instance followed by sustained low storage temperature will preserve the attractive visual appeal of meat for an extended period (Gagaoua et al, 2015).

» Cold chain is the most important element in the preservation process hence ensuring food safety

Meat is rich in proteins, lipids and water, which renders it a favourable substrate for the growth of microorganisms. The lipid content also makes it very sensitive to oxidation. Muscle tissue is effectively sterile at the point at which the hide or skin is removed. The slaughter, evisceration and dressing operations inevitably produce microbial contamination in depth and especially on

the surface, through contact with equipment, tools, hands and clothes. The extent to which a carcass becomes contaminated is dependent very much on work practices and on hygiene at the slaughterhouse. Again, micro-organism growth is a temperature-dependent process (Rani et al, 2017).

To minimise microbial growth on carcasses, it is essential to reduce the temperature of the meat, especially on the surface, immediately after dressing. Cooling must therefore be carried out in the slaughterhouse itself. This operation is known as primary chilling (Aghamohammadi, et al 2014). To prevent or even to reduce the deterioration process, particularly microorganism development, chilling must be carried out quickly after the slaughter process and the chilled state has to be maintained until the meat is processed for consumption.





03

Approach and Methodology

3.1 Approach

The study took a value chain approach, where all the meat supply chain actors were mapped out and their functions in the value chain determined. The process involved identification of critical value addition nodes and where there is potential for investments in technology, cold chain and food safety measures. A value chain approach provides a structured way of linking the information collected to specific value chain functions, hence making it all inclusive.

Fig 1 below shows the value chain framework that was developed to guide this study. The framework was developed by the consultants after in-depth review of livestock value chain reports, consultants' knowledge of the

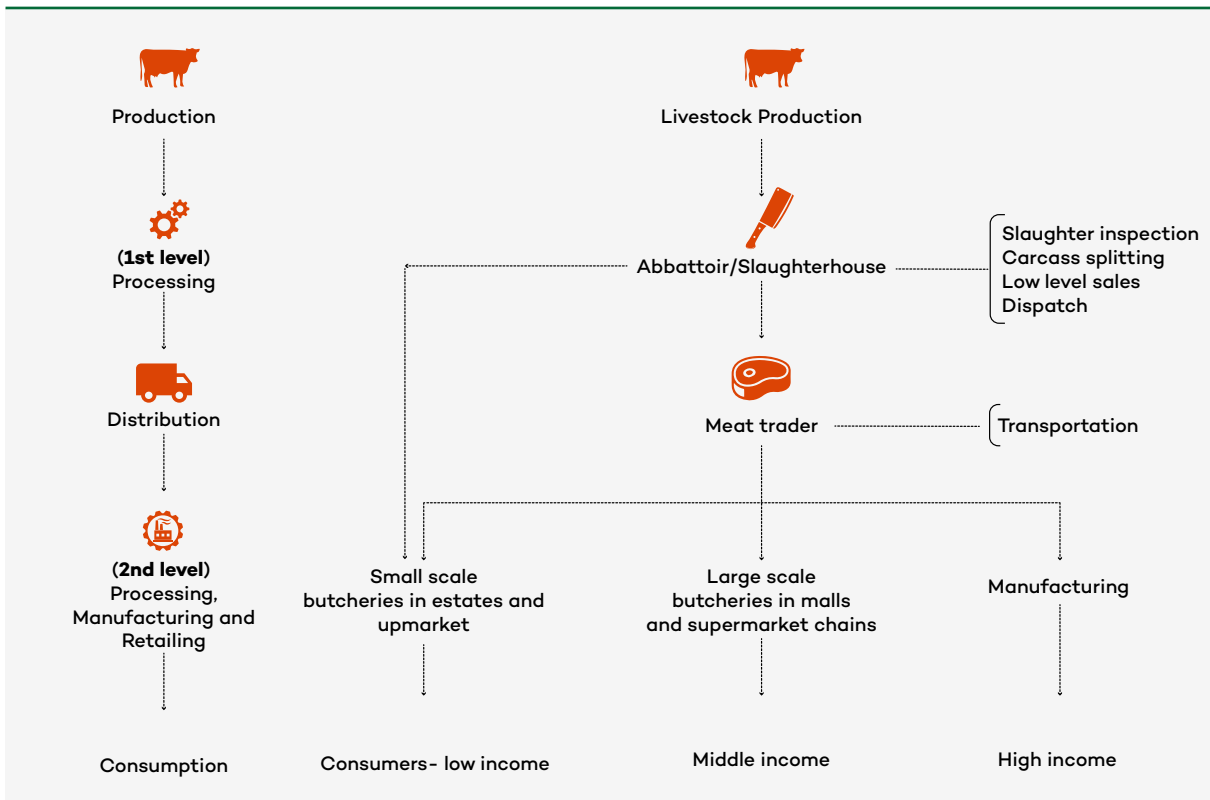
livestock and meat sector and stakeholder consultations.

The main nodes of the meat supply chain include

- production,
- primary processing,
- secondary processing distribution (wholesaling),
- retailing and consumption.

Each of these steps have been briefly described below.

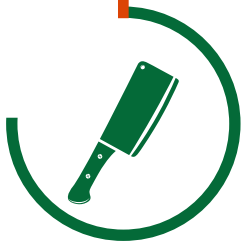
Figure 2: Meat Supply Chain Map





First level production:

this segment involves production of live animals from farms or by pastoralists. In Kenya, large production takes place mainly in the pastoral areas, agro-pastoral and ranches to a very small extent. Culled animals from the dairy production system also contributes immensely to the number of animals slaughtered in the country especially in the dairy production areas. In the context of meat supply chain, production of live animals is considered as the supply of raw materials for the meat chain. As such, the cost drivers of production are not incorporated in the economic analysis of meat modernisation. It is however expected that meat industry modernisation will trigger improvement in production with more emphasis on quality and mechanisms for traceability. In this analysis, the live animal is traced in the terminal markets located at the slaughterhouses where final transactions between meat traders and live animal traders takes place.



Second-level production and first-level processing:

In the context of meat value chain, slaughterhouses and abattoirs play both production and processing functions. Slaughterhouse/abattoirs are considered as production units for meat since the facility is used to slaughter live animals (in this case raw materials) to produce meat and other by-products (Offal, hides/skins among others). From a processing perspective, the slaughterhouse provides certain value addition activities to carcasses such as cleaning, carcass cleaning before dispatch, chilling and ageing of meat. In the context of meat supply chain, slaughterhouse/abattoir is the first point for traceability of meat and determination of key parameters for inventory management system.



Distribution/wholesale:

In the context of meat value chain, this involves distribution of carcasses from slaughterhouses to butcheries and other retail outlets for processing and retail. At this stage carcasses are dispatched as quarters (Fore and hind quarters). Some of the wholesalers (distributors) basically buy many cattle or carcasses and slaughter them and release a specific number of carcasses to different market segments. They usually benefit from speculative and opportunistic selling often dictated by scarcity of high-quality beef.



Secondary-level processing and manufacturing:

After slaughter some of carcasses are taken to butcheries for further processing, packaging and retail.

3.2 Description of Study Respondents

A total of 39 respondents were interviewed in this study. There were two categories of respondents from whom information was collected to meet the objectives of this study. These were the core value chain actors and the actors providing services to the core value chain actors.

A. Core Value Chain actors

The actors were selected purposively, guided by the following two factors:

i. The products and services:

For a comprehensive economic analysis, it was imperative that information on all possible meat products in the domestic market is collected. Some actors operate at basic level for instance retailing meat on bone, others have a wide range of products including differentiated products at small and medium scale while other are fully integrated slaughter, processing and manufacturing companies. To ensure inclusion of possible actors, a list of possible meat products in the market was first generated and thereafter actors involved in the production of each of the products was determined. The list of actors was thereafter clustered depending on the consumer segment served, levels of investment in technology, skills and food safety measures as well as scales of operation.

ii. Levels of investments:

This is closely tied to the products and services. To collect credible data on investments in modernisation, it was imperative that actors who have invested in different modernisation system be interviewed to provide information on costs and revenues and opportunities for improvement. Those who have not invested were also interviewed to collect information on the opportunity costs for

non-adoption and also information on any form of inefficiencies that can be improved through modernisation systems.

List of interviewed core value chain actors

Initial mapping of actors considering the range of products and services, and the levels of investments in the modernisation system yielded the following categories of actors, who were thereafter targeted for data collection:

1. Two Class B large-scale private slaughterhouses that provide slaughter services applying/conforming to basic food safety and meat quality enhancements as required by law
2. One large-scale slaughterhouse licenced as Class A that buys livestock, slaughters; processes and also manufactures meat products for domestic and export markets. This category additionally provides slaughter services
3. Two small scale slaughterhouses usually licenced as Class B where owners slaughter and distribute meat while also offering slaughter services to the meat traders. These largely supply meat to the high and upper middle-income segments
4. Four meat processors who do not own slaughterhouse but buy meat from meat traders, process and manufacture meat products
5. Four small scale butcheries that have invested in meat processing equipment to produce differentiated meat products which are retailed at the butchery. This category consisted of high-end butcheries in the malls and upmarket shopping areas
6. Two large scale retail outlets (supermarkets) serving middle income consumer segments who have invested in food safety and quality enhancement systems

7. Four small scale butcheries, mainly selling meat on bone with limited differentiation which serve middle- and low-income consumer segments;
8. Four meat traders who use slaughter services to slaughter animals and distribute meat to butcheries and supermarkets. Meat traders are further differentiated into those how serve each of the three consumer segments.
9. Two meat transporters who are using modern refrigerated vans
10. Two meat transporters who use non-refrigerated vans

B. Support Services Providers

These include the service providers and input suppliers to the core value chain actors. This category was interviewed to provide information related to cost of services and equipment which are used in the modernised systems. In some cases, the interviews were used to validate the information provided by the core value chain actors on their costs. This category further provided information on future opportunities for modernisation, based on the advancement in technology. The service providers and input suppliers included:

1. Two Meat transporters,
2. Two Live animal transporters,
3. One Supplier of meat processing and manufacturing equipment (supplemented with online shops)
4. Two Suppliers of cold chain equipment (supplemented with online shops)
5. One Organisations that have had experiences in installation of traceability systems,
6. One technology company that develops apps for traceability and inventory management (supplemented with online shops)

7. Two Slaughterhouse management as service providers to meat traders

One meat inspector

The identity of the informants has not been disclosed due to fact that the information collected was very sensitive business information, some of which was provided in high confidence.

C. Secondary data:

Reports and secondary data were reviewed to show trends in the Kenyan meat industry especially in relation to demand, supply, and consumer preferences; gathering information to triangulate the primary sources especially on technology, equipment and prices (the Kenya Meat end market study report was one of the most recent reports on consumption patterns).

Other reports have been cited in this report and listed in the reference section. In addition, there was review of secondary information to study the best meat industry standards that can be adapted in the Kenyan context and also to reveal the global trends and how they can influence the meat industry in Kenya.

Validation: There was extensive consultation with experts in the meat industry, to validate the data provided by the core value chain actors and the key assumptions that were used for economic analysis. Annex 1 presents the key assumptions that were used in the financial modelling.

3.3 Delivery Process

Data was collected in three interconnected steps as follows:

Step 1: Mapping out of the actors in the meat supply chain:

This was an essential first step in data gathering process to provide critical information on the chain context and help in identification of respondent categories. Actor mapping was done through a brainstorming session which involved key experts and practitioners in the meat supply chain. During the mapping, homogenous clusters of actors in each value chain node were identified, culminating into the list of actors presented in section 3.2 above.

Key outputs:

- Meat Supply Chain map showing all the actors involved and what they do (fig1)
- Clusters /sub categories of homogenous businesses in the meat sector, showing their distribution and how each cluster will be targeted (section 3.2)
- Data Collection plan for the selected clusters

Step 2: Development and validation of data collection tools:

Primary data collection involved the use of semi-structured questionnaire for KII. The tools were developed in a manner to capture all the variables required for the economic analysis, for each of the homogenous categories of respondents presented in section 3.2.

Step 3: Training of data collection teams:

This was a one-day training session for the study team. The purpose of this training was to ensure every team member understood the objectives of the study, and generate a common understanding of the information to be generated by each of the tools. Different field scenarios were also deliberated on, especially in relation to collection of sensitive enterprise information.

Step 4: Field data collection:

Field data collection was guided by a schedule developed during the initial actor mapping activity. Data was mainly collected through key informants' interviews, targeting the owners or people involved in day today management of enterprises.

Step 5: Collation of information and analysis:

Analysis was done at two levels as described below:

1. Analysis of means for different variables:

In this first level of analysis information collected from each of the representatives of the 10 actor categories under section 3.2 was first collated and analysed for each and every variable. This was done by comparing data from all the respondents in each category and calculating the averages. These analyses were used to generate key assumptions and variables to be used in the economic analysis. The outputs of this analysis were:

- All cost drivers
- Installed capacity and capacity utilisation
- Quantified losses
- Revenues
- Important assumptions for each cost driver and revenues

2. Economic analysis:

The data generated in the first step was fed into the economic analysis models. Finance modelling was done using Microsoft excel involving a set of scenarios. The major outputs were:

- Balance sheet
- Cash flow
- Income statements

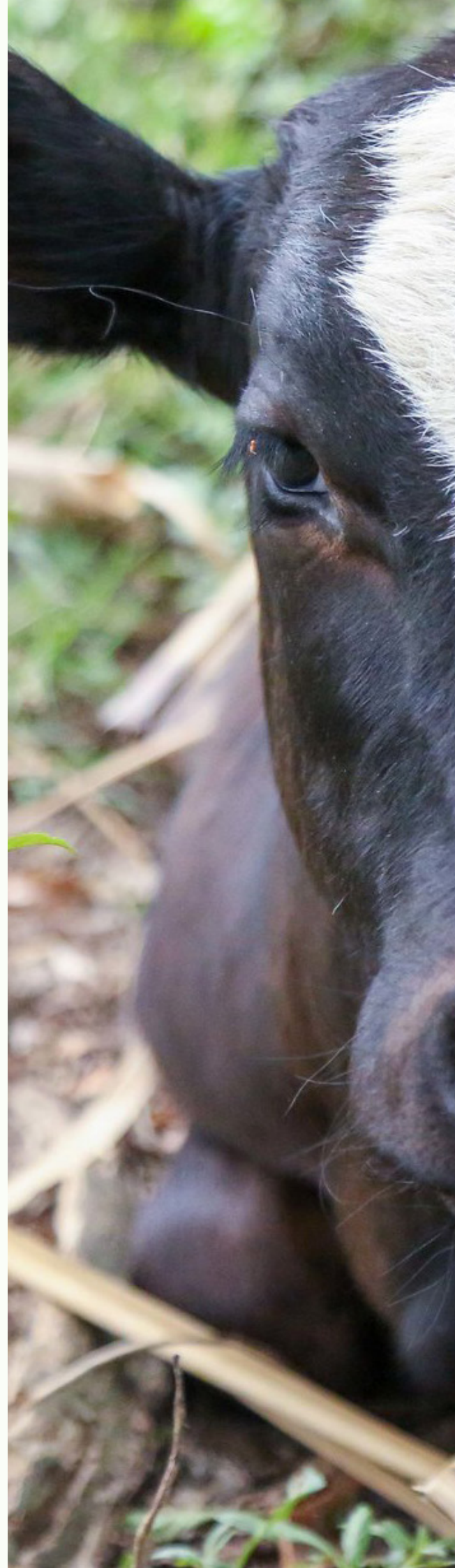
- Ratios (return on Investment, Return on Equity, Return of Investment)
- Breakeven points

3.4 Report outline

The report integrates the findings related to all the assignment objectives in a sequence of chapters arranged according to the main nodes of meat supply chain where Modernisation is possible. These are production/primary processing, distribution, processing and manufacturing. The analysis starts off with economic analysis of the slaughterhouse as the convergence point for live animals on one hand and production of carcasses on the other hand. This is followed by an analysis of meat distributors who are mainly meat traders, who in many cases are the intermediaries between live animals in terminal markets and meat retail outlets. The next chapters are focusing on the two pathways from slaughterhouse and distribution i.e. butcheries for processing and manufacturing.

In each chapter, there is a presentation of the current practices, highlighting the food safety and inefficiencies. This sets a background on which Modernisation strategies are propose followed by economic analysis. The economic analysis has integrated the expected outputs for each of the assignment objectives to allow a coherent flow of information and effectively communicate the targeted audience.

Financial modelling was done using data sourced from people who are in the value chain as described in the methodology section. Where it was possible to get information from more than one source for one variable, the average value of the variables is calculated and used in the model. Given the structure and level of investment in the industry, there were cases where only one respondent was available for responding. Such cases, the information from the respondent was compared with secondary information and validation by meat industry experts. It is not possible to provide name of institution or people who provided information, since much of the information was confidential business information.





04

Results and Findings

4.1 Modernisation of Slaughter Practices in the Kenyan Meat Industry

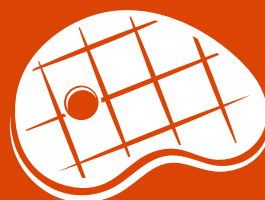
4.1.1 An Overview of Current Slaughter Practices in Kenya

Background Information on the Current Pre-slaughter Practices in the Kenyan Meat Industry

Approximately 80 per cent to 90 per cent of the red meat consumed in Kenya comes from livestock raised by pastoralists under extensive production system within Kenya and neighbouring countries mainly Tanzania, South Sudan, Ethiopia and Somalia (ACDI VOCA, 2012). Kenyan pastoralists and agro-pastoralists' production accounts for 65-70 per cent of the Kenya red meat supply the remaining 20-25 per cent comes from informal cross border trade with neighbouring counties. Private ranches contribute 2-3 per cent of total meat production in Kenya, principally for the high-value market.

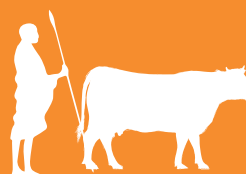
Livestock markets remain the main convergent points for livestock from pastoral areas which are destined for slaughter in the main cities in the country. The Nairobi terminal markets are recipients of animals that are trekked all the way from Tanzania, Somalia, and Ethiopia to the border livestock markets and finally trucked to Nairobi once they loaded from the Kenyan secondary markets. The trekking from the production areas can take weeks or months depending on the source during which animals are allowed to graze on their way to interiors and secondary markets. The long trekking, inadequate feed and water, together with other environmental changes contribute to significant stress and weight loss whenever grazing is limited or compromised.

The stress is extended during transportation from some of the far-flung secondary markets like in Turkana, Moyale, Migori etc. because of lack of resting facilities for animals in transit. Once at the terminal markets, the animals are rested for a few hours, depending on arrival time and slaughtered the following day in the morning.



80% to 90%

of the red meat consumed in Kenya comes from livestock raised by pastoralists under extensive production system



meat production

Kenyan pastoralists and agro-pastoralists' production accounts for

65-70%

20-25%

comes from informal cross border trade with neighbouring counties

2-3 %

is contributed by Private Ranches



Slaughterhouses provide slaughter services, with limited investment on the holding grounds, which necessitates the livestock and meat traders to clear the animals in the lairages (Places where animals rest on their way to slaughter) as soon as possible to provide space for other incoming livestock

Pre-slaughter stress has negative effect on carcass and meat quality because it causes carcass depreciation due to weight losses as well as meat quality defects due to abnormal muscle acidification (Faucitano, 2001, 2010, 2016; Schwartzkopf-Genswein et al., 2012). Pre-slaughter stress includes physical stress such as exposure to high ambient temperature which is a common exposure in livestock markets, confinement in the holding yards, noise, crowding, breakdown of social groupings within animals and mixing with unfamiliar animals, unfamiliar or noxious smells, loading and offloading trauma in vehicles and trekking for long distances (Warriss, 2003). Smith and Grandin (1998) reported that proper handling of meat animals can improve productivity, quality and profitability.

Current Slaughter Practices

Kenya's formal slaughterhouses and abattoirs are broadly categorised into those licensed to slaughter for the domestic market only and those licensed to slaughter for both for domestic and export markets. Local slaughterhouses and abattoirs operate under local slaughterhouse regulations, which meet national requirements under the Meat Control Act Cap 356. The following are the three categories of slaughter houses, as stipulated in the Meat Control Act:

① **Category A for large slaughterhouses:**

These slaughter animals for export and domestic markets and can supply meat to all parts of the country. There are three export slaughterhouses in Kenya, namely the Kenya Meat Commission, Neema and Choice Meat

② **Category B for medium slaughterhouses:–**

These slaughter animals for domestic markets only; they are allowed to sell meat to neighbouring counties. Bulk of meat consumed in cities of Mombasa and Nairobi are slaughtered in category B slaughterhouses

③ **Category C for slaughter slabs:** These are located in the sub counties and can only supply meat within the sub county

Estimation on the total number of slaughterhouses in the country was quite challenging due to lack of data, especially after devolution, since the national government have only retained the mandate of the export slaughterhouses only. With Nairobi as the largest consumer market for meat in Kenya, a list of slaughterhouses that serve butcheries within the Nairobi metropolis is hereby used to illustrate the dominance of class B slaughterhouse in serving the largest meat consumers in the county.

There are at least 10 large scale cattle, sheep and shoats slaughterhouses which slaughter more than 100 cattle per day

Choice Meat -A,

Kenya Meat Commission - A,

Njiru -B,

Dandora - B,

Kiamaiko -B,

Keekonyokie -B,

Kiserian- B,

Dagoretti – B;

Neema -A;

Quality Meat Packers - A.

Out of these, 4 are licenced as export slaughterhouses (Class A) and remain the only export slaughterhouses in the country. The remaining 6 (60 per cent) are class B slaughterhouses. All other slaughterhouses in the country are either class B or slaughter slabs except some privately-owned slaughterhouses which slaughter exclusively for high end butcheries in the cities.

The latter category is not a target for modernisation, firstly because they already have adopted the modernisation practices as required by the market they serve, and second because their capacity to serve the bigger population of meat consumers is limited. However, they served as sources of information related to modernisation practices.

Classification of slaughterhouses based on consumer segments:

Over and above the classification by the meat control act, slaughterhouses can also be classified based on the market segments which they serve. The classification follows the same pattern as the consumer segmentation as follows:

1. High-end and Export Slaughterhouses:

The high end and export slaughterhouses have invested in high standards of food safety and quality enhancements in order to meet their customers' expectations. These largely serve the quality sensitive markets, mainly dominated by high income and the upper middle-income consumer categories and institutions and hotels that serve these consumers.

2. Local Slaughterhouses:

The local slaughterhouses are the bulk suppliers of meat in the Kenyan market, being the recipient bulk of live animals from the pastoral areas. They operate as terminal live animal markets and slaughter facilities. With basic hygiene standards, these slaughterhouses do slaughter animals that are consumed by all the

consumer segments in the country. As such they served different categories of meat traders ranging from those who slaughter for high end consumer segments to the low-income consumers. The main differentiating factor between the traders is the quality of animals bought. Hence all classes of animals ranging from high standard to commercial grades are offered for sale by live animal traders operating at the terminal live animal markets within these slaughterhouses. To ensure that they get meat of the quality, required, traders who serve the high-income segments usually communicate with the live animal traders to supply a specific number of animals of specified quality. Their operations are as follows:

- **Final transactions between live animal and the meat traders:** There are two peculiar business operations that operate at slaughterhouses: (1) Butcher and livestock traders who buy live animals brought in the terminal markets attached to slaughterhouse and slaughter for their outlets and (2) resident abattoir traders and external traders who buy livestock at the terminal markets, slaughter and sell meat to butcheries, retail outlets and institutions.
- **Slaughter:** After purchase, the animals are driven to the stunning area for stunning and severing of the neck by a Muslim slaughter man to certify meat as Halal as per the meat control Act regulations and Halal certification requirements for meat sold for public consumption or sale. Thereafter the whole process of bleeding, flaying, evisceration, cleaning of offal and weighing of carcasses. Slaughter services are provided by the owners of the slaughterhouse at a cost. These services include cleaning, water, lighting system, slaughter waste management and management of cattle holding yards.

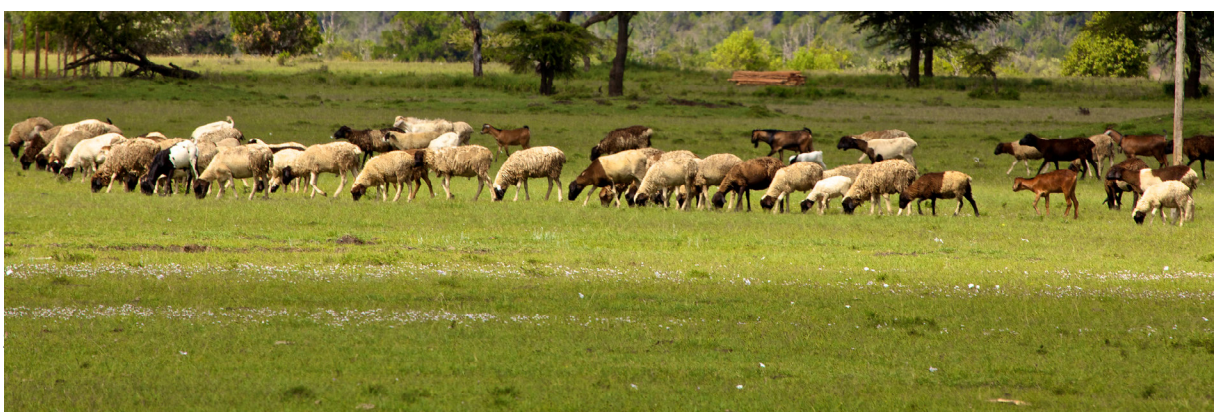
- **Inspection:** After slaughter, meat is inspected by a gazetted inspecting officer from government i.e. an official from veterinary department and the meat must be stamped with a roller mark as certification for inspection
- **Packaging and transportation:** After slaughter and inspection the routine is that most carcasses are loaded to the vans by the slaughter men. However, some slaughter houses like Njiru have chilling facilities and meat is loaded onto refrigerated vans to their destination. The meat traders and butchery operators usually take away all the meat and offal, including heads and hooves. The hides are sold to hides and skins traders at the market. The meat traders and butchery operators are thereafter issued with a certificate of transport by the veterinary official at a cost of KES 20 per consignment. The meat is thereafter transported to retail outlets. Burma market receives meat from outside Nairobi with COTs and they also bulk and opportunistically resell as wholesalers or retailers
- Manual operations that creates room for increased contacts between the flayers and the carcasses, thus increasing scope for contamination
- The tools like knives etc. which are sometimes not of the recommended quality increasing the scope for contaminations and low-quality cuts.
- Inadequate systems for disposal of both liquid and solid wastes; this increases chances for transmission of airborne microorganisms in the slaughterhouses;
- These slaughterhouses have cold rooms as required by law. However, the cold rooms are never fully utilised due to the low demand by the meat traders and butchery operators. The slaughterhouse management also considers this as a driver for high electricity costs.

Some of the meat traders usually wash meat carriers at car washing facilities, sometimes using inappropriate detergents, mainly those used for washing cars. This can cause contamination of meat with soap residues.

Other than the food safety issues, there are several inefficiencies in the slaughterhouses as summarised below:

Key Food Security and Quality Issues in the large-scale Slaughterhouses (Slaughtering for domestic market only)

- There is no system that traces the carcasses across the entire chain; the Veterinary inspection stamp (roller mark) is unique for each slaughterhouse which provides a very basic information on which slaughterhouse the carcass came from; the Certificate of Transport (CoT) is another basic document which provides basic information on where the carcasses came from and where it is being transported to.
- High utilisation of water because of highly manual operations
- High labour costs since all operations are manual
- Loss of value due to shrinkage which occurs when carcasses are not passed through the cold chain system.



4.1.2 A Case for Modernisation of Slaughterhouses Offering Slaughter Services

Proposed Interventions

Table 1 presents a number of opportunities for modernising the slaughterhouses in order to improve food safety standards, quality of carcasses and make processes more efficient. In a modern slaughterhouse, the aim is to invest in automations, systems and processes that enhance quality and food safety measures.

Table 1: Potential areas for investments in modernisation of local slaughterhouses

Modernisation Opportunities	How will they enhance safety and quality?	Possible options	Who to invest
Traceability Systems	<ul style="list-style-type: none"> This system will trace the carcass from the terminal market (slaughterhouse up to the butchery and to the retail outlets. This will eliminate infiltration of non-classified meat or meat of unknown sources from entering the meat supply chain 	<ul style="list-style-type: none"> Slaughterhouse to set up a database of all animals slaughtered each day, based on the information contained in the movement permits. Establish identification system for animals slaughtered each day. The meat trader should buy a tag for each of the animal before it is slaughtered. Investment in a tag harvester/barcode, which removes the tags from animals as it goes to the stunning area. Investment in a software that picks the information in the harvested tag/barcode and relays to a database in order to record the animal identification information Electronic registration of all livestock in order to come up with a national data bank from which meat inspectors can generate an authentic slaughter register 	<ul style="list-style-type: none"> Slaughterhouse management to invest in carcass traceability system involving a tag harvester that is linked to animal inventory management systems Meat traders, should pay for animal tagging (barcoding) at the slaughterhouse as soon as they have bought the animal and before slaughter. National and county governments to develop and operationalise the electronic registration of livestock
Replace manual hoists with electrical hoisting	<ul style="list-style-type: none"> Ensures clean meat production with limited contamination with floor and offal's Easier flaying with good blood drainage to the floor 	Investments in electrical hoists	<ul style="list-style-type: none"> Slaughterhouses

Modernisation Opportunities	How will they enhance safety and quality?	Possible options	Who to invest
Stunning	Reduces the pre-slaughter stress	Investment in stunning boxes	Slaughter house
Flaying	<ul style="list-style-type: none"> With good flaying technologies, there will be minimal contact between the flayer and the carcasses. It is also time efficient which reduced the operational costs. Quality of hides and skins improved hence increasing value of animals 	<ul style="list-style-type: none"> Invest in the use of hind pullers to minimise contacts between the flyers and the carcasses 	<ul style="list-style-type: none"> Slaughterhouses
Evisceration	<ul style="list-style-type: none"> Good evisceration is critical for clean meat production and will minimise contamination and bacterial cross over from the viscera to the meat 	<ul style="list-style-type: none"> Use well trained flayers to do evisceration 	Slaughter house
Cleaning	<ul style="list-style-type: none"> Critical for minimising flies and contamination. Good hygiene standards 	<ul style="list-style-type: none"> Manual or automatic cleaners or people 	Slaughter house
Dispatch	<ul style="list-style-type: none"> Clean meat is easy to dispatch as there is no time wasted to remove stains etc. 	<ul style="list-style-type: none"> Use of plastic or colon cloths would reduce contamination during dispatch or loading 	Slaughter house
Cleaning the facilities	<ul style="list-style-type: none"> Improves hygiene and speed of operations 	<ul style="list-style-type: none"> Manual cleaning using basic hand equipment 	Slaughter house
Cold-room facilities	<ul style="list-style-type: none"> Enhances quality by softening the meat. Increased shelf life 	<ul style="list-style-type: none"> Use refrigerated vehicles Chilling carcasses immediately after slaughter 	<ul style="list-style-type: none"> Abattoir Meat traders Meat transporters

4.1.3 Economics of Modernising Slaughterhouses

Introduction

The economic analysis considers a number of scenarios, which potentially operate in the Kenyan meat industry. Broadly there are two scenarios, the modernised and non-modernised slaughterhouses. The modernised slaughterhouses are those that have invested in technologies and practices that enhance food safety, efficiency, and quality enhancement, required for the sector growth. This involves mechanising slaughtering processes, acquisition of efficient slaughter equipment, operationalising of the cold rooms for the meat carcass, adopting appropriate

efficient waste management practices, setting up appropriate animal holding structures, and adopting desirable traceability and inventory management systems. The non-modernised slaughterhouses are a model of the current practices, where only basic food safety and quality enhancement measures are applied. Data used to feed into the modelling was collected from two modernised and two non-modernised slaughterhouses. For both modernised and non-modernised, analysis is made for small, large and medium scale slaughterhouses as discussed below.

Key Assumptions

Cost Drivers

The financial models for slaughterhouses provide detailed information on major assumptions used in the economic analysis. A summary of the main cost drivers for each of the slaughterhouse are as follows (Table 2):

- a. **Labour:** The study found out that the current practices are highly manual and therefore very intensive with a total labour force of 55 casual workers compared to 14 in the modernised operations. In the current practices, the casual workers are paid per, per piece (per cow), resulting to a direct labour cost of KES 325 per cow which is not incurred in the modern system. In modern system, casual layout is replaced by machines like hide pullers, electrical hoists, electrical meat splitters etc. In both systems, permanent labour is employed, to ensure that each of the slaughter process is supervised by at least one person, paid monthly. This brings near equal number of permanent employees in the two systems:
- b. **Production equipment:** In the modernised slaughterhouse, the high cost of labour (based on the existing practices in the slaughterhouses that were included in the study) is replaced by machines which brings efficiency and reduces risks of contamination. This is the highest cost driver for the modernised slaughterhouse which costs 7,261,500. In addition, the modern system has invested in a cold room which meat traders will be using for chilling meat. The size of cold room is dependent in the capacity of the slaughterhouse, with an assumption that each carcass will require at least 4 cubic meters.
- c. **Electricity:** Because of manual operations, the electricity requirements for the current slaughterhouse is just to provide lighting. The modern slaughterhouse on the other hand employs electricity-driven equipment like cold room, electric hoisters, and electricity weighing scales and hide pullers. As such the cost of electricity in the modernised slaughterhouse is as high as KES 5 per head compared to 0.5 per head in the current practices (based on the average expenditures from the slaughterhouses that were interviewed)
- d. **Water:** Operations in the current practices require intensive use of water, to the tune of 200 litre per bovine carcass. With the highly mechanised processes in the modern slaughterhouse, the water requirement is reducing to about 20 litres per bovine carcass. As such water is a direct cost in the current practices but not in the modernised system.
- e. **Software:** traceability and inventory management systems are key cost drivers in a modern slaughterhouse, since traceability in the meat supply chain starts at the slaughterhouse. This involves in investment in the software that costs about KES 8,500,000 and computers (based on prices given by the software companies). In addition, the modern slaughterhouses will be custodians of databases of animals that are slaughtered every single day, showing the animal origin as per the movement permits. This system is non-existent in the current practices by local slaughterhouses.
- f. **Fees and Licenses:** the government fees and licenses are equally applicable in both the modern slaughterhouses and those that have not invested in the modernised systems.

Table 2: Cost drivers for modern and non-modernised slaughterhouses

Land required in acres	Number of acres		Area under construction	
	Non modernised	Modernised	Non modernised	Modernised
Slaughter house	1.00	2.00	30.0%	30.0%
Holding ground	0.30	1.00	0.0%	90.0%
Solid waste disposal	0.25	0.50	40.0%	60.0%
Liquid waste disposal	0.25	0.50	30.0%	60.0%
Biogas system	0.10	0.20	30.0%	60.0%
Open space	0.60	0.60	0.0%	0.0%
Total	2.50	4.80	20.2%	46.3%
Cost of Land	750/Acre			
Permanent Employees	Non modernised	Modernised	Monthly Salary Modernised	Monthly Salary - Modernised
Manager	1	1	30,000	100,000
Bleeders	1	1	15,000	30,000
Hide and skins	1	1	15,000	30,000
Stunner	1	1	15,000	30,000
Accountant	1	1	20,000	50,000
Boma attendants	1	1	15,000	30,000
Security	2	2	30,000	40,000
ICT	-	1	-	70,000
Total	8	9		
Number of casual workers (paid per piece in the current model)	Non-modernised	Modernised		
Flayers	50	-		
Offal Cleaners	25	-		
Cattle lead	30	-		
Eviscerating	50	-		
Chain pullers	25	-		
Splitters	50	-		
Offal Transporters	25	-		
Carcass Cleaners	25	-		
Bleeding	25	-		
Stunner	20	-		
Total	325			
Production Equipment	Non modernised	Modernised	Units	Total Costs
Weighing scale - meat	-	250,000	5	250,000
Electric Chain hoist	-	898,500	4	1,480,000
Fraying / De-hider	-	750,000	1	300,000
Overhead rails	-	1,000,000		
Skinning cradles	-	107,500		
Evisceration machine	-	600,000		
Carcass trolleys	-	158,500		
Stainless steel Landing table	-	158,000		
Electrical carcass spreader	-	100,000		
Head washing cabinet	-	500,000		
Carcass washing cabinet	-	600,000		

Carcass split saw	-	1,000,000		
Breastbone saw		500,000		
Stunning box	-	389,000	1	
Generator	-	250,000	1	
Total	-	7,261,500		
Software	Non modernised	Modernised	Units	Units Costs
Traceability software	-	7,700,000	1	7,700,000
Computers	-	350,000	5	70,000
Livestock weighing scale	-	400,000	1	400,000
Tag harvester	-	50,000	1	50,000
Total	-	8,500,000		
Cold room				
Cost of cold room	8,700,000	8,700,000	300	29,000
Waste management				
Biogas system (30 cubic meters)	-	1,000,000	1	1,000,000
Other overheads				
Overheads include; water, electricity, permits and licenses etc.	256,000	294,000		

Revenue Drivers

- a. Slaughter fees:** The main source of revenues for the two categories of slaughterhouse is slaughter fee that are charged to meat traders for using the slaughter facilities. In the slaughterhouses that have not applied modernisation, the slaughterhouse charges are currently at KES 700 per cow (this is based on the average slaughter charges from 3 major slaughterhouses serving Nairobi market. After application of modernisation systems, the slaughterhouse fees have been adjusted to KES 800 per cow. This is much lower than some of class A slaughterhouses in the country.
- b. Cold room fees:** The modern slaughterhouses will be offering chilling services to the meat traders to ensure the carcass quality is enhanced or to provide facilities for making high quality products like aged meat.
- c. Holding fee:** The analysis has proposed that a modern slaughterhouse will invest in 4.8 acres of land, to allow adequate room for resting cattle, after transportation from source markets. The fees have been casted at KES 500 per cow (This is

average from two of the slaughterhouses with serving the Nairobi market).

- d. Sale of manure:** the modern slaughterhouse will engage in sale of manure at KES 1000 per cow compared with KES 500 for the current practices.

4.1.4 Capacity Utilisation

The economic analysis considers the following scale of operations:

1. Small-scale slaughterhouses with capacity to slaughter up to 300 cattle a day
2. Medium-scale slaughterhouses with capacity to slaughter up to 450 cattle
3. Large-scale slaughterhouse capable to slaughter up to 600 animals a day.

To start with the analysis, the number of animals slaughtered in major class B slaughterhouses serving Nairobi markets was taken as the base slaughterhouse capacity. This led to a base figure of 300 which was used for financial model to determine the middle and large-scale operations.

4.1.5 Process Mechanisation

Key activities of modernised slaughterhouses will include providing hygiene and safe slaughter services as well as offering cold chain services to traders for the meat carcasses. In order to ensure quality and safety, of the meat, slaughterhouses will also focus on handling of live animals at the pre-slaughter stage as well as of the meat produced at the post slaughter stage. The slaughterhouse will set up appropriate holding pens to receive the livestock from different markets across country for pre-slaughter resting at a fee. There is room for slaughterhouses to provide holding services to traders who would be willing to source animals in bulk and holding them for a period of time, which helps to improve traceability. Also replacing the manual slaughter processes with mechanised processes will improve the speed and efficiency of slaughter services, which will influence the operating capacity.

Appropriate suspension system the slaughter processes with an overhead rail will reduce contact of the carcass with floor to reduce contamination of the meat. Mechanising the processes including installing necessary slaughter equipment will require about 600 square metres for a small-scale slaughterhouse. Immediate focus for mechanisation will be stunning, hoisting, flaying, evisceration, carcass splitting, and carcass washing sections with desirable interventions including acquiring modern equipment and capacity building slaughterhouse workers.

Key equipment required will include an overhead rail expected to cost about KES 750,000, electrical chain hoists expected to costs about KES 300,000, hide pullers which costs about KES 150,000, electric evisceration machine expected to cost about KES 600, 000, and dressing hooks and rollers among other equipment.



4.1.6 Waste and effluent management

Processes of converting the livestock into meat produces significant amount of solid and liquid wastes that exposes slaughterhouses to substantial health and environmental risks. Modernisation will require developing the necessary frameworks that will include cleaning and sanitation procedures, waste and effluent treatment, and training of slaughterhouse workers to comply with environmental requirements. However, setting up efficient waste treatment plant remains very expensive and beyond reach for most small-scale slaughterhouses due to the huge initial investment. Modernisation will include setting up waste treatment facility including simplified treatment facilities such as installing biogas digesters that are capable of significantly reducing the impact of wastes and effluent. Biogas digesters are relatively inexpensive and requires little maintenance. Information from service providers revealed that constructing a 30 cubic metre digester would cost about one million Kenya shillings.

Biogas digesters also generates gas to substitute some of the energy requirement

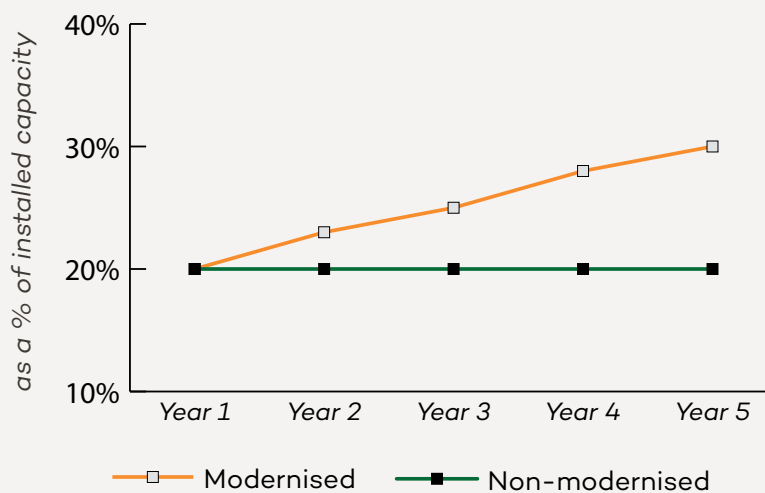
at the slaughterhouse estimated at five (5) kWh per animal slaughtered. Slaughterhouses could use biogas to boil water for cleaning slaughter equipment as well as in general cleaning and sanitation while selling solid residuals as fertiliser.

4.1.7 Operationalising cold room services

Building and installing cold room is the most capital-intensive investment in modernising slaughterhouse operations. The cost of installing a medium size cold room with a capacity to hold up to 200 carcasses stands around KES 13 million. Majority of conventional slaughterhouses have installed cold rooms which are underutilised. With emerging requirements on meat quality and safety, modernisation will require slaughterhouses to provide cold room services to traders as part of slaughter services to contribute to the safety and quality of the meat available at consumer outlets that include butcheries, supermarkets, hotels, and restaurants among others. Unrefrigerated, meat will require short handling period between the slaughterhouse, retail outlet, and consumers.

Graph 1: Key challenges to the finishing and fattening businesses

...with modernisation, utilisation of the cold rooms at the slaughterhouses will improve gradually...



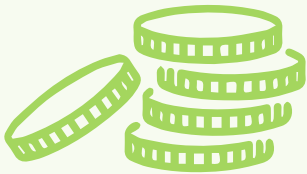
4.1.8 Revenues

First year revenues and profit for the two types of slaughterhouses at different scales of operations are presented in table 3.

- Gross Revenues:** The modernised slaughterhouses are generating much higher annual revenues, close to double the non-modernised slaughterhouses for three scales operations. In both scenarios, this revenue continues to increase over time.
- Net income:** After considering taxes, profit for the modernised slaughterhouses is estimated at KES 1,455,082, KES 766,480 and KES 2,551,517 for small, medium and large-scale slaughterhouses. Respectively. This is much higher than the non-modernised system, whose profits stand at KES 14,712, KES 61,059 and KES 1,205,425 for small, medium and large scale non-modernised slaughterhouse respectively. The net margins and returns from the small-scale modernised slaughterhouse is however negative in the first year, because of the initial investment on equipment in the first one year. This however improves with time as the capacity utilisation improves.
- Profitability:** According to the projected income statement, the medium and large-scale slaughterhouses will start generating profits in the first year of operation. Profitability ratios (Table 4) indicate that on average, the modernised slaughterhouse yields a gross profit of 59.3 per cent compared to 34.7 per cent. The net margins for the modernised slaughterhouses are -6.6 per cent, 2.3 per cent and 5.8 per cent for the small, medium and large-scale slaughterhouses in the first one year. The non-modernised slaughterhouses on the other hand have net margins of 0.1 per cent, 2.3 per cent and 3.5 per cent for small, medium and large-scale slaughterhouses respectively in the first year. Although the small-scale modernised slaughterhouses appear to start the first year with negative margins, the net profits are improving over time to 17.2 per cent by year 5. On the other hand, the profit margins for the small scale non-modernised slaughterhouses are reducing over time up to one per cent in year five. The profitability for year one for a modernised slaughterhouse is generally low resulting from the high investment in equipment, but this improves over time as capacity utilisation improves.

Table 3: Revenues and Gross Margins from Modernised and Non-modernised Slaughterhouses

Description	Modernised			Non-modernised		
	Small	Medium	Large	Small	Medium	Large
Gross Margin	13,149,656	19,724,484	26,299,311	6,061,018	9,091,527	12,122,036
EBITDA ¹	1,701,656	4,832,484	7,963,311	1,309,016	2,803,527	4,298,036
*EBIT ²	1,455,082	1,094,971	3,645,024	21,018	871,527	1,722,036
Earning before tax	1,455,082	1,094,971	3,645,024	21,018	871,527	1,722,036
Net surplus	1,455,082	766,480	2,551,517	14,712	61,059	1,205,425
Gross margin	59.3%	59.3%	59.3%	34.7%	34.7%	34.7%
Net margin	-6.6%	2.3%	5.8%	0.1%	2.3%	3.5%
Return on Assets	-3.1%	1.4%	4.2%	0.1%	3.1%	4.7%
Return on Equity	4.8%	2.1%	4.9%	0.1%	3.1%	4.8%
Return on Investment	-8.6%	4.5%	15%	3.7%	101.4%	150.3%



profit for the modernised slaughterhouses is estimated at

KES 1,455,082 for small scale

KES 766,480 for medium scale

KES 2,551,517 for large-scale

non-modernised slaughterhouses system, profits stand at

KES 14,712 for small scale

KES 61,059 for medium scale

KES 1,205,425 for large-scale

Profitability ratios indicate that on average, the modernised slaughterhouse yields a **gross profit of 59.3% compared to 34.7%**



Although the **small-scale modernised slaughterhouses** appear to start the **first year with negative margins**, the net profits are improving over time to **17.2% by year 5**

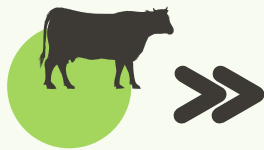


the profit margins for the **small scale non-modernised slaughterhouses** are reducing over time up to **1% in year five**

4.1.9 Break Even Analysis

Break Even Analysis indicates that BEP of output is 24,419, 26,155 and 33,092 live animals per year for small, medium, and large-scale modernised slaughterhouses respectively as shown in table 4. For the non-modernised, slaughterhouses the breakeven point number of slaughtered animals is 19,219, 31,148 and 37,877 live animals per year for small, medium and large scale non-modernised slaughterhouses respectively. Table 4 shows that minimum of 24,419, 26,155 and 33,092 live animals should be slaughtered per year in case of small, medium and large-scale slaughterhouses respectively under the modernised system. Implicit in the above Break-even point of output is the need to revisit the volumes of animals slaughtered in each county to inform decisions on reorganisation

of the slaughter services and the investments. Depending on size of county, a medium scale slaughter house may be what is needed with an efficient cold chain transport system to distribute the meat. The non-modernised systems on the other hand required a minimum of 19,219, 31,148 and 37,877 live animals to be slaughtered in a year for the case of small, medium and large-scale slaughterhouses respectively without sustaining losses. These results show that though starting with a relatively low or negative margin of safety, the modernised slaughterhouse will improve the margin of safety over time compared to the non-modernised system. It is evident from fig 3 and 4 that margin of safety reveals positive relation with capacity showing higher profits on modernised systems.



BEP output of live animals for modernised slaughterhouses per year is

24,419 for small scale
26,155 for medium scale
33,092 for large-scale



BEP output of live animals for non-modernised slaughterhouses per year is

19,219 for small scale
31,148 for medium scale
37,877 for large-scale



The minimum of

24,419 for small scale
26,155 for medium scale
33,092 for large-scale

live animals should be slaughtered per year under modernised system



The minimum of

19,219 for small scale
31,148 for medium scale
37,877 for large-scale

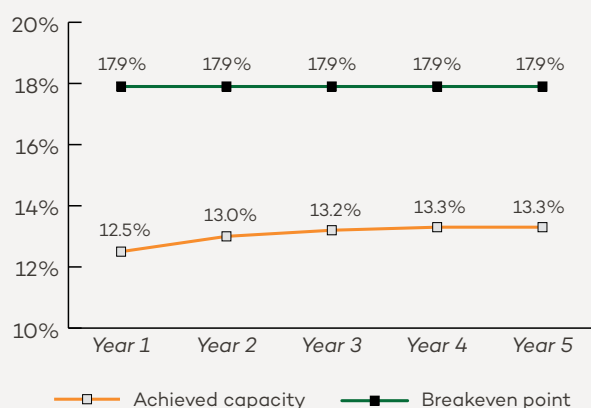
live animals should be slaughtered per year under modernised system

Table 4: Revenues and Gross Margins from Modernised and Non-modernised Slaughterhouses

Small-scale	Modernised					Non-modernised				
	Yr1	Yr2	Yr3	Yr4	Yr5	Yr1	Yr2	Yr3	Yr4	Yr5
Installed Capacity	108,000	108,000	108,000	108,000	108,000	108,000	108,000	108,000	108,000	108,000
Achieved Capacity Total Output	21,986	24,686	27,386	30,086	32,781	19,286	19,286	19,286	19,286	19,286
Break even Number of Slaughtered Animals	24,419	23,629	22,198	20,936	19,831	19,219	19,365	19,068	18,757	18,463
Margin of Safety on achieved capacity	(2,433)	1,057	5,188	9,150	12,950	67	(79)	218	529	823
Margin of Safety on achieved capacity	-11%	4%	19%	30%	40%	0%	0%	1%	3%	4%
Medium Scale										
Installed Capacity	162,000	162,000	162,000	162,000	162,000	162,000	162,000	162,000	162,000	162,000
Achieved Capacity Total Output	32,979	37,429	41,079	45,129	49,179	28,929	28,929	28,929	28,929	28,929
Break even Number of Slaughtered Animals	31,148	30,015	28,269	26,721	25,348	26,155	26,204	25,767	25,308	24,879
Margin of Safety on achieved capacity	1,831	7,414	12,810	18,408	23,831	2,774	2,725	3,162	3,621	4,050
Margin of Safety on achieved capacity	6%	20%	31%	41%	48%	10%	9%	11%	13%	14%
Large Scale										
Installed Capacity	216,000	216,000	216,000	216,000	216,000	216,000	216,000	216,000	216,000	216,000
Achieved Capacity Total Output	43,971	49,371	54,771	60,171	65,571	38,571	38,571	38,571	38,571	38,571
Break even Number of Slaughtered Animals	37,877	36,401	34,339	32,506	30,875	33,092	33,043	32,466	31,860	31,287
Margin of Safety on achieved capacity	6,094	12,970	20,432	27,665	34,696	5,479	5,528	6,105	6,711	7,284
Margin of Safety on achieved capacity	14%	26%	37%	46%	53%	14%	14%	16%	17%	19%

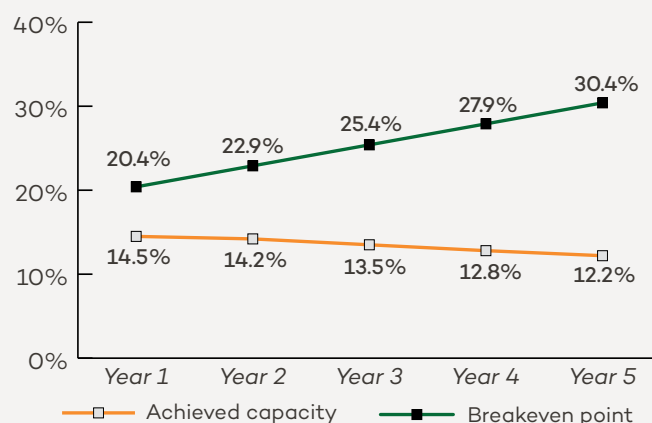
Graph 2: Improvement in Breakeven points with Capacity Utilisation over time for Non-Modernised for slaughterhouse

...with limited investment expected, operating capacity of non-modernised slaughterhouses will remain constant while breakeven will worsen (as a % of installed capacity)... The Margin of safety reduces with time, which reduces overall profitability



Graph 3: Improvement in Breakeven points with Capacity Utilisation over time for Modernised slaughterhouse

...modernisation will gradually improve operating capacity by mechanising operations. Breakeven will improve with scale and timeframe (as a % of installed capacity)... The margin of Safety improves with capacity utilization which increases overall profitability



4.1.10 Impact of modernisation on prices

The modernised slaughterhouse is generating the highest gross revenues per animal compared to the non-modernised systems as can be seen in table 5 and fig 5. The price differentials between the modernised and non-modernised are increasing over time, from 14% in the first year to 26% per year, resulting to from the higher efficiency over time.

Table 5: Projected Gross Revenue per Animal Slaughtered

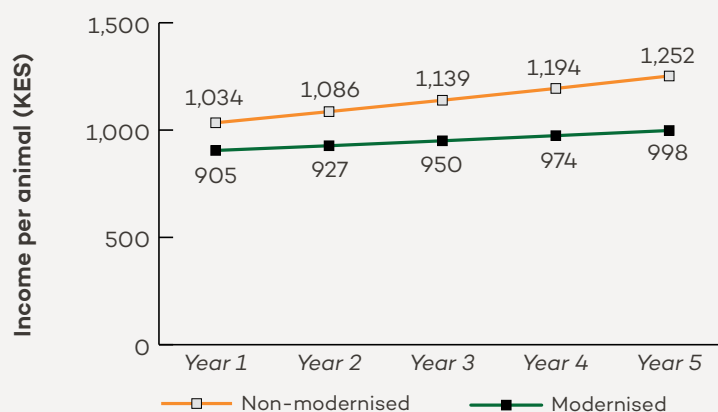
Gross Revenue per Animal	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5
Non-Modernised (KES)	905	927	950	974	998
Modernised (KES)	1034	1086	1139	1194	1253
Price Differential (%)	14%	17%	20%	23%	26%

The price differentials between the modernised and non-modernised are increasing over time, from **14% in the first year to 26% per year**, resulting to from the higher efficiency over time.



Graph 4: Income per live animal slaughtered will improve over time for modernised and non-modernised slaughterhouse influenced by inflation

Modernisation will improve revenues received by the slaughterhouse through holding fees and sale of biomass. Biogas produced will further reduce expenditure on energy.



As with Gross revenues, the gross margins per animal slaughtered within the first year under the modernised slaughterhouses are very high, at 75 per cent as shown in table 6. The non-modernised system has a relatively lower gross margin per animal of 27 per cent. Table 6 summarises these findings.

Table 6: Gross Margins per animal slaughtered

Description	Modernised			Non-modernised		
	Small	Medium	Large	Small	Medium	Large
Gross Revenue	17,443,929	26,165,893	34,857,857	22,183,586	33,275,379	44,367,171
Gross Margin	13,149,656	19,724,484	26,299,311	6,061,018	9,091,527	12,122,036
Number of animals at installed capacity	21,986	32,979	43,971	19,286	28,929	38,571
Gross Margin per animal	598.09	598.09	598.11	314.27	314.27	314.28
		75%	75%	27%	27%	27%

A slaughter fee of KES 800 used in this analysis have yielded high positive returns from the modernised slaughterhouses over non-modernised systems. This indicates that implementation of modernisation will not create major changes to the prices charged to the meat traders who use the slaughterhouses. It implies at a slaughter

fee of KES 800 the meat traders will enjoy high food safety standards, efficiency from mechanised services as well the assurance of traceability of meat they buy. Bearing in mind the cost of treating food borne disease by families, this price differential is worthy considering to ensure health populations.

4.1.11 Cost Structures

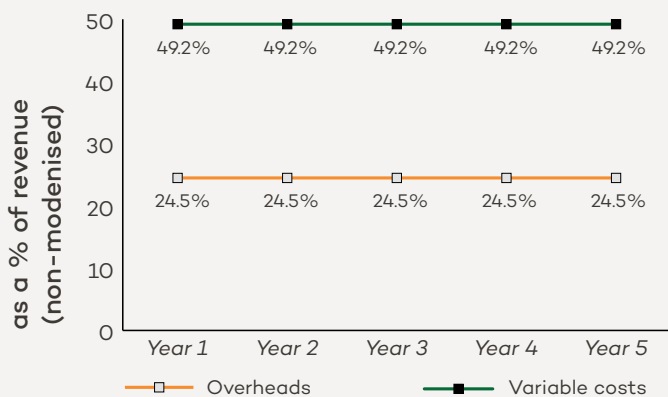
Modernising the slaughterhouses will result into better quality carcasses through reduced post slaughter stress after investments in appropriate lairages, effective slaughter processes through mechanisation, and improved hygiene and sanitation. Non-modernised slaughterhouses operate cheaply due to limited expenditure on human resource, limited repair and maintenance, inadequate management of hygiene, inefficient waste and effluent management, and limited use of energy that allow for low slaughter fees per animal.

Modern slaughterhouse will incur increased monthly overheads resulting from increased

use of energy estimated at KES 30,000, water estimated KES 20,000, waste disposal estimated at KES 20,000, cleaning and sanitation estimated at KES 60,000, operating permits estimated at KES 14,000, security estimated at KES 60,000, and office expenses estimated at KES 20,000 among other expenses. Salaries and wages for permanent staff hired will also be a major cost. With increased efficiency over time, the overheads for modernised slaughterhouses will however reduce while in the non-modernised systems, the overhead and variable costs will remain proportionate to revenue, as shown on fig 6 and 7.

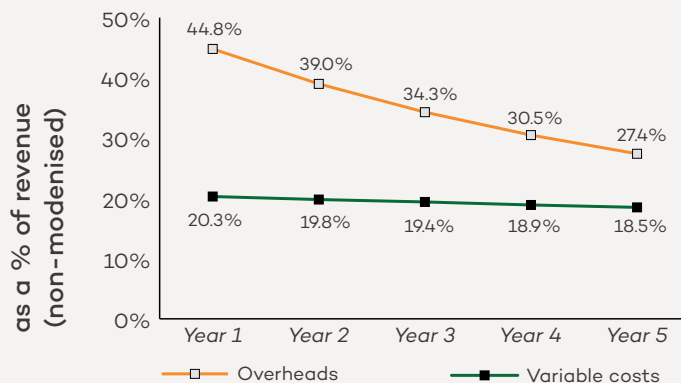
Graph 5: Percentage change in revenue over time for non-modernised slaughterhouse

...due to limited efficiency, variable costs and overheads will remain proportionate to revenues regardless of scale or timeframe



Graph 6: Percentage change in revenue over time for modernised slaughterhouse

...with expected improvement in efficiency, variable costs and overheads will improve gradually with scale and timeframe



4.1.12 Human Resource in Production

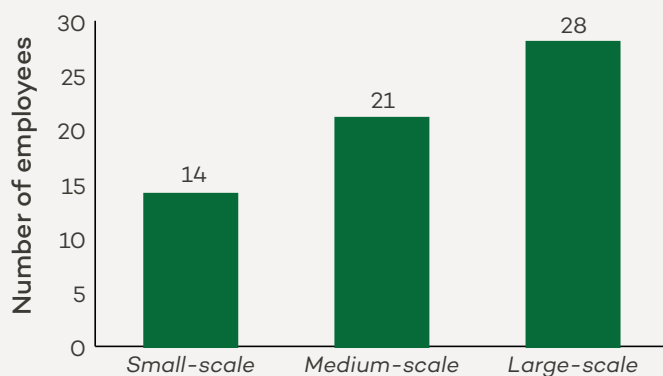
Recruiting qualified and competent slaughter worker at slaughterhouse and appropriately training the staff to handle operations will be necessary in modernising the slaughterhouses. The skills and attitude of the slaughter personnel will influence the safety and quality of the meat distributed to market. Projecting from data from one of the large-scale modernised slaughterhouses,

results show that Small-scale slaughterhouse with a capacity to slaughter up to 300 cattle will have approximately 14 permanent staff to manage the mechanised slaughtering process. Currently slaughtering is purely manual with casual workers paid per piece estimated at KES 325 per animal. Administrative personnel carry out coordination of activities. Empowering staff in hygiene standards,

cleaning and sanitation control, and slaughtering technology will be primary focus for the slaughtering personnel in the modernised system. This will have a significant impact on salaries and wages that the slaughterhouse will pay. However, it will significantly reduce the variable costs by eliminating the current piecemeal payments for slaughtering processes (currently estimated at 55 persons in non-modernised system of a similar scale).

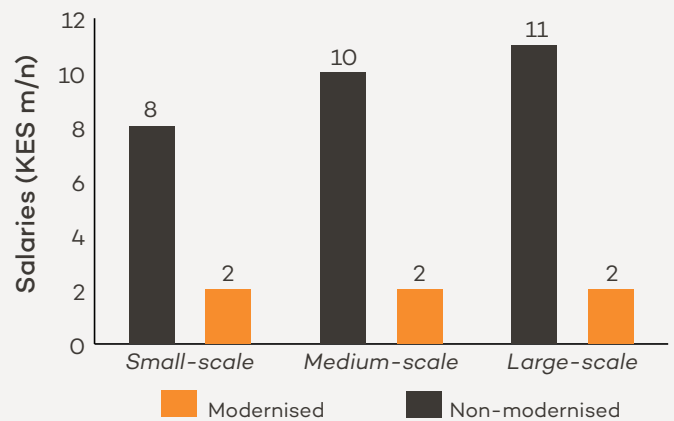
Graph 7: Number of employees for small, medium and large scale modernised and non-modernised slaughterhouses

Non modernised slaughterhouses have no permanent slaughter staff but utilise casual workers that are paid per per piece



Graph 8: Salaries in millions of KES for small, medium and large scale modernised and non-modernised slaughterhouses

Salaries for administrative and slaughtering employees will be a major cost in modernisation. Non-modernisation will only incur salaries for administrative staff.



4.1.13 Capital Expenditure

To modernise and enhance the viability and safety of the slaughterhouses, significant investment will be required in acquiring suitable equipment, improving hygiene standards in slaughtering as well as in waste management. Conservative estimates of costs for a small-scale slaughterhouse with a throughput of 10 - 15 heads per hour will be KES 7.3 million for slaughter equipment, KES 8.7 million for cold chain facilities, and KES 1 million for waste and effluent management facilities. The slaughterhouse will also invest in appropriate traceability and inventory management system estimated to cost about KES 8.5 million to support in monitoring the movement and weight of livestock and the meat distributed to the consumer outlets.

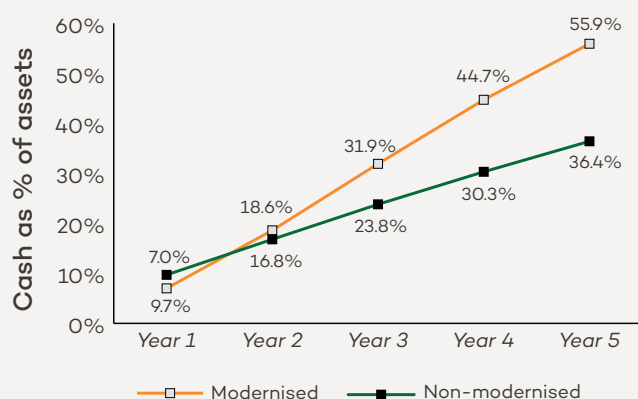
Modernising the slaughterhouses will also include upgrading the physical structures, improving cleaning and sanitation standards, holding pens, and waste and effluent treatment facilities. Traceability and inventory

system will enable tracking of critical data and information upstream to the source market as well as downstream to the consumer outlets. The traceability system will include electronic tagging of the animals at source estimated to cost about KES 150, weighing scales at the market and slaughterhouse, appropriate stamping system for the meat to enhance traceability to the consumer outlets, and application will capture necessary data about the animals from the market through to the slaughterhouse. Modernisation will also require investment in necessary loose tools that will include meat inspection tools.

The quality of equipment acquired and the hygiene standards maintained during the slaughtering process as well as the meat handling processes will play a role in enhancing safety of the meat. In addition, necessary renovation on existing buildings and slaughter grounds to meet the necessary standards will reduce contamination of the meat.

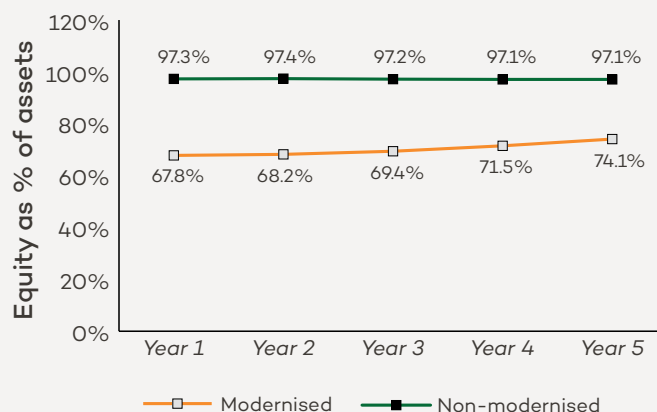
Graph 9: Cash percentage of assets over time for modernised and non-modernised slaughterhouse

Liquidity position for modernised operations will improve faster overtime to reduce contribution of non-current assets to the balance sheet



Graph 10: Equity as percentage of assets over time for modernised and non-modernised slaughterhouse

Non-modernised slaughterhouses will on a limited extent rely on commercial funding to finance assets and operations.



4.1.14 Investment Returns

Investments into modernising the slaughterhouses will take into consideration the value of assets the slaughterhouse will acquire, and potential of the slaughterhouse to generate future earnings based on the revenues and expected cost structures. Investment in slaughterhouse will require an investment period of 2 - 4 years. With the expected positive financial performance, the business will guarantee investors good returns on exit,

and will support expansion of operations over the period. Supported by economies of scale, modernised slaughterhouses will generate significant free cash flow from operating activities with adequate cash flow to repay commercial funds borrowed to finance capital expenditure while creating a reserve for rewarding the investors. Table 7 below presents these results.

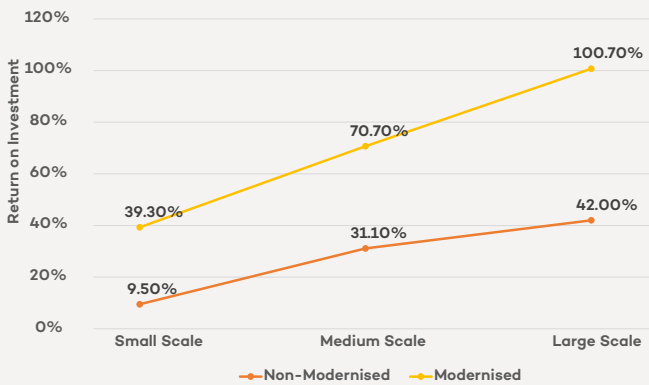
Table 7: Investment Returns for modernised and non-modernised slaughterhouses

5-year horizon	Non-Modernised			Modernised		
	Small	Medium	Large	Small	Medium	Large
Cash Flow from Operations	6,799,086	13,530,750	20,254,743	30,427,291	54,234,837	77,605,859
Cash Flow from Investing	2,107,788	3,161,682	4,215,575	17,539,962	17,929,193	18,318,425
Cash and bank balances	4,983,214	10,736,942	16,482,998	29,655,124	52,886,587	78,681,525
Payback period	Year 1	Year 1	Year 1	Year 4	Year 3	Year 2

Sustainability of modern slaughterhouse will remain high and will continue to improve gradually overtime despite discounting the free cash flow from operations by 18 per cent to mitigate the risk of failure expected during the initial years. Returns from the investment will depend on the amount of money invested, investment period allowed, financial performance of the investment, and free cash flow generated during the period. Financial performance will influence revenue generated from operating activities, and costs incurred by the slaughterhouse. With positive NPV, IRR and ROE, holding the investments in the business for a longer investment period will earn the investor better returns on exit.

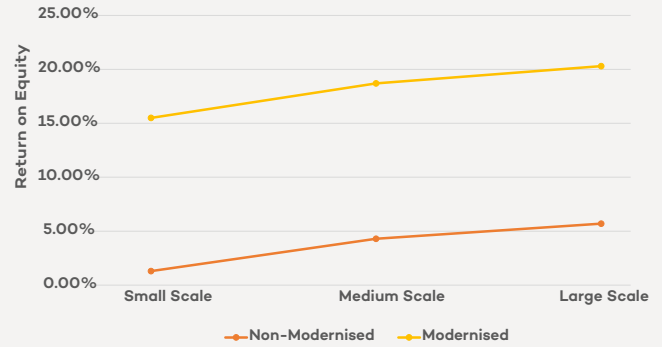
Graph 12: Return in Investment over time for Modernised and non-modernised slaughterhouses

modernisation will support attractive return on investment for the investors



Graph 13: Return on equity over time for modernised and non-modernised slaughterhouses

with interest rates ranging from around 14% modernisation offer investors more attractive returns.



4.2 Modernisation of Meat Processing and Value Addition

4.2.1 An Overview of Meat Processing Practices

Processing in the Kenyan meat industry mainly takes place in butcheries and it involves either change of form of a meat product either to extend shelf life or improve taste among other reasons. Processing does not include non-meat product. Methods of processing include differentiation of meat into prime cuts, deboning, aging and mincing/grinding among others. Some of these methods like mincing are steps in the making of value added or manufactured meat products. Meat processing practices in Kenya range from small scale informal processing often done on streets to large scale commercial processing.

Kenyan meat industry is largely a hot carcass chain system. After slaughter, meat is hanged in the butchery and sold to consumers. Butchers who serve more quality sensitive consumers usually age meat by hanging carcasses overnight before selling to consumers. This implies that majority of the meat processors and manufacturers of the meat products must apply various tenderisation interventions in order to achieve the desired quality. Interviews with the meat retailers revealed that to manage the risks of

losses associated with spoilage, butchers are restricted to buying meat that can last for a maximum of 3 days under room temperature storage conditions when hanged/suspended.) In addition, majority of the retail outlets have deep freezers where they preserve any unsold meat at the end of the day. The retailers have creative ways of clearing their stock, including value addition to Samosa and having extensions of Nyama Choma outlets. Through these strategies, they have significantly minimised the losses associated with deterioration.

Types of Processed Products: in Kenyan Market

Below is a brief description of common processed products in the Kenyan meat market.

a) Differentiated Meat Cuts

This is a value adding process which differentiates carcasses into prime meat cuts. This is mainly practiced in the butcheries supplying to the high-income consumer

segments. This differentiation, which is largely driven by the consumers produces special cuts which fetch high prices compared to non-differentiated meat cuts. Once differentiated, the retailers are able to capture premium prices from these products, which yields increased the net returns. There is low level of awareness of the prime beef cuts by the low- and middle-income consumer categories. As a

result, majority of the retail outlets do not sell differentiated meat cuts. The unknown fact to all consumers however is that differentiated cuts is the only way to get value for their money because there is no cheating on meat to bone ratio. Table 8, present's classical information of potential yields from different meat cuts from a cow carcass.

Table 8 Proportion of different meat cuts from different quarters

Type of Cut	% yield	Type of Cut	% yield
Hind Quarter		Fore quarter	
Sirloin on Bone	15.5	Rolled Ribs	14.1
Rolled-Sirloin	12.5	Brisket	14.81
Topside	10.1	Shin on Bone	12.96
Silver Side	11.1	Shin hones	12.96
Top Rump	6.7	Chuck Steak or Mince	9.26
Rump Steak	8.2	Middle Ribs	7.41
Shin on Bone	4.8	Flat Ribs	7.41
Boneless Shin	2.3	Neck	7.41
Flank	5.3	Flank	7.41
Bones'	10.4	Waste and Dehydration	5.56
Waste	5.8		
Kidney	0.5		
Mince	2		

Source: Berhe, 1976;

b) Ageing

Ageing involves chilling meat at -4 degrees celsius keeping meat under refrigeration for 21 days (this is on average ageing time however; some clients demand longer ageing periods) Discussions with meat industry actors revealed that most aged meat in Kenya is predominantly beef. This is an enzymatic process which results in the severing of muscle fibers hence improving the tenderness of meat. Chilling in this instance is purely the vehicle which provides the shelf life and therefore the time necessary for the ageing process. Ageing however has little effect on very tough meat, irrespective of whether the toughness is a result of animal age, rigor or a result of extreme cold shortening. It is

therefore important to ensure that the animal slaughtered is of good quality and that the carcasses are chilled soon after slaughter to allow for greater value to be extracted from ageing process.

The Kenya meat end market study conducted by KMT revealed that aged meat was the product that only minority of consumers were aware of and consumed. In many instances, it is consumed by high end consumers (Tourist and expatriate category). As such this is one of the most expensive products with a price range of KES 1,200 to 4,000 per Kg, depending on the consumer segment.



Aged meat is one of the most expensive products with a price range of **KES 1,200 to 4,000 per Kg**

c) Vacuum Packaging

A more common complementary treatment for meat storage is the vacuum packaging of boneless meat cuts. Special extremely airtight (oxygen-tight) synthetic films have been developed which can be heat-sealed after removing the air around the packed meat cut, thus keeping it practically out of contact with the surrounding atmosphere. Provided hygienic slaughter and cutting methods are used, the shelf-life of meat packed in this way and stored under 0°/-1°C can be remarkably extended (up to eight weeks for beef, four weeks for lamb and two to three weeks for pork), which is important for the export of boneless chilled meat. It is important to note that that vacuum-packed beef must not necessarily be chilled. When not chilled, it is registered un-chilled vacuum meat and could keep for up to 2 weeks without any visible physical changes

d) Curing

Curing involves preservation of meat with salt (sodium chloride) and sodium or potassium nitrite or nitrate or a mixture of these two salts. The use of salt is one of the oldest methods of preserving meat by inhibiting growth of most spoilage organisms. The early curing procedures were lengthy and recent developments have led to a reduction in the time required. Curing is the first step in the processing or manufacturing of most meat products. In Kenya, this value addition is mainly done by large scale processors/manufacturers producing products like bacon, salami, and peperoni among others.

e) Meat mincing

Mincing is taking whole muscle meat and finely dicing it with processor, referred to as a meat mincer. Meat mincing is widely practiced in the retail outlets, mainly those that mainly serve the middle income and the low high-end income segments. The retail outlets mainly serve the households, traders who make other meat products like Samosa as well as hotels. Minced meat is priced at an average price of KES 550 per kg which is relatively higher than the retail price for meat on bone.

The processing and value addition segment involve diverse actors due to limited barriers to entry, save for the capital required. Butcheries are a key focus in the modernisation since they are the main channels for meat processing and retail. Besides, butcheries in Kenya distribute close to 70 per cent of the fresh meat in Kenya (Tschirley et al., 2010). As a result, meat processing ranges from large scale operators processing more than 3 carcasses per day to small scale vendor who buy and sell less than half a carcass per day.

To maximise profit, assure quality and manage risks of spoilage, some processors are involved in meat trade as well. The meat processing is broadly categorised as follow:

1. **Meat traders** – Buying live animals, slaughtering and selling carcasses to butcheries
2. **Butcheries** – Buying carcasses from slaughterhouses and meat traders
3. **Large scale outlets**

4.2.2 Modernisation of Meat Trading Practices



Current Practices

Meat traders usually buy live animals from terminal markets, slaughter and sell carcasses to butcheries in all the three consumer segments and institutions. They are the main users of slaughterhouse services, providing a link between production of live animals and meat retail. In this category, are traders who slaughter in Class B slaughterhouses located outside Nairobi e.g. Laikipia, Narok, Rumuruti etc. and distribute meat to butcheries in Nairobi. The operations and levels of investments of meat traders is quite variable, depending on the target consumers. Those supplying high income consumer segments usually slaughter high quality animals with potential to have a high yield of primal. Those that serve the low-income market segments on the other hand usually buy small sized animals of less than 300 Kg live weights, in order to serve the price sensitive low-income consumer segments. The main cost drivers for this category include transport costs of the live animals, slaughter services and meat transportation. Their revenues come from sale of carcasses and fifth quarter.



Key food safety and quality issues:

The key food safety concerns at this level include

- **Risks of unethical traders** selling uninspected meat or non-classified meat is very high, since the traders have no trace back systems (This could especially happen because there are no spot checks

on transported meat to verify whether the meat transported is consistent with what has been covered by the CoT)

- **There is limited refrigeration**, from slaughterhouses to the butcheries
- **Meat is largely transported in meat boxes**, some of them though licenced are washed at the car wash facilities, which raises high food quality and safety concerns
- **Diseased carcasses** could easily find their way to these markets



Modernisation of the meat trade

Proposed modernisation of meat trade aims at addressing the food safety concerns listed above and also addressing operational inefficiencies. Any changes in slaughterhouse charges as a result of modernisation of slaughter services could be easily absorbed by meat traders if, they addressed inefficiencies in meat trade. These inefficiencies include:

1. **Underutilisation of live animal transport:** In the current live animal transport, about 20 live animals are transported in 15-ton trucks which is about 50 per cent Capacity utilisation. Increasing the capacity utilisation could significantly reduce the cost of transporting animals
2. The current meat transportation involves **use of meat boxes carried in pickups, which are not economically efficient.** For instance, to transport meat from Laikipia to Nairobi, a 1 tonner pick up charges KES 12,000 which translates to KES 12 per Kg. On the other hand, using refrigerated vans for the same distance costs KES 18,000 for a 2-toner van which translates to KES 9 per kg.

4.2.3 Economics of Modernisation

Assumptions

The major cost drivers for this segment is assets (live animal truck and a refrigerated van for transporting meat), personnel and slaughterhouse costs. Table 9 presents a summary of these assumptions, while a detailed list of assumptions is presented in annex 1.

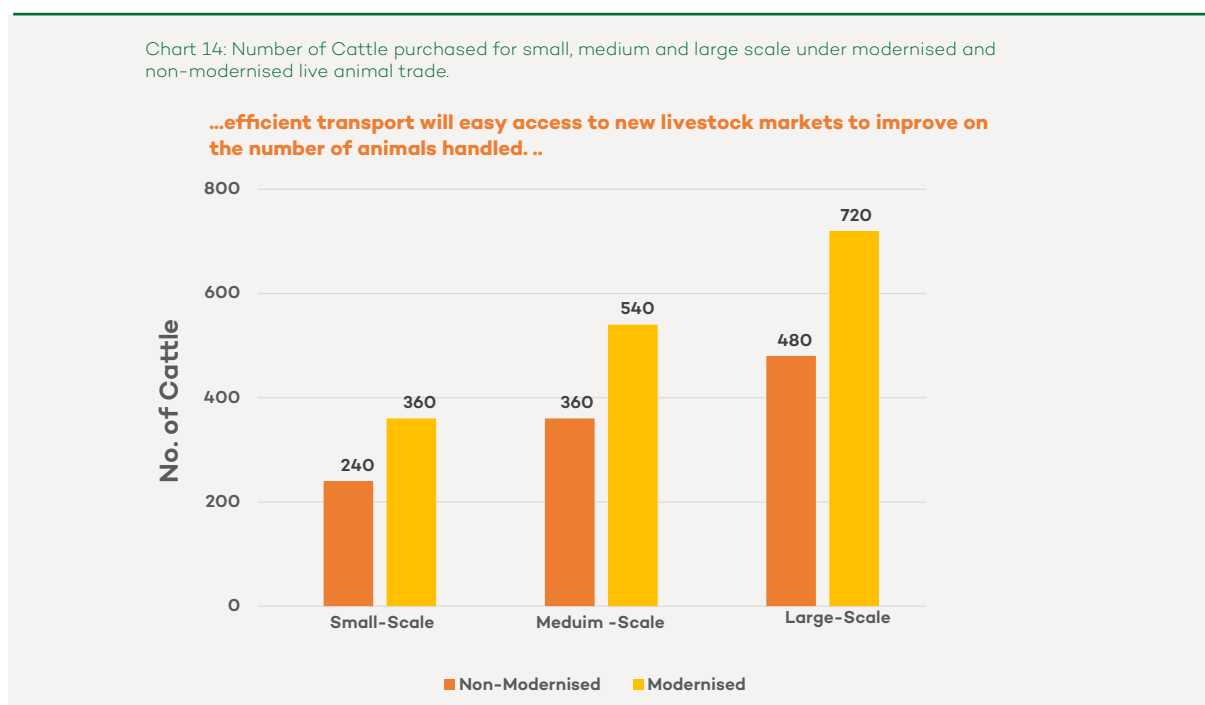
Table 9: Key Assumptions in financial analysis for live animal and meat trade

Number of animals	No of cattle handled	Trips per month		
Small-scale	20	1		
Medium-scale	30	1		
Large-scale	40	1		
Number of trips	Non modernised	Modernised		
Per month	1.0	1.5		
Cost of Sales	Non-modernised	Modernised		
Cost per kg of live animal	112	112		
Transport per live animal	700	-		
Holding fees	1,000	1,000		
Slaughter charges	700	800		
Transport per carcass	800	800		
Cess and permits	150	150		
Other overheads	Non-modernised	Modernised		
Transport for trader	30,000	30,000		
Security	15,000	-		
Meals and accommodation	20,000	20,000		
Telephone and communication	5,000	5,000		
Total	70,000	55,000		
Kilograms per animal	Mean (kgs)	Distribution	Non-Modernised	Modernised
131 - 150	141	20%	28	29
151 - 180	166	20%	33	34
181 - 210	196	20%	39	40
211 - 400	306	20%	61	63
> 400	400	20%	80	82
Average		100%	241	247
Expected improvement				2.5%
Meat conversion ratio	Conversion	Distribution	Non-Modernised	Modernised
131 - 150	48%	20%	10%	10%
151 - 180	50%	20%	10%	10%
181 - 210	52%	20%	10%	10%
211 - 400	54%	20%	11%	11%
> 400	56%	20%	11%	11%
Average		100%	52%	52%
Gain by modernisation			0%	5%

1) Economies of Scale

Modernisation of live animal and meat trade will include investment in efficient transport for the live animals to the slaughterhouse, appropriate holding pens within the slaughterhouse to guarantee pre-slaughter health of the animals, and refrigerated vans to ensure safe delivery of meat from the slaughterhouse to retail outlets. Traders will purchase the live animals from farmers in different markets and ranches across the country, organise for appropriate transport of the animals to the slaughterhouses, pay for slaughter services, and distribute meat to retail outlets including butcheries, supermarkets, hotels and restaurants, and meat processors. Modernisation will support the traders to achieve desirable economies of scale, promote the health of animals on transit, and enhance the yield per animal during slaughter.

Economic analysis for live animal and meat trade considers activities of small-scale traders handling up to 20 live animals per trip, medium-scale traders handling up to 30 animals per trip, and large-scale traders handling up to 40 animals per trip. Modernisation will influence an increase in the number of animals handled and trips made to the market to source the animals, reduce mortality of animals during transport, and improve average weight per animal. Traders will invest in weighing scales to weigh the animals upon purchase and tagging equipment for tracking the animals. Modernisation will support the traders to improve on the number of animals handled by about 50 per cent from about 240 to 360 cattle for smallholder traders, 360 to 540 animals for medium-scale trader and 480 to 720 for large-scale traders.



Modernisation will enhance mobility of the traders to reach more markets for the animals. Target desirable live weight of the animals will range between 201 and 246 kilograms per animal with meat conversion ratio of about 52 per cent per animal. To achieve this, the traders will have to target animals that are well finished as well as animals from ranches. Modernisation will also stimulate opportunity for fattening animals in feedlots for marketing to traders.

2) Financial Performance

The main sources of revenue will be the sale of meat on wholesale to retail outlets at an estimated price of KES 271 per kilogram and by-products that will include offal at a price of KES 700 per piece. The prices used are an average as they vary depending on grade, size of carcass, season and carcass size with a range of KES 260-320. Generally, it is assumed that prices will grow gradually influenced by processes and activities of transporting the animals from the market to the slaughterhouse and converting livestock into meat.



The main sources of revenue will be the sale of meat on wholesale to retail outlets at an estimated price of **KES 271 per kilogram** and by-products that will include offal at a price of **KES 700 per piece**

Sale of meat will account for 98 per cent of the revenues generated by the traders with the remaining coming from the by-products including the offal. Although the price on live weight and the price per kilogram meat will remain constant, modernisation especially for large scale operators will improve the net margins supported by enhanced scale and controlled operating costs.

Status

Driver

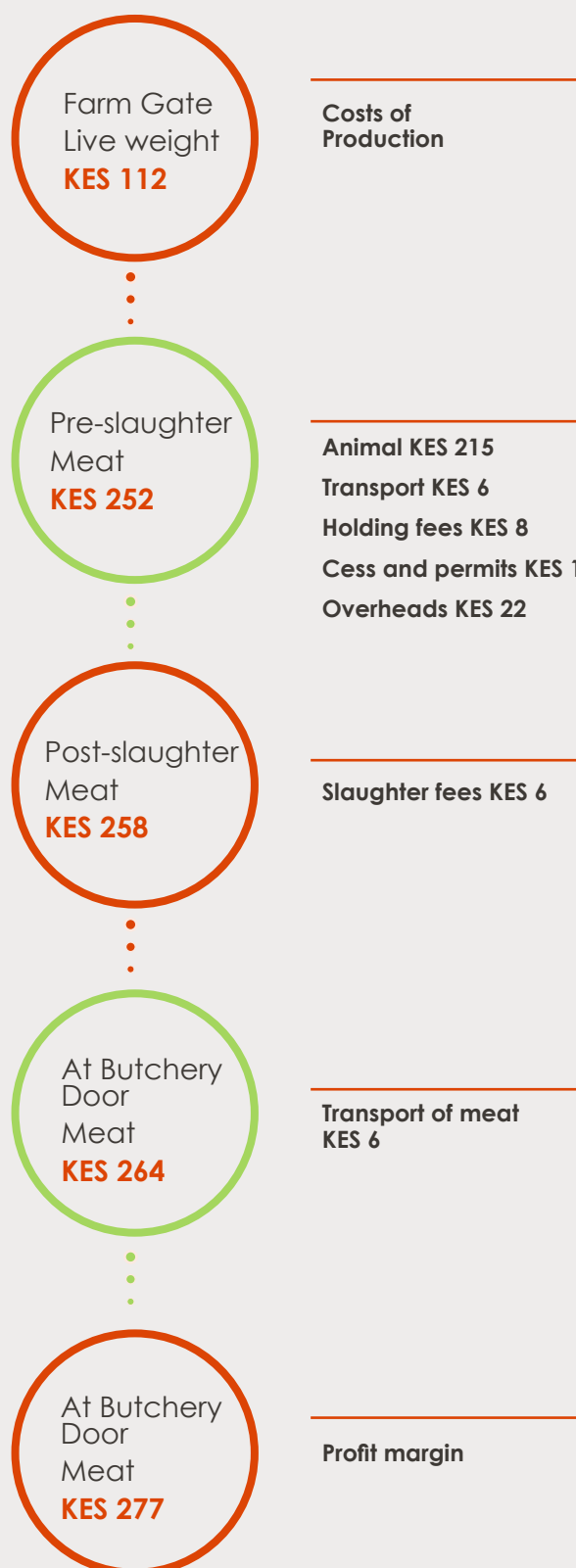


Chart 15: Prices along meat supply chain for small, medium and large scale non-modernised meat trader

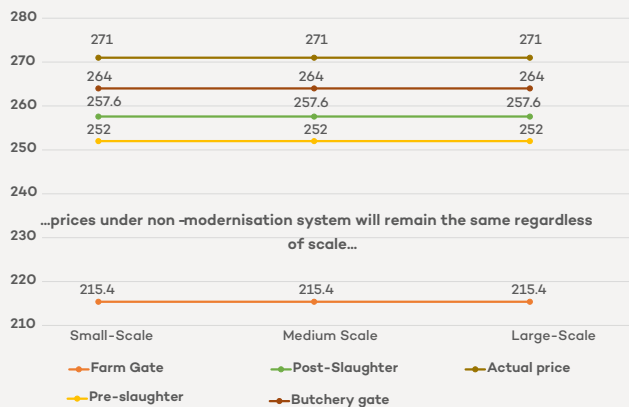
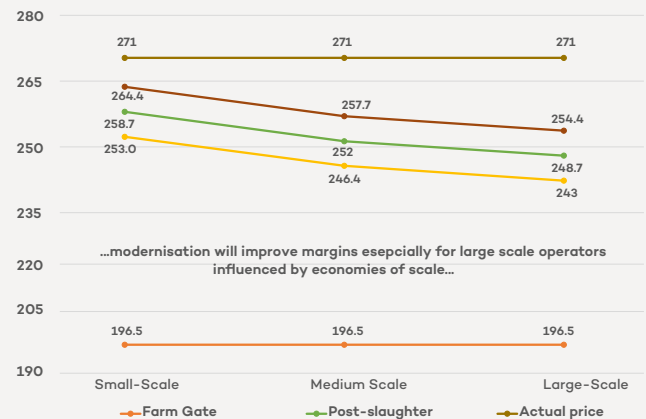


Chart 16: Prices along the meat supply chain for small, medium and large-scale modernised meat trader



Total costs incurred include variable costs and overhead expenses classified into various categories. Variable costs will include costs of purchasing the animals estimated at KES 112 per kilogram of live weight, cost of transporting the animal from the markets to the slaughterhouse estimated at KES 700 per animal, transporting the meat to butcheries estimated at KES 800 per carcass, and pre-slaughter holding fees estimated at KES 1,000 per animal. Other direct costs will be cess and permits paid to various authorities estimated KES 150 per animal, and slaughter fees of about KES 700 per animal paid for slaughter services. Slaughterhouses will incur significant costs in maintain high standards of hygiene during slaughter process in order to guarantee the safety of the meat.

Additional staff together with essential investment required to support modernisation will increase operating expenses in terms of salaries and wages estimated at KES 65,000 for the driver and assistant, motor vehicle fuel estimated at KES 17 per kilometre, motor vehicle insurance estimated at 7.5 per cent of book value, and repair and maintenance estimated at 2.5 per cent of book value of motor vehicle. Other overhead expenses will include security for the livestock estimated at KES 15K per month, and depreciation of motor vehicle estimated at 12.5 per cent per annum of book value. With modernisation slaughterhouse will operate pre-slaughter holding pens with adequate security for the animals. Under non-modernised system, traders will incur security expenses for the animals.

Chart 17: Costs for small, medium and large scale non-modernised meat trader

...most costs under non-modernised system will related to the variable costs including cost of animals and transport of animals to the slaughterhouse...

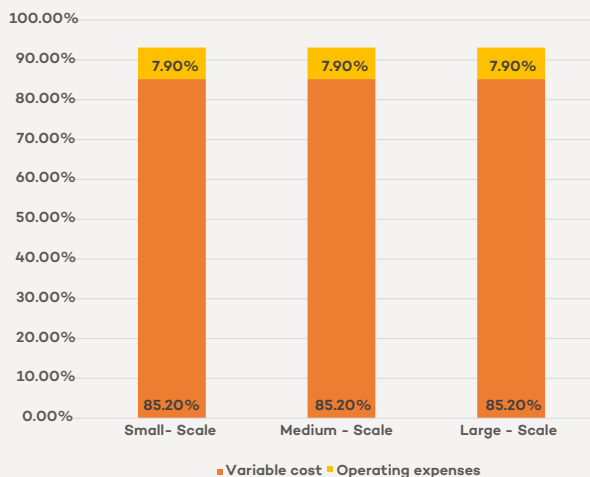
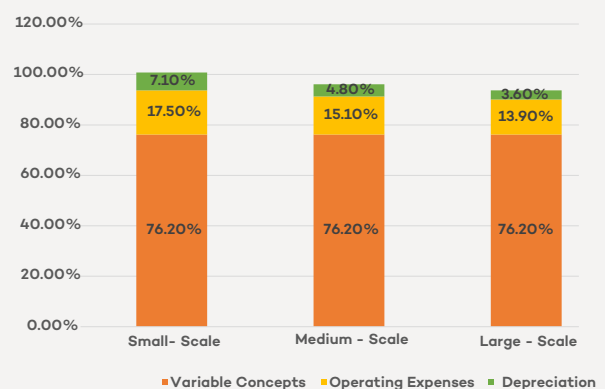


Chart 18: Costs for small, medium and large-scale modernised meat trader

modernisation will improve on variable costs by eliminating transport cost for animals while replacing it with salaries and motor vehicle expenses



3) Break Even Analysis

The break-even analysis for meat trader operating under modernised and non-modernised is presented in table 10. The trader must handle a minimum of 194, 291 and 388 cattle under non modernised live animal trader system, to avoid getting into losses. This is equivalent to 24, 345, 48,869 and 36,517 kg of meat per year in the first one year. In the modernised system, the trader should handle 510, 0586 and 627 cattle in the first year under small, medium and large-scale trade respectively. This is equivalent of

70,706kg, 82712 Kg and 88,432 Kg of meat under small, medium and large-scale trade in year one respectively. The margin of safety for the small and medium scale meat trade is negative meaning it's not economical to invest and operate and this scale. The modernised traders operating at the large scale have very high margin of safety which has an upward trade over time. This means investment in modernised trade of livestock and meat should be more profitable if operated under large scale.

Table 10: Break even analysis for modernised and non-modernised meat trade

Small Scale	Non-Modernised					Modernised				
	Yr1	Yr2	Yr3	Yr4	Yr5	Yr1	Yr2	Yr3	Yr4	Yr5
No of cattle handled	240	240	240	240	240	360	360	360	360	360
Equivalent if Kg Live weight	57,936	57,936	57,936	57,936	57,936	89,077	89,077	89,077	89,077	89,077
Equivalent in Kg of Meat	30,127	30,127	30,127	30,127	30,127	50,774	50,774	50,774	50,774	50,774
BE in Kg of Meal	24,345	24,345	24,345	24,345	24,345	70,706	64,402	59,057	54,477	50,560
BE in Kg No of Cattle	194.00	194	194	194	194	501	501	501	501	501
Margin of Safety	19%	19%	19%	19%	19%	-39%	-39%	-39%	-39%	-39%
Medium Scale										
No of cattle handled	360	360	360	360	360	540	540	540	540	540
Equivalent if Kg Live weight	86,904	86,904	86,904	86,904	86,904	133,615	133,615	133,615	133,615	133,615
Equivalent in Kg of Meat	45,190	45,190	45,190	45,190	45,190	76,760	76,760	76,760	76,760	76,760
BE in Kg of Meal	36,517	36,517	36,517	36,517	36,517	82,712	82,712	82,712	82,712	82,712
BE in Kg No of Cattle	291	291	291	291	291	586	586	586	586	586
Margin of Safety	19%	19%	19%	19%	19%	-8%	-8%	-8%	-8%	-8%
Large Scale										
No of cattle handled	480	480	480	480	480	720	720	720	720	720
Equivalent if Kg Live weight	115,892	115,892	115,892	115,892	115,892	178,153	178,153	178,153	178,153	178,153
Equivalent in Kg of Meat	60,253	60,253	60,253	60,253	60,253	101,547	101,547	101,547	101,547	101,547
BE in Kg of Meal	48,689	48,689	48,689	48,689	48,689	94,714	88,432	83,068	78,488	74,574
BE in Kg No of Cattle	388	388	388	388	388	672	627	589	557	529
Margin of Safety	19%	19%	19%	19%	19%	7%	13%	18%	23%	27%

Modernisation and increased economies of scale will enhance efficiencies of the trade, which will result into gradual improvement on the amount of variable costs and overhead expenses incurred. Large scale traders will receive adequate income from sales to cover variable costs and overheads as well as generate reserves to reward investors. Profit margins will improve with increased economies of scale and overtime.

Chart 19: BEP for small, medium and large scale modernised and non-modernised meat trader

Non-modernised will record constant BEP regardless of scale while modernised will record improve with scale. operating costs will influence favourable BEP for non modernised..

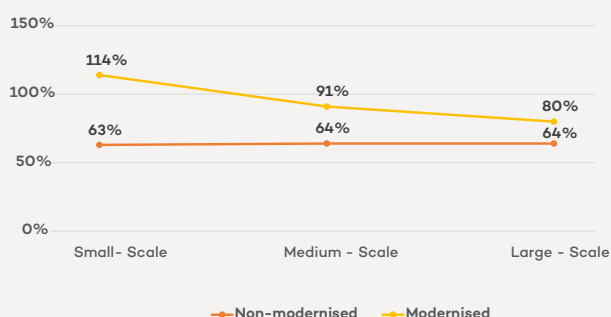
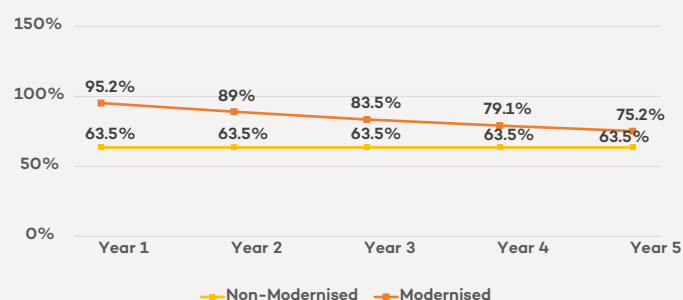


Chart 20: BEP modernised and non-modernised meat trader over time

...timeframe will positively impact on breakeven for modernised system...



4) Revenues and Gross Margins

The revenues and gross margins for the modernised and non-modernised live animal and meat trade is presented in table 11. Results show that the modernisation of live animal and meat trade is not profitable at small and medium scale. Modernisation is however marginally profitable at large scale. This is due to the high capital investments required for transportation of live animals and meat which can only make economic sense if operations are at scale.

Table 11: Revenues and Gross Margins for live animal and meat trader

Description	Non-Modernised			Modernised		
	Small	Med	Large	Small	Med	Large
Total Revenue	8,332,341	12,498,512	16,664,682	14,011,662	21,017,494	28,023,325
Gross Margin	1,039,509	1,559,264	2,077,018	3,045,083	4,567,625	6,090,166
EBITDA	199,509	299,264	399,018	242,062	1,044,604	1,447,146
EBIT	199,509	299,264	399,018	(1,195,438)	(392,892)	409,646
Earning before Tax	199,509	299,264	399,018	(1,195,438)	(392,892)	409,646
Net Surplus	139,656	209,485	279,313	(1,195,438)	(392,892)	286,752
Gross Margin	12.5%	12.5%	12.5%	21.7%	21.7%	21.7%
Net Margin	1.7%	1.7%	1.7%	-8.5%	-1.9%	1.0%
Return on Assets	70%	70%	70%	-11.6%	-3.6%	2.4%
Return on Equity	100%	100%	100%	100%	100%	100%
Return on Investment				-10%	-3.4%	2.5%

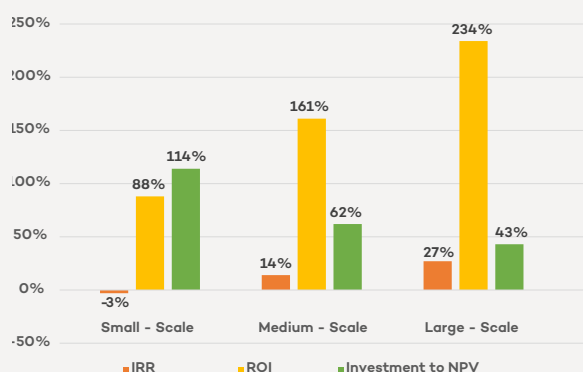
5) Capital Expenditure

Investing in modern live animal and meat trade will enhance profitability of the trade by improving on the number of animals handled and number of trips to the market. Areas of modernisation will include acquiring appropriate transport for live animal estimated to cost about KES eight million with a capacity to hold up to 12 tons per trip, and a refrigerated van to distribute meat to the retail outlets estimated to cost about KES 3.5 million. Adequate repair and maintenance of transport will be essential to support efficiency and cost effectiveness. Linking the traders will be necessary in order to access appropriate finances for the investments. The analysis anticipates greater funding to come from commercial sources at the cost of 14 per cent per annum. Overall results show that modernisation of trade will produce higher returns for large scale operators with reasonable payback period.

Chart 21 returns on investments for non-modernised meat trader

Chart 22: Returns on investments for modernised meat trader

Returns from modernisation will improve gradually over time. modernisation will be uneconomical for small scale traders



6) Investment Returns

Valuation of investment in live animal and meat trade takes into consideration the value of assets the traders will acquire, and potential of generating future earnings based on the revenues and expected cost structures supported by attainable assumptions. Investment in animal and meat trade will require long-term payback period despite scale of operations. Compared with the level of investment required, live animal and meat trade will record weak free cash flows from operating activities as well as cash and bank balances that will not be adequate to repay commercial funds raised to finance capital expenditure as well as create a reserve to reward the trader and any other investor. These findings are summarised in table 12.

Table 12: Investment Returns for Modernised and non-modernised meat trader

KES	Non-modernisation			Modernisation		
	Small	Medium	Large	Small	Medium	Large
Cash Flow from Operations	2,819,612	6,754,149	10,095,587	800,146	1,200,219	1,600,292
Cash Flow from Investing	11,500,000	11,500,000	11,500,000	-	-	-
Cash and bank balances	2,800,439	6,668,096	9,942,656	-	-	-
Payback period	No	No	No	No	No	No
Internal rate of return	-22%	-6%	5%	-	-	-
Return on investment	0.1%	5.5%	10.9%	-	-	-
Return on equity	-0.3%	71.3%	31.6%	21.0%	21.0%	21.0%
Net present value	3,851,421	8,791,783	13,732,145	1,228,157	1,842,236	2,456,314

4.3 Modernisation of the Processing Practices

4.3.1 Overview of Processing Practices

Meat processing takes place in butcheries, based on the customer needs. There are three main categories of butcheries in the meat retail segment. Below is a brief description of butcheries, according to the information collected during the meat end market study.

a) High end butcheries: This category of Butcheries usually serve the high-income consumer segments. Specifically, these are the expatriate/tourist and the cosmopolitan professionals). They are usually located in the upmarket shopping centres and high-end malls and their model involves buying carcasses from contracted meat traders, based on specific specifications. As such they do not directly interact with slaughterhouses. These butcheries processes carcasses into prime cuts shown in table 6 above. In order to meet requirements for this consumer category, all processes including slaughter, meat transportation and retail practices have to adhere to the highest quality and food safety practices. Animals slaughtered for this market, have to be purchased from quality breeds, mainly sourced from ranches. This category, usually serving about 14 per cent of the total consumers, is considered to be modernised to a great extent.

b) Butcheries that serve the middle-income consumer segment: These are mainly located in estates and supermarkets that serve the middle-income consumer segments. According to the Meat end market trends study, about 66 per cent of the middle-income butcheries have some cold chain equipment, mainly freezers for small scale butcheries while the supermarkets have invested in the cold rooms and display chillers. The degree of meat differentiation especially in the estate butcheries is quite low with majority selling meat on bone. According to the meat end market study, consumers

in this market segment are quite sensitive to meat quality and food safety. This is one of the reasons why majority of the processors in this category (68 per cent), according the KMT meat end market study prefer buying meat from traders right inside slaughterhouses. Given this background, this category of processor is most suited for modernisation interventions.

c) Butcheries that serve the low-income consumer segments: These butcheries are mainly located within the residential areas for low income earners, including informal settlement. While meat end market study revealed that this is the largest consumer segment, the same study established that this is a price sensitive consumer segment. Any additional costs would trigger a significant drop in demand, as consumers shift in search of alternative proteins. Based on this scenario, modernisation of this segment may not require significant investment in equipment and technologies. A basic model where slaughterhouses are encouraged to develop their brands which the butchers display in their shops would be more appropriate. This can be enhanced by enforcement of law and having butchery owners display their Certificate of Transportation and the roller mark on the carcasses.

4.3.2 Modernisation of Meat processing in Small Medium and Large-Scale Butcheries

The main food safety concerns in meat processing include:

- Lack of traceability mechanisms for the meat at the butchery
- Use of crude tools like pangas and wooden stools for cutting bones
- Limited use of cold chain; most of them use deep freezers for overnight preservation

about
66% of the
middle-income
butcheries have
some **cold chain
equipment**



One of the main losses incurred by processors comes from the quality of carcasses. Some of the butcheries hardly maximise returns from each carcass purchased, due to the low quality of carcasses used. The higher the quality of carcasses, the higher the yield for primal cuts as shown in Table 13. This is in addition to the expected 18 per cent loss associated with bones and connective tissues. The price of prime cuts is about KES 500-700 on average, but can go as high as KES 1000 depending on the specific prime cuts and market segments. The traders should aim at buying cattle that will yield 40 -50 per cent prime cuts in order to maximise returns from prime cuts

Table 13: Proportion of prime and non-prime meat cuts from different carcass weights

Carcass weight	Primal Yield	Non-Prime yield
Below 130 Kg	25%	75%
131-180	30%	70%
181-210	40%	60%
211-400	50%	50%
401 and above	45%	55%

Source: This data was derived by computing average figures given by 10 butchers

The other source of losses is due to spoilage when meat is not refrigerated. Interviews with meat trades reported that the losses increase with the length of period meat is kept without refrigeration, as shown in table 14.

Table 14: Projected losses when meat is not refrigerated

Period of hanging meat in open air	Projected losses
1 day	1-4%
2 days	8%
3 days	Spoilage (11%)
4 days	Spoilage (50%)
5 days	100% (loss)

Source: This data was derived by computing average figures given by 10 butchers

Proposed Modernisation Interventions:

Modernisation of this segment involves investments in the meat processing equipment, cold chain, and traceability and inventory management systems. Investment in cold chain reduces spoilage close to zero per cent when meat is chilled up to a maximum of 10 days. In addition, meat quality improves, as the cold storage enhances tenderness of meat which enhances processing. Traceability is a key food safety investment which also increases consumer confidence. Investment in meat processing equipment is a key food safety measure by eliminating of broken bones and pieces of wood in meat. This further enhances the processing operations, by giving quality cuts. A key enabler for increased value from modernisation is selection of good quality animals with potential to yield at least 40 -50 per cent primal cuts. Given the low numbers of these high-grade cattle it is important that to facilitate backward linkages between the processors and feedlot owners

4.3.3 Economic Analysis

1) Important Assumptions

Assumptions on Cost Drivers

The main cost drivers are summarised in table 9 below:

- a) **Cost of buying meat:** It is assumed that the processor buys 40 per cent commercial grade, 30 per cent standard grade and 30 per cent prime grade. At a price of KES 250, 270 and 300 per kg, this yields an average buying price of KES 271 per kg.
- b) **Other direct costs:** These are variable, with the processing butchery having a higher cost of packaging and utilities at KES 10 and 7 per kg of meat compared to the non-processing butchery whose costs are 5 each for packaging and utilities.
- c) **Personnel:** Each of the two scenarios has one manager and one butcher. The processing butchery has one accountant

for the processing butchery. Their salaries are however variable; the processing butchery is paying higher salaries than the non-processing butcheries because the former requires more skilled personnel than the latter. The processing butchery requires a butcher who can separate at least 18kg of meat per day.

- d) **Other overheads:** The processing butchery has higher overheads of KES 32,000 compared to the non-processing butchery whose costs are KES 20,000. The difference is caused by the high utilisation of electricity to run the chillers and meat cutting equipment, which are not found in the non-processing butchery. Water, detergents, transport and communications are relatively higher in the processing butchery, due the higher hygiene and food safety standards
- e) **Butchery equipment:** The processing category of butchery has a higher cost of equipment amounting to KES 500,800 compared to the non-processing butchery, whose cost of equipment is at KES 75,800. The biggest cost drivers for the processing categories are the cold chain equipment, and meat processing machines.
- f) **Shrinkage and spoilage:** The shrinkage for non-processing butchery is at five per cent while for the processing butchery is

at one per cent per cent . Similarly, the spoilage in the non-processing is assumed to be four per cent while the processing has only one per cent spoilage. The loss due to shrinkage and spoilage are reduced through utilisation of the cold chain.

- g) **Non-edible part:** in both cases the non-edible parts (bones, connective tissues and fats) are assumed to be 15 per cent of the non-prime parts.

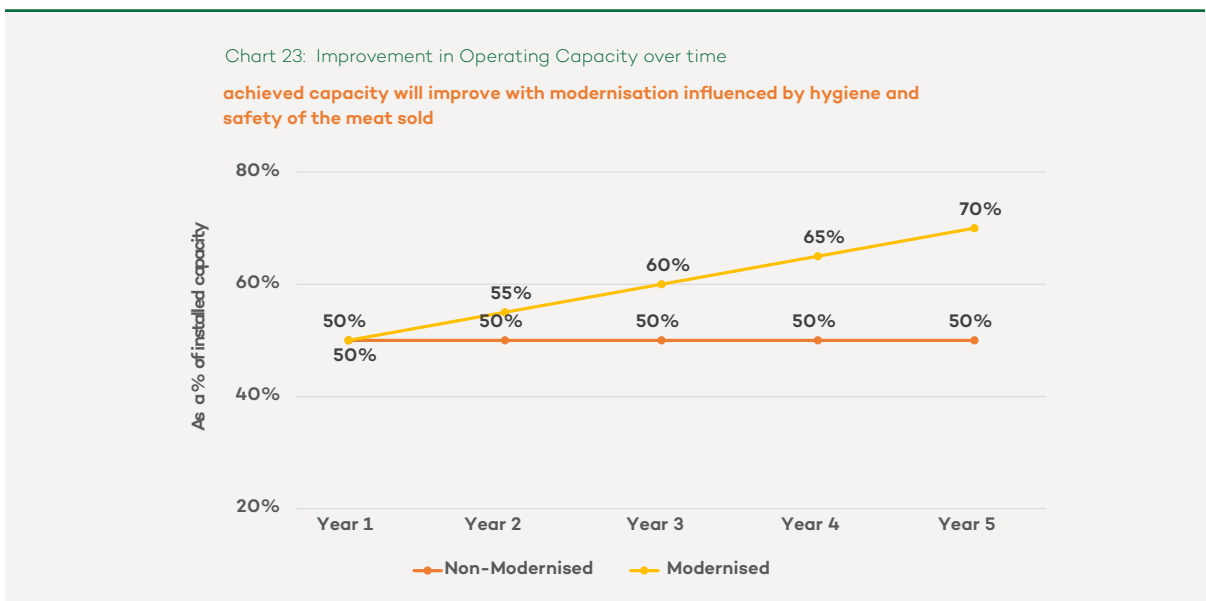
Revenue Drivers

Revenues are generated from the following sale of meat and nod edible pars like bones and connective tissues

Details on each of these assumptions are presented in Annex 1

2) Operating Scales

The analysis considers three scenarios for butcheries i.e. small-scale with the capacity to sell up to 100 kilograms of meat a day, medium-scale with the capacity to sell up to 150 kilograms a day and large-scale with the capacity to sell up to 200 kilograms of meat a day with the initial achieved capacity estimated at about 50 per cent . These estimates are based on average from two cases of each of these categories of slaughterhouses.



3) Expected Cost Structures

Butcheries will purchase either commercial meat carcass at KES 250 per kilogram, standard meat carcass at KES 270 per kilogram, or prime meat carcass at KES 300 per kilogram. The other direct costs expected will include packaging estimated at KES 10 per kilogram of meat sold, and utilities such as electricity and water estimated at KES 7 per kilogram among others. The butchery will also invest cost effective packaging technology with environmental consideration to promote hygiene and prevent contamination.

Modernised butcheries will incur increased overheads related to staff costs, electricity and water, and cleaning and sanitation of the premises and equipment. A small-scale

butchery will recruit at least a manager paid approximately KES 35,000 per month, two qualified and competent butchers paid KES 30,000 each to serve customers, and a record clerk paid KES 25,000 per month. Other overheads expected will include rent estimated at KES 75 per square foot, cleaning and sanitation estimated at KES 5,000 per month, electricity estimated at KES 10,000 for general use, and water for general use estimated KES 3,000 among others. A small-scale butchery will require space of about 100 square feet while medium scale will require about 225 square feet and large-scale butcheries about 400 square feet. Overall modernisation will significantly increase operating expenses for the butcheries.

Chart 24: Changes in Variable and Overhead costs as a percentage of revenues with time for non-modernised processors

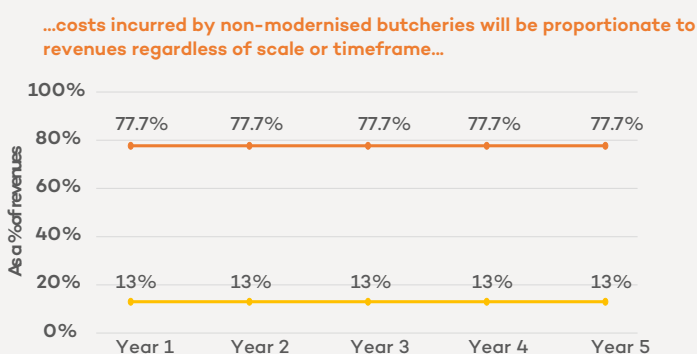
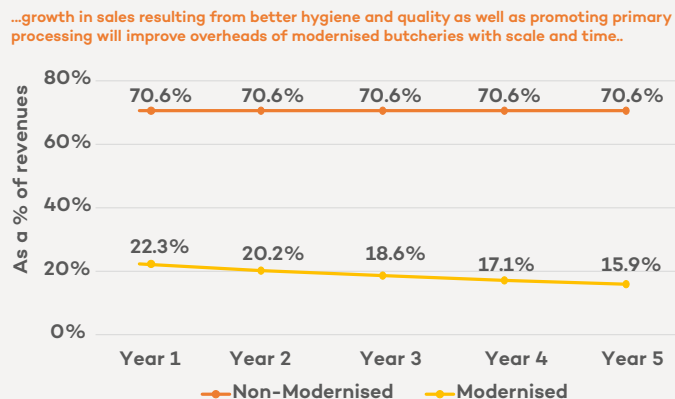


Chart 25 Changes in Variable and Overhead costs as a percentage of revenues with time for modernised processors



4) Capital Expenditure

Modernising the butcheries will require investing in necessary equipment and infrastructure and improved hygiene and handling of meat to improve quality and safety of meat at the butcheries. In addition, modernisation will require proper cleaning and sanitation of the butchery and equipment to support safety of the meat.

Key equipment required by modern butcheries will include cutting tools and equipment estimated at KES 25,000, electric bone saw machine estimated at KES 80,000, electric

mincing machine estimated at KES 55,000, display counter chiller estimated at KES 200,000, freezer at KES 45,000, weighing scale estimated at KES 20,000, and standby generator estimated at KES 35,000 among others. Butcheries will also invest in necessary furniture and fittings estimated at KES 109,000, office equipment estimated at KES 200,000, and desirable quantity of packaging materials. Large scale butcheries will also invest in an inventory system estimated to cost about KES 2.7 million and an annual maintenance fees of KES 150,000.

Chart 26: Changes in Liquidity overtime for modernised butcheries

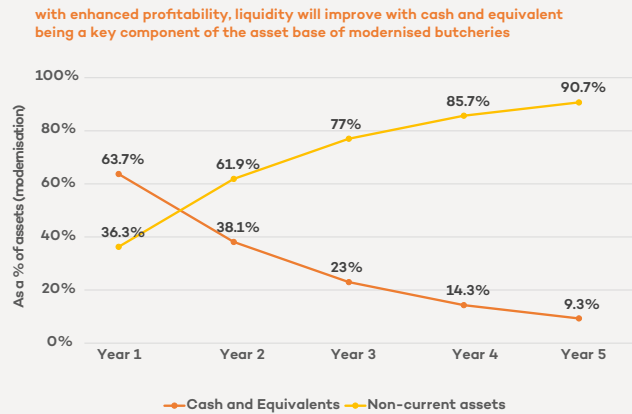
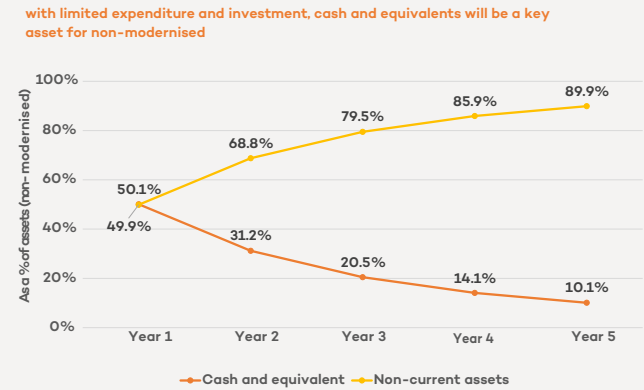


Chart 27: Changes in Liquidity overtime for non-modernised butcheries



5) Revenues and Gross Margins

First year revenues and profit for the two types of butcheries at different scales of operations are presented in table16.

Gross Revenues: The modernised butcheries are generating much higher annual revenues and gross margins compared to the non-modernised butcheries. The Gross margins for the modernised butcheries are, close to double the non-modernised butcheries in the three scales operations. In both scenarios, this revenue continues to increase over time.

Net income: After considering taxes, profit for the modernised slaughterhouses is estimated at KES 182,459, KES 301, 9420 and KES 1,070,941 for small medium and large-scale butcheries respectively. The non-modernised butcheries have net margins of KES 354,218, KES 390,265 and KES 572,968 for small, medium and large scale non-modernised butcheries respectively. The net margins and returns from the small-scale modernised butcheries are lower than the non-modernised butchery. However, the net returns show a positive improvement over time, with improved efficiency and capacity utilisation to culminate at KES 939,153, 1,471,849 and 3,655,976 for small, medium and large-scale butcheries in year 5 respectively compared to 432,995, 477,272 and 1,065,258 for the small, medium and large scale non modernised butcheries in year five respectively.

Profitability: According to the projected income statement, the medium and large-scale butchery will start generating the profits in the first year of operation. Profitability ratios (Table16) indicate that on an average the modernised butcheries yields a gross profit of 29.4 per cent compared to 22.3 per cent earned in the non-modernised butcheries. The net margins for the modernised butcheries are three per cent for small and medium scale butcheries and five per cent for the large-scale butcheries. The non-modernised slaughterhouses on the other hand have net margins of five per cent, four per cent and three per cent for small, medium and large-scale butcheries respectively in the first year. Although the modernised butcheries are lower than non-modernised in year one, the improvement in operating capacity and efficiency over time, yields a gradual increase in net margins in the subsequent years and eventually performing better than the non-modernised systems by the third year as shown in the accompanying annexes. On the other hand, the net margins for the non-modernised slaughterhouses are reducing over time up to and eventually overtaken by the margins under the modernised systems. The profitability for the year one for modernised butcheries are generally reduced by the high investment in equipment, but this improves over time as capacity utilisation improves.

Table 15: Revenues and Gross Margins from Modernised and non-Modernised butcherries

Description	Modernised			Non-Modernised		
	Small	Med	Large	Small	Med	Large
Gross Revenue	7,396,380	11,094,570	22,49,1140	6,552,000	9,828,000	19,656,000
Gross Margin	2,176,380	3,264,570	2,529,140	1,458,000	2,187,000	4,374,000
EBITDA	406,380	587,670	2,389,140	588,000	649,500	1,614,000
EBIT	260,655	431,345	1,529,915	506,025	557,525	818,525
Earning before Tax	260,655	431,345	1,529,915	506,025	557,525	818,525
Net Surplus	182,459	301,942	1,070,941	354,218	390,265	572,968
Gross Margin	29.4%	29.4%	29.4%	22.3%	22.3%	22.3%
Net Margin	3%	3%	5%	5%	4%	3%
Return on Assets	15%	20.5%	20%	39%	36%	14%
Return on Equity	100%	100%	100%	100%	100%	100%
Return on Investment	19%	27%	27%	79%	67%	16%

6) Break Even Analysis

Break Even Analysis indicates that BEP sales is 10,695 Kg, 18,306 Kg and 39,944 Kg per year for small, medium, and large-scale modernised butcherries respectively. For the non-modernised, butcherries, the breakeven sales 13,151Kg, 19,449Kg and 34,318 Kg per year for small, medium and large scale non-modernised butcherries respectively. Table 16 shows that minimum of 10,695 Kg, 18,306 Kg and 39,944 Kg should be sold per year in case of small, medium and large-scale butcherries under the modernised system without sustaining losses. The non-modernised systems on the other hand required a minimum

of 13,151Kg, 19,449Kg and 34,318 Kg to be sold in a year for the case of small, medium and large-scale butcherries without sustaining losses. Implicit in this study is that there could be many small-scale butcherries out there that are not economically viable and selling unsafe products to the consumers. This could be the potential reason for malpractices in the industry to ensure survival of business. It is evident from Table 16 that margin of safety shows positive relation with capacity showing higher profits on modernised systems, right from the first year.

Table 16: Breakeven analysis for butcherries

Small Scale	Modernised					Non-Modernised				
	Yr1	Yr2	Yr3	Yr4	Yr5	Yr1	Yr2	Yr3	Yr4	Yr5
Potential Capacity (Kg)	36,000	36,000	36,000	36,000	36,000	36,000	36,000	36,000	36,000	36,000
Achieved Capacity (Kg)	18,000	19,800	21,600	23,400	25,200	18,000	18,000	18,000	18,000	18,000
Net Sales (Kg)	14,940	16,434	17,928	19,422	20,916	16,380	16,380	16,380	16,380	16,380
Break even Sales (Kg)	13,151	12,949	12,792	12,669	12,572	10,695	10,490	10,303	10,178	10,084
Margin of Safety on Net Sales (Kg)	1,789	3,485	5,136	6,753	8,344	5,685	5,890	6,077	6,202	6,296
Margin of Safety on Net Sales %	12%	21%	29%	35%	40%	35%	36%	37%	38%	38%
Medium Scale										
Installed Capacity (Kg)	54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000

Achieved Capacity (Kg)	27,000	29,700	32,400	35,100	37,800	27,000	27,000	27,000	27,000	27,000
Net Sales (Kg)	22,140	24,650	26,892	29,133	31,374	24,570	24,570	24,570	24,570	24,570
Breakeven Sales (Kg)	19,449	19,233	19,065	18,934	18,831	18,306	18,057	17,872	17,734	17,630
Margin of Safety on Net Sales	7,551	10,467	13,335	16,166	18,969	8,694	8,943	9,128	9,266	9,370
Margin of Safety on Net Sales	28%	35%	41%	46%	50%	32%	33%	34%	34%	35%
Large Scale										
Installed Capacity (Kg)	108,000	108,000	108,000	108,000	108,000	108,000	108,000	108,000	108,000	108,000
Achieved Capacity (Kg)	54,000	59,400	64,800	70,200	75,600	54,000	54,000	54,000	54,000	54,000
Net Sales (Kg)	44,820	49,302	53,784	58,266	64,748	49,140	49,140	49,140	49,140	49,140
Breakeven Sales (Kg)	34,318	32,811	31,699	30,876	30,267	39,944	37,583	35,852	34,583	33,651
Margin of Safety on Net Sales	19,682	26,589	33,101	39,324	45,333	14,056	16,417	18,148	19,417	20,349
Margin of Safety on Net Sales	36%	45%	51%	56%	60%	26%	30%	34%	36%	38%

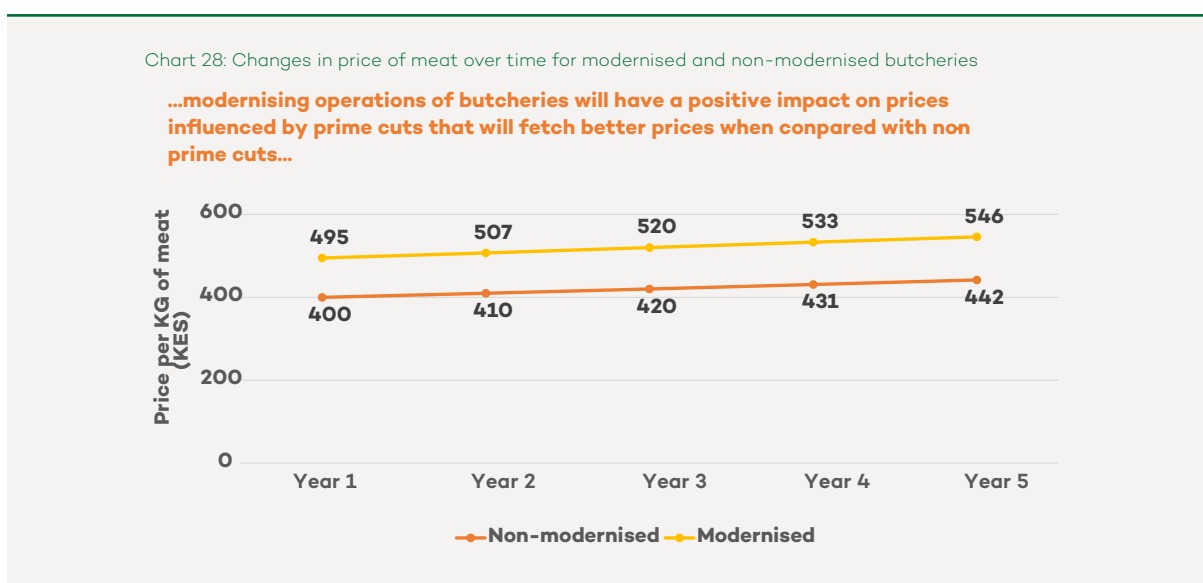
7) Impact on Price

Poor handling and storage will expose the meat to significant shrinkage and spoilage, which will significantly affect profitability. Modernising operations of the butchery will reduce shrinkage from around five per cent to about one per cent and spoilage from around four per cent to about one per cent. Unlike non-modernised butcheries, modernised butcheries will incur a 15 per cent loss related to non-saleable parts of the meat guided by the quality and safety standards. Butcheries will sell non-saleable parts as animal food at KES 100 in order to reduce losses. This has potential impact of reducing the meat deficit in the country.

The analysis shows that at a sales price of 495 per Kg, modern slaughterhouses will yield positive margins discussed above. This is based on an assumption that primary processing which will involve selling both prime are expected to account for 38 per cent of the carcass and non-prime cuts that will account for the remaining. There is potential for higher price per Kg depending on the type of differentiated and value-added products that a modernised butchery will be selling, since some cuts go to as high as 800-1200 per Kg. Increasing the sale of prime cuts will therefore significantly improve the overall prices of meat.



Poor handling and storage will expose the meat to significant shrinkage and spoilage, which will significantly affect profitability



8) Investment Returns

Valuation of butcheries will take into consideration the value of capital investment, and potential of the business to generate net surpluses from operations. Good returns from modernisations will motivate butcheries to invest modern equipment that will promote meat quality and safety with a payback period of two to three years. With the expected positive financial performance, modern butcheries will guarantee good returns as shown in table 17. Supported by economies of scale, modern butcheries will generate significant free cash flow from operation activities and significant cash to repay funds borrowed to finance capital expenditure as well as create a reserve to reward the owner and any other investor.

Table 17: Investment Returns for Modernised and non-modernised butcheries

5-year horizon	Non-modernised			Modernised		
	Small-scale	Medium-scale	Large-scale	Small-scale	Medium-scale	Large-scale
Cash Flow from Operations	2,428,290	2,683,982	-	3,692,585	5,390,989	16,090,660
Cash Flow from Investing	449,800	579,800	-	959,800	1,089,800	4,029,800
Cash and bank balances	2,379,290	2,629,857	-	3,658,720	5,342,066	15,891,565
Payback period	Year 1	Year 1	-	Year 3	Year 2	Year 2

Despite a discount of 18 per cent on the free cash flow to mitigate risks associated with failure during the initial years, sustainability of modern butcheries will remain high and will continue to improve gradually overtime. However, returns will depend on the amount invested and scale of operations, timeframe, financial performance, and free cash flow generated during the period. While financial performance will depend on revenue generated from butchery activities, and costs incurred in offering various products and services.

Chart 29: return on Investments for Small, Medium and large scale modernised and non-modernised butcheries

modern butcheries will record attractive return on investment with a slight drop for large scale butcheries due to investment in inventory management system

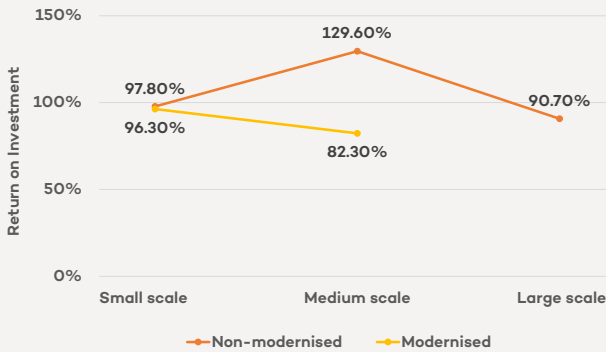
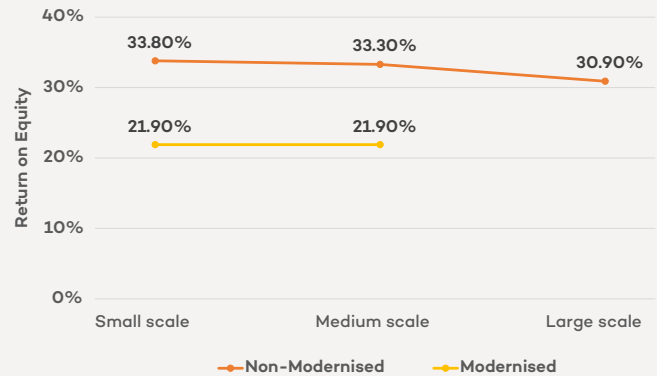


Chart 30: return on Equity for Small, Medium and large scale modernised and non-modernised butcheries

with average interest rates standing at around 14% modern butcheries will record attractive return on equity



4.4 Modernisation of Manufacturing Practices

4.4.1 An overview of the current manufacturing practices

In the meat industry, manufacturing products have both meat and non-meat components. There are a wide range of manufactured meat products in the market, across all the consumer segments. Some of these are made informally while others are manufactured by formal companies and distributed through the formal retail outlets. The Kenya Meat End Market Trends Study revealed that despite high level of awareness of different manufactured and processed products in the formal outlets by consumers in the high- and medium-income segments, results show that only a smaller proportion of households in both segments are consuming these products. Specifically, it is observed that only sausages (71 per cent of households), minced meat (57 per cent of households), fish fillets (51 per cent of households) and beef Samosa (63 per cent of households) are consumed by majority of households in high income segment. Products like ham, bacon, canned meat, aged/cured meat, chicken samosa and meat balls are consumed by minority of consumers in the high-income segment who range between six and 24 per cent.

Among the middle-income consumer segments, results revealed that only sausage (58 per cent of households), minced meat (41

per cent of households) and beef Samosa (52 per cent of households) are consumed by majority of the households in this segment. On the other hand, products like ham, bacon, canned meat, aged meat, burgers, hotdogs and meat balls are only consumed by minority of households, all of them below 10 per cent of the total households in the middle-income segment. The study further revealed that Sausages are the only processed products that are consumed by majority of consumers in the low-income segment with 59 per cent of the households consuming. Other processed and manufactured products that are mainly sold through the formal channels are consumed by minority of households in this segment, between three per cent and six per cent.

Manufacturing is dominated by a few large-scale companies. These companies have a number of differentiated sausages targeting different consumer segments. The biggest leap was made after introduction of affordable smokies to low income segment, through a mobile vending system.

This is the main reason why majority of the consumers reported to have access to sausage, with the street vending being the

main channel for the low-income settlements and for 25 per cent of the middle-income segment and 65.8 per cent of the low-income segment (KMT 2019). This raises questions on efforts the manufacturers have been putting towards ensuring access of other products by consumers.

While there are no limitations in the availability sausages manufactured under well-developed food safety environment, it is clear that the full market potential for manufactured products has not been exploited. Manufacture of meat products is always a compromise between the expected quality of the finished product, the cost of raw materials and the techniques applied. This creates room for innovation and production of a wide variety of products through the manipulation of different variables such as meat formulation, type of meat, processing temperature, types of casing and particle size. As a result, there is scope for a wide range of value-added products, made from different types of meat, including poultry. For instance, high value sausages can be made from low value trimmings and even by-products, combined with adequate technological knowledge. The common sausage types in the market include the Salamis, Smokies, Frankfurters, Vienna Sausages, Bolgna among others

This analysis presents a value proposition for more innovations in meat manufacturing, to produce a variety of safe products that can be sold to consumers in all the market segments. This is based on the premise that the bottom of the pyramid has the highest proportion of consumers, about 60 per cent, which if reached by affordable products, can significantly increase meat consumption in the country. Bringing in more actors in manufacturing of quality and safe products will also makes the manufacturing more competitive, hence and appropriately priced.

4.5 Economic Analysis:

The manufactured products analysed by this study include Sausages, burgers, minced meat, smokies, Salamis and Brawns. Based on information from leading meat

manufacturing companies, each of these products contributes 16.7 per cent of the total manufactured products. The cost drivers for manufacturing include:

- 1 Personnel:** The administrative staff include manager, accountant, marketing manager and a driver. This amounts to three staff for small scale and four staff for medium and large-scale manufacturing. A total of 17 production staff with a monthly salary of LES 365,000.
- 2 Equipment:** manufacturing equipment are the main cost drivers for manufacturing of meat and meat products. The model has assumed that the manufacturers at all levels will have to invest in the equipment whose cost is KES 5,860,000.
- 3 Cost of ingredients:** This include the cost of buying meat and non-meat ingredients. Each of the manufactured products has a different combination of different ingredients which determines the individual units' cost. The price of meat is at KES 271 per kilo and non-meat ingredients are costing KES 110 per kg.

Details on each of these cost drivers and other assumptions are presented in Annex 1

4.5.1 Expected Production against Scale

The consumption of processed meat products continues to gain popularity, which has created an opportunity for manufacturing of various meat products with focus on low-income consumers. Economic analysis considers activities of small-scale meat manufacturers with the capacity to handle up to 100 kgs of meat a day, medium-scale manufacturers with a capacity to handle up to 150 kgs of meat and large-scale manufacturers with a capacity to handle up to 200 kgs of meat a day with an achieved capacity estimated at 50 per cent. The processors will record a gradual incremental growth of five per cent on achieved capacity supported by the quality of products. Manufacturing will provide low-income consumers with an opportunity to access quality and affordable processed meat products that will include sausages, burgers, minced meat, smokies, salamis, and brawns among others.



Sausages, burgers, minced meat, smokies, Salamis and Brawns contributes **16.7% of the total manufactured products.**

Chart 31: expected production of different manufactured meat products

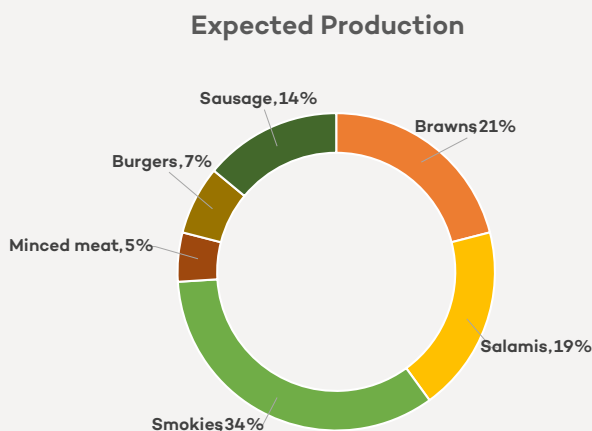
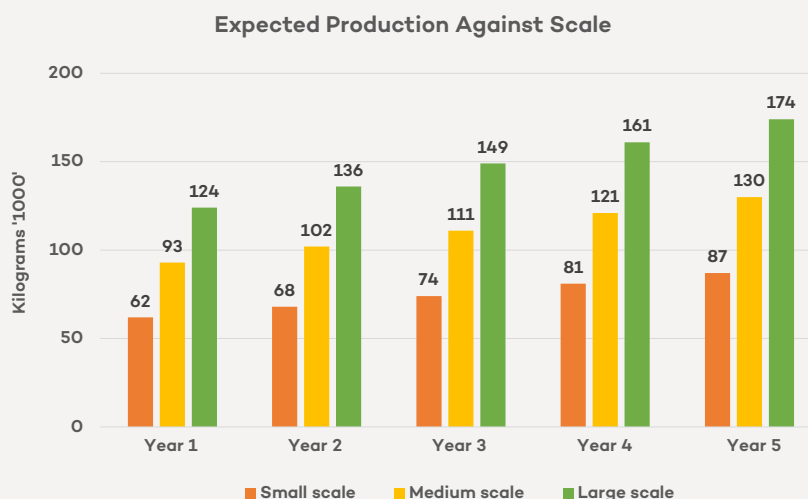


Chart 32: Expected production against scale



4.5.2 Meat Manufacturing Activity

With increasing consumption of meat, consumers are demanding for increased availability of variety of meat products. Using specific processing technology for each product, meat manufacturing will address this challenge by producing shelf-stable meat products that will eliminate limitations of fresh meat that require quick consumption to avoid spoilage. The products will be stored under appropriate temperatures to maintain quality and safety.

Manufacturing will replace expensive meat with cheaper ingredients to reduce costs and increase volumes. Along with meat, a wide

range of non-meat ingredients including meat extenders and fillers will form an important part of the manufacturing process of the meat products. Careful selection of the non-meat ingredients guided by suitability and characteristics of the final products will be necessary required to support quality and safety of the meat. Choosing appropriate ingredients will be indispensable for efficient manufacturing of various products will affect the quality of the products and resulting revenues generated. Therefore, developing enterprise specific standards on ingredient composition for each product will be necessary for quality and consistence.

Chart 33: Proportion of meat and meat non-ingredients used in manufacture of meat products

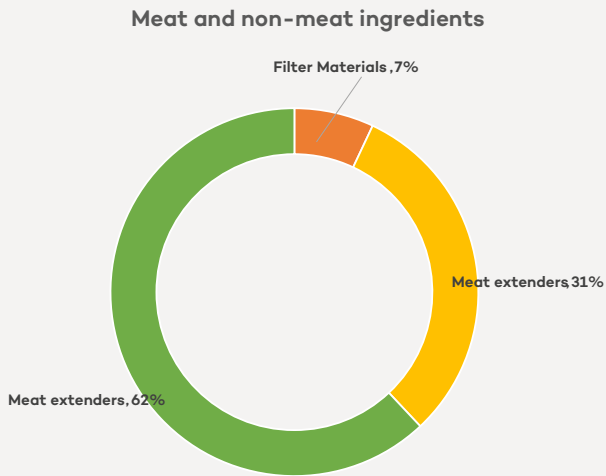
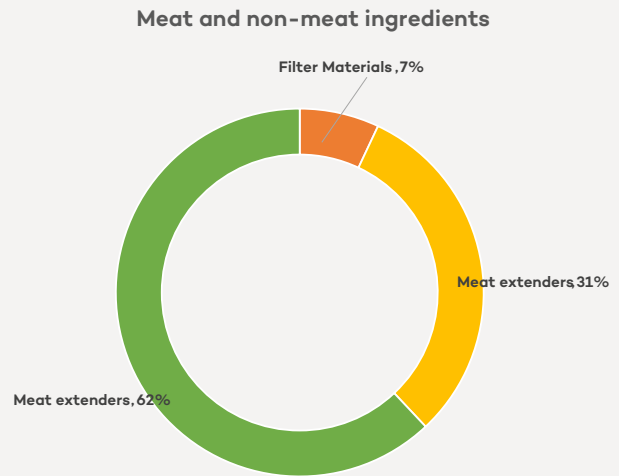


Chart 34: Cost of meat and non-meat ingredients



Quality meat will cost about KES 271 per kilogram while meat extender such as soy additive will cost about KES 80 and filler materials such as cereal (maize) flour and starch will cost about KES 30 per kilogram. Adequate access to quality inputs will stimulate manufacturing of affordable meat products targeting low-income consumers. Encouraging marketing of valuable primal cuts fresh while processing the remaining carcass and trimmings arising from primary processing into various products will support favourable prices.

4.5.3 Other Costs of Production

Manufacturing process will require a number of ingredients to add taste, flavour, appearance colour, texture, shelf life, and curing among others to the products. The ingredients will include chemical additives such as salt, seasonings, and preservatives required in very small quantities of less than one per cent of gross weight of the product. Manufacturers will also incur other costs related to utilities such as electricity and gas estimated at KES 15 per kilogram, and packaging estimated at KES 10 per kilogram of processed products among others.

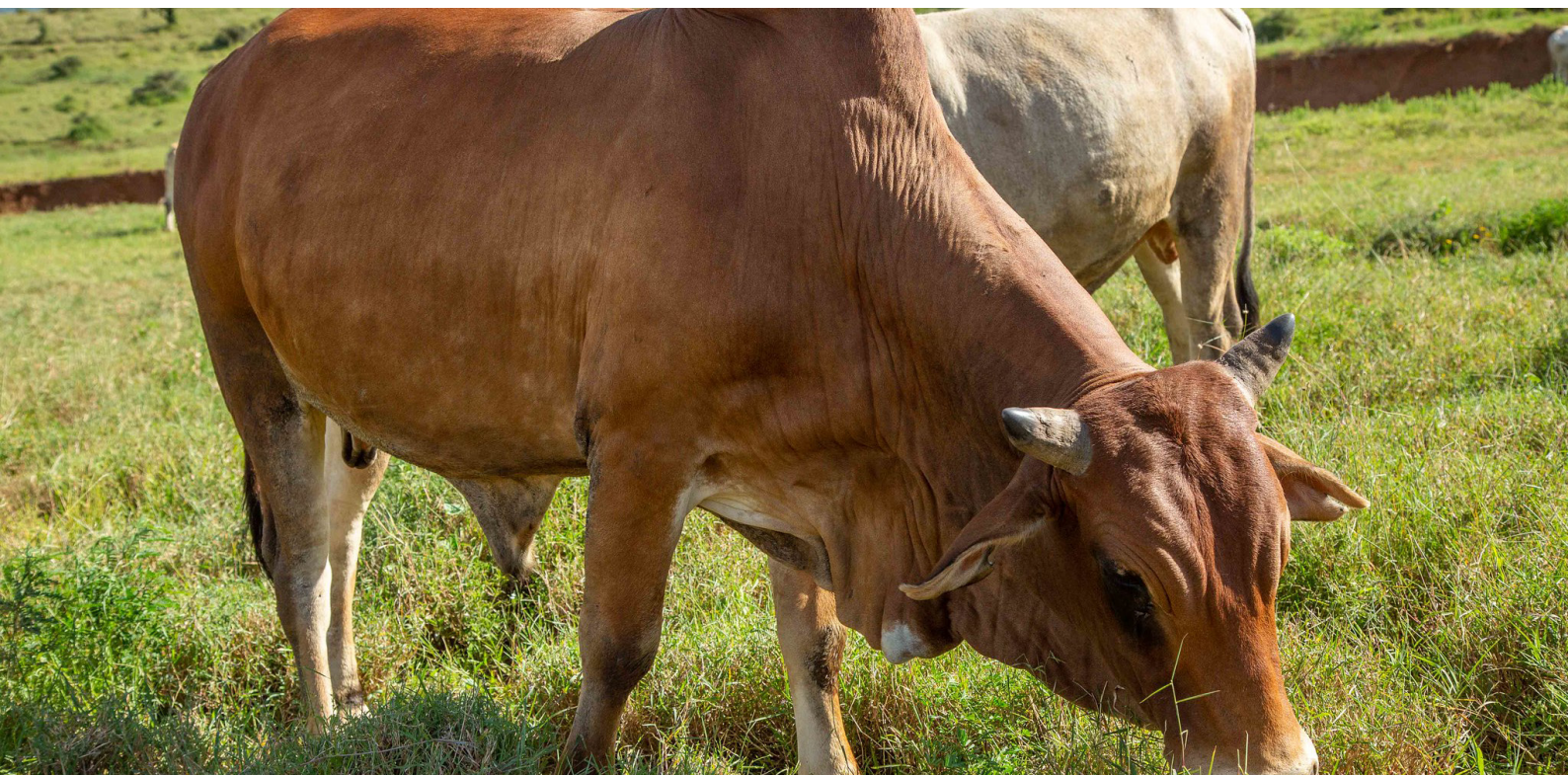


Chart 35: Cost of Energy for small, medium and large-scale manufacturing

Electricity and gas will remain a key component of costs of manufacturing due to expected cooking and boiling

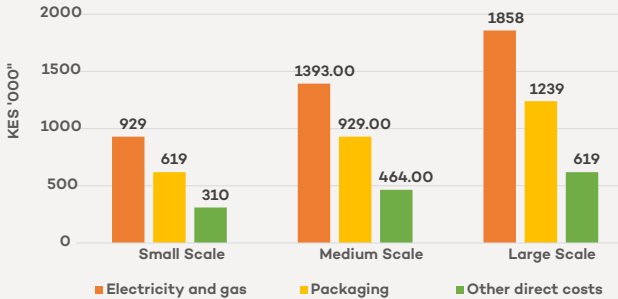
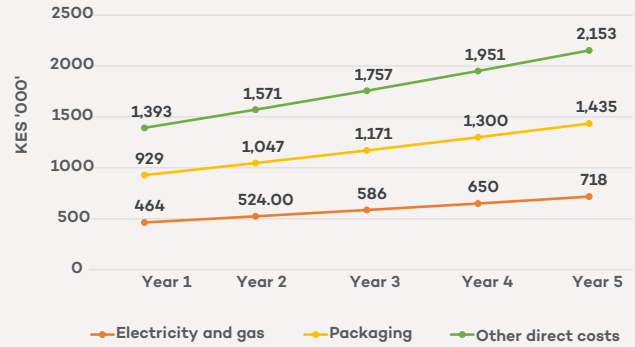


Chart 36: Changes in other direct costs for manufacturing over time

Other costs of production will increase with scale and time but will be proportionate to sales



4.5.4 Operating Expenses

Key overheads expected in meat manufacturing will include salaries and wages for administration and production staff, and rent among others. The manufacturer will recruit administrative staff who include factory manager, accountant, marketing manager, and driver with total monthly salary of about KES 140,000. Also, necessary will be production staff who will include production manager at a monthly salary of around KES 40,000, and supervisor at monthly salary of about KES 25,000. Other personnel will be production staff for different departments including cutting and trimming, chilling, meat curing, chopping, stuffing, cooking, smoking,

and cleaning and sanitation among others that will receive an average monthly salary of about KES 20,000 each.

Other major overheads expected include rent estimated at about KES 45 per square foot, cleaning and sanitation estimated at KES 7,000 per month, electricity estimated at KES 15,000, water estimated KES 10,000, and telephone and communication estimated at KES 5,000 among others. Space requirement will be approximately 1,600 square feet for small-scale plant, 2,400 square feet for medium-scale plant, and 3,200 square feet for large-scale plant.

Chart 37: Changes in Overheads over time in manufacturing of meat products

Overheads related with manufacturing will improve gradually with enhanced efficiency in operations.

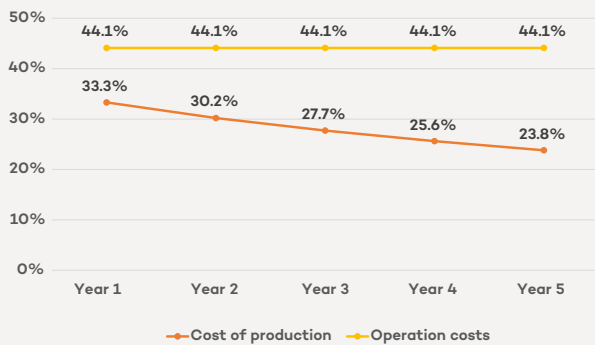
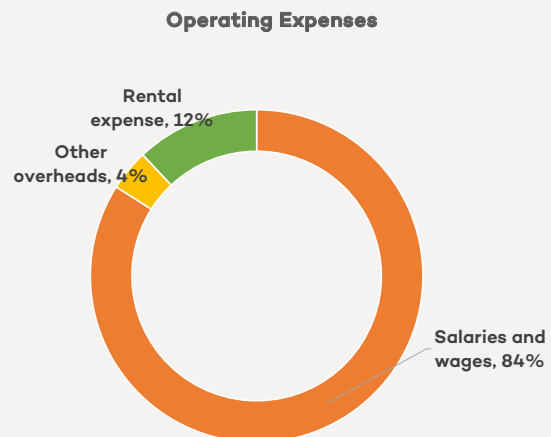


Chart 38: Proportion of different costs in the total overhead costs



4.5.5 Capital Expenditure for Manufacturing

Manufacturing will require significant investment in processing equipment and loose tools to promote effective processing of various products. Depending on the scale of operations, investments in loose tools will be KES 119,000 for small-scale plant, 238,000 for medium-scale plant, and 428,000 for large-scale plant with replacement expected every year. Investment in processing equipment that will range from KES 5.9 - 11.7 million depending on scale will include the meat grinding machine costing about KES one million, curing machine costing about KES 600,000, meat tumbler costing about KES 580,000, meat pickle injector costing about KES 850,000, and meat cutter costing about KES 450,000. Other equipment will be sausage stuffer costing about KES 580,000, meat cooker costing about KES 500,000, sausage linker costing about KES 300,000, meat smokehouse costing about KES 600,000, and vacuum filler costing about KES 400,000 among others. Processing equipment will depreciate by 12.5 per cent per annum.

Chart 39: Impacts of Current Assets on Balance sheet over time

With liquidity expected to improve significantly overtime the impact of current assets on the balance sheet will grow significantly

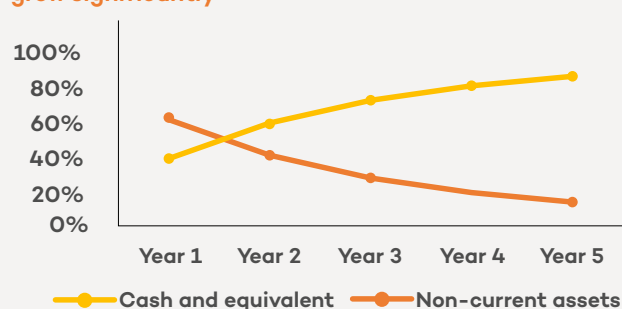
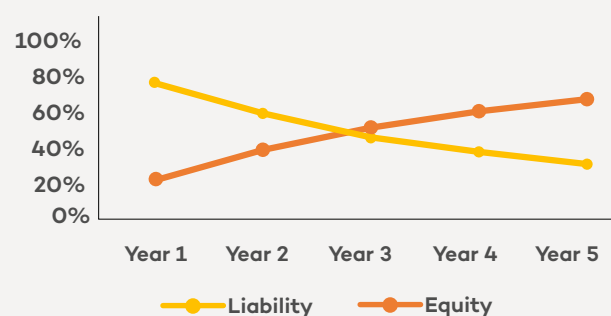


Chart 40: Improvement on Productivity Over time

With profitability expected to improve retained earnings will be a major source of funds for investment



4.5.6 Break Even Analysis

The break-even analysis is presented in table 18. Results shows a model of an enterprise with different combinations of product, each operating at breakeven to bring the overall profitability of the enterprise.

Table 18: Breakeven Analysis for Small, Medium and Large-scale meat manufacture

Small Scale	Yr. 1	Yr2	Yr3	Yr4	Yr5
Average target production at BE (Kg)	61,926	68,118	74,311	80,503	86,696
Sausage	8,400	9,240	10,880	10,920	11,760
Burgers	4,667	5,133	5,600	6,009	6,533
Minced Meat	3,000	3,300	3,600	3,900	4,200
Smokies	21,000	23,100	25,100	27,300	29,400
Salamis	11,667	12,833	14,000	15,167	16,333
Brawns	131,920	14,512	15,831	17,150	18,649

Medium Scale					
Average target production (Kg)	92,888	102,177	111,466	120,755	130,044
Sausage	12,600	13,860	15,120	16,382	17,640
Burgers	7,000	7,200	8,400	9,100	7,800
Minced Meat	4,500	4,950	5,400	5,850	6,300
Smokies	31,500	34,650	37,800	40,950	44,100
Salamis	17,500	19,250	21,000	22,750	24,500
Brawns	19,988	21,767	23,740	25,725	27,704
Large Scale					
Average target production (Kg)	123,851	136,236	148,622	161,007	173,392
Sausage	16,800	18,780	20,160	21,840	23,520
Burgers	9,833	10,267	11,200	12,133	13,067
Minced Meat	6,000	6,600	7,200	7,800	8,400
Smokies	42,000	46,200	50,400	54,600	58,800
Salamis	23,333	25,667	28,000	30,333	32,607
Brawns	26,385	29,023	37,622	34,300	36,938

4.5.7 Revenues and Gross Margins

Table 19 presents a summary of gross revenues and margins from the small, medium and large-scale manufacturing enterprises. Results show that the manufacturing enterprise earns positive margins across all the scales of operations. The margins present an increasing trend over time, as shown in the accompanied annexes.

Table 19: Revenues and Gross Margin for manufacturing

Description	Small	Med	Large
Total Revenues	22,335,308	33,502,962	44,670,615
Gross Margin	12,493,303	18,739,954	24,986,605
EBITDA	5,063,427	7,844,140	10,624,853
EBIT	4,271,427	6,626,140	8,945,853
Earning before Tax	4,271,427	6,626,140	8,945,853
Net Surplus	2,929,999	4,638,298	6,262,097
Gross Margin	55.9%	55.9%	55.9%
Net Margin	13%	14%	14%
Return on Assets	30%	30.9%	31%
Return on Equity	100%	100%	100%
Return on Investment	50%	51%	52%

4.5.8 Price Improvements

Appropriate manufacturing technology will enhance availability of affordable meat products targeting low-income consumers. The technology will classify meat into valuable and low valuable with low valuable meat going for further processing quality meat products for low-income consumers. High value meat parts will be for sale to the high-end consumers as primal cuts to improve profitability. Prices on products will decrease further with use of meat extenders

including soy additives and filler materials including cereal flour and starch in the production. Table 20 shows the price improvements as a result of the proposed manufacturing process

Table 20: Price improvement for Range of manufactured products

Type of Product	Current Market Price (KES/Kg)	Factory Price from Proposed Manufacture Processes (KES/Kg)	Price Improvement
Sausages	525	370	30%
Burgers	550	400	27%
Minced meat	500	350	30%
Smokies	390	320	18%
Salamis	500	380	24%
Brawns	580	350	40%

4.5.9 Investment Returns

Valuation of meat manufacturing investment takes into consideration the value of assets the business will acquire, and potential of the business to generate future earnings based on the revenues and expected cost structures supported by attainable assumptions. The anticipated good returns from business operations will be among the factors that will motivate private sector investment into meat manufacturing. Meat manufacturing will require long-term investment period particularly in the processing equipment, and renovation of production premises. With the expected positive financial performance, the business will guarantee investors good returns on exit, and support expansion of asset base over the period. Supported by economies of scale, meat manufacturing will generate significant free cash flow from operating activities and cash and bank balances to repay commercial funds raised to finance capital expenditure as well as create a reserve for rewarding the investors.

Table 21: Investment Returns for Manufacturing within a 5 Year Horizon

5-year horizon	Small-scale	Medium-scale	Large-scale
Cash Flow from Operations	32,223,013	48,937,033	66,081,176
Cash Flow from Investing	6,485,503	14,438,634	25,689,709
Cash and bank balances	31,294,558	47,288,971	63,415,563
Payback period	2 years	2 years	3 years

Despite the significant discounting of the free cash flow from operations by 18 per cent to mitigate the risk of failure expected during the initial years, sustainability of meat manufacturing will remain high and will continue to improve gradually overtime. Returns to investors upon exit period will depend on the amount invested, investment period, financial performance, and free cash flow generated during the period; while financial performance will depend on revenue generated from manufacturing activities, and costs incurred in processing and marketing the various products. With positive NPV, IRR and ROE, holding the investments in the business for a longer investment period will earn the investor better returns on exit.

Chart 41: Returns from Manufacturing over time

with an exit period of 5 years, investing in meat manufacturing will guarantee investors attractive returns

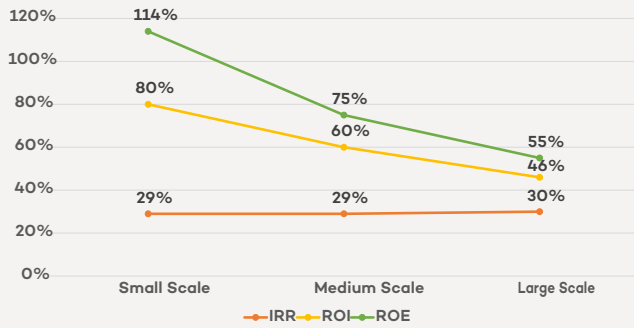
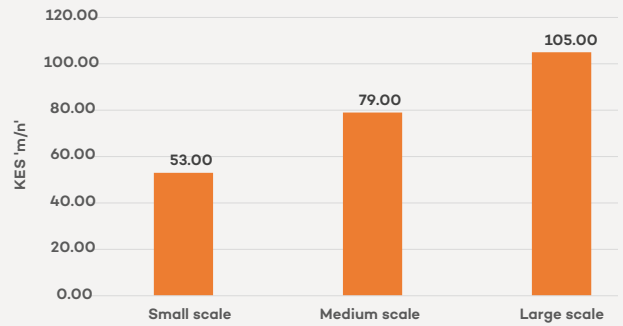


Chart 42: Reserves Created by Small, Medium and Large-scale manufacturing

With impressive NPV and positive cash flow investment into meat manufacturing will create adequate reserves to comfortably reward the investors



05

**Global Trends and
Potential Impacts on
Kenyan Meat Industry**

Below is a list of factors which are impacting the global-food industry. Industry modernisation requires the investors to consider the opportunities created by these factors and threats for effective positioning in the meat sector.

- **Globalisation:** globalisation in this context refers to reduction in barriers to the cross-border movement of goods, services and capital; an increased flow of commodities, technologies, information, financial capital, modes of distribution and marketing. Kenya, being a red meat deficit country is exposed to impacts of globalisation. At the moment, Kenyan meat is among the most expensive in the region. As a result, the country is able to attract inflow of live animals from neighboring countries. The industry is already experiencing entry of large multinational fast food and supermarket chains and is further exposed to increased inflow of processed meat products from other countries as well. For instance, the continued influx of cheap Chinese fish in the Kenyan market could potentially provide cheap alternative sources of protein which can cause a shift in red meat consumption.
- **Climate Change:** The impacts of climate change in meat industry cannot be over emphasised. The most critical effect is increased frequency of droughts resulting to high livestock mortalities in Kenya and other developing countries. Pastoral system is becoming increasingly vulnerable and the question as to whether the pastoral systems will sustain meat industry in Kenya and neighboring countries in future should be the top agenda for the meat industry players. From a futuristic perspective, there is need for more investments in other production system like feedlots in order to meet the supply gaps, both in quality and quantity.
- **Population growth:** the growing population means continued demand for food. This presents opportunities for innovations in production, to meet the demand as the population continues to grow.
- **Changing consumer needs:** with busy lifestyles and increased access to information, convenience is significantly influencing food distribution systems for instance food delivery systems, growing trade of processed foods, and growth of fast food industry
- **Rising disposable income and growth of middle-income consumer segments:** as a result, consumers are more inclined to improved diets with quality and food safety becoming a significant consideration when making food choices
- **Urbanisation:** Like many other countries, Kenya is rapidly urbanising, with United Nations projecting Kenya to become an urban country (at least 50 per cent of the population living in urban areas). Estimates of the Kenya Urbanisation Review put the urban population at slightly more than 14 million people. By 2030 Kenya can expect to have over 22 million urban dwellers, and by 2050 about 40 million (FAO 2004). This urbanisation is a major influencing factor in dietary change and subsequent changes in nutritional as well as the myriad lifestyle changes associated with it. In the context of rapid urbanisation, street foods are becoming increasingly important as both cheap and quick meal option and as an income-generating strategy. In this regard, quality and safety are two common concerns regarding street foods.
- **Technological advancement especially in the ICT sector:** Increase access to information, mobile phone ownership and internet connectivity is impacting on the food industry. This has enabled development of many online food shopping platforms enabled by mobile phone-based payments. Availability of inventory management applications will provide opportunities for investors to engage in meat trade at different levels, unlike before where traders depended on ingenuity of butchers to determine dressing weights and yields.

- Revolution in the retail sector:** Kenya, like many developing countries is experiencing an increasing dominance of supermarkets in the retail sector. The actors include large and small local supermarket chains as well as larger conglomerates. The traditional pattern of supermarket entry into retail was to specialise in the sale of packaged and processed foods, followed by fresh or frozen meat and lastly fresh produce. This is slowly changing especially in the Kenyan local retail chains which are offering restaurant services within the supermarkets, take away food and home deliveries. This has an implication on the meat retail sector, especially providing opportunities for franchise systems in meat retail.
- Role of advertising:** Secondary factors such as marketing, advertising, the appeal of new products, new retail outlets including supermarkets and multinational fast food chains contribute to dietary adaptation and convergence. Effectiveness of advertisements in creating dietary changes is largely enabled by availability and accessibility of information thanks to the wide coverage of multimedia channels like radio, TV and social media platforms.
- Low purchasing power among the low-class earners i.e. as noted in the Peculiar eating habits for many Kenya’s informal working class:** Most informal sector workers would love to primal meat cuts but due to low purchasing power, the cheap meat available becomes their best option. Most working or income earners from the informal sector cherish eating any kind of

meat or meat products as long as they have money to spend. Boiled bony beef “Mlima” is a delicacy for lunch among the informal sector in Nairobi and other urban establishment, this is served with the popular Ugali. This meal often sells before noon. This is an assured for low quality bony meat from slaughterhouses and wholesale meat outlets such as Burma market. This class of income earners also form the bulk of the 5th quarter consumers and associated by products such as “Mutura”- traditional sausage.

• **Projected Demand for Meat in the Domestic Market:**

Projected Demand for Meat in the Kenyan Domestic Market:

It is expected that factors discussed above will continue to drive the demand increase for meat globally. The population of Kenya is projected to grow from 53,491,697 in 2020 to 66,959,993 by 2030 (<http://worldpopulationreview.com/countries/kenya-population/>). According to FAO, the consumption for meat is projected to reach 806.4 Metric Tons (MT), with beef contributing the highest share estimated at 514.3 MT (FAO, 2016). Production is also projected at 808.4 MT by 2030. FAO reports total meat production in 2017 to be at 733,830 MT with 588,693 coming from beef, 35,090 from chicken, 62,602 from goat meat, 12,953 from pork and 33,421 from sheep (FAO stat, 2017). This means that production will have to increase by about 10 per cent in order to meet the demand. Table 21 summarises these trends.

Table 22: Projected demand for meat in Kenya by the year 2030

Type of Product	2000						2030					
	Consumption			Production			Consumption			Production		
	Rural	Urban	Total	Import	Export		Rural	Urban	Total	Import	Export	
Beef	227.2	59.2	286.9	287	0.1	0.2	344.1	170.2	514.3	514.3	0	0
Mutton	44.3	11.5	55.5	55.3	0.2	0	60.6	29.9	90.5	90.5	0	0
Pork	9.1	2.3	11.4	12.2	0.1	0.9	24.9	12.1	37	37	0	0
Poultry Meat	423.3	11.3	54.8	56.9	0.1	2.2	7.7	54.4	164.6	166.6	0	2
Total	4513.6	84.3	408.6	411.4	0.5	3.3	437.3	266.6	806.4	808.4	0	2

Source: FAO, 2016

Consumers will be the **main drivers** of modernisation Agenda

Untapped Domestic Market Under Meat Modernisation

Analysis of meat industry report shows that out of the total meat slaughtered in the local slaughterhouses, 98 per cent is sold through the hot carcass chain, with Nairobi and Mombasa cities consuming an estimated 80 per cent of this meat. Out of the total meat that goes through the hot chain system, about nine per cent is sold to high end meat markets. The rest is sold to low end retail which is largely informal with limited value addition and food security enhancement. The aim of modernisation is therefore to increase the proportion that goes through the cold carcass chain, where food safety and product quality are significantly enhanced.

The economic analysis reveals that modernisation of meat industry presents a business case for industry players in the area of modernisation at slaughter, processing and manufacture. According to the KMT Meat end market study (2019), it was reported that the total red meat consumption in Kenya is estimated at 648,252 MT with the high-income

segment, consuming 32,760 MT (five per cent), while middle- and low-income segments are consuming 171,882 MT (27 per cent and 443,610 MT (68 per cent) respectively. The study projected that the expanding middle class can potentially take 43 per cent of total red meat market share and the low income taking a 52 per cent market share with little difference on the high income segment whose potential market share remains at five per cent .

To determine the domestic potential, we have taken potential for middle income segment to take 43 per cent of market share if the current food security concerns are addressed (KMT meat end market study, 2019). The aim of modernisation is therefore to increase the proportion of meat from slaughterhouses that goes through the hot carcass chain from the current nine per cent to 43 per cent . The untapped domestic potential is 278,748 MT which is 43 per cent of the total meat consumed (648,252 MT) in the country.



out of the total meat slaughtered in the local slaughterhouses, **98 % is sold** through the hot carcass chain, with Nairobi and Mombasa cities consuming an estimated **80% of this meat**

06

Accelerators of Modernisation

1) Consumers to Drive the Modernisation Agenda, Demanding Quality and Food Safety From Meat Industry

For the consumers to drive the modernisation agenda, there is need for intensive consumer awareness and education regarding the issues listed above. They need to be educated to demand well drained meat and not muscle, value for money through quality meat cuts, traceability and use of cold chain to improve quality and safety of meat. They should be educated on the regulations that govern the meat industry so they can demand compliance from the traders and processors. This demand by consumers will ultimately pull all the other actors to respond in the required direction. Furthermore, well-educated consumers will also drive the lobbying for a more supportive policy and legal framework.

2) Enforcement of Existing Food Safety and Quality Enhancement Regulations:

The government has put in place some basic regulations which if followed strictly could result to significant modernisation of the industry. There is need for the concerned ministries to involve the law enforcement agencies to enforce food safety regulations. Some of the actions include:

- Random checks by Police on meat transporterstoensuretheyaretransporting meat according to specifications in the COT.
- The public health to undertake regular random tests on samples of meat in the retail outlets to ensure there is no adulteration of carcasses and also to ensure the carcasses are preserved appropriately.
- The vet department, with support from the law enforcement agencies should make random visits to ascertain that the carcasses sold are from the right animal species etc.
- The government can enhance some of the measures like for instance making the roller mark more prominent and have the retailers display as a proof of inspection;

- Slaughterhouses could be required to keep records of origins of animals brought for slaughter based on the movement permits. This information should be considered as public information
- Establishment of a strong meat regulatory body to oversee the sector including policy enforcement across board

3) Enhanced Private Sector Investment

The meat industry is currently very informal and unstructured with no entry barriers which has been a major limitation towards modernisation. Interviews with butchers in the slaughterhouses visited revealed that there is growing concern from their customers on whether the meat is genuinely from slaughterhouses while other are avoiding meat for fear of lifestyle diseases. In addition, the current trends for instance importation of cheap fish from china could gradually become an alternative to red meat as a cheap high-quality white meat. These threats should be brought to the private sector with a view to stimulating investment in food safety in the meat industry. Some of the investments required include, but not limited to:

- Investment in self-regulation mechanisms (by industry players / stakeholders) geared towards food safety, quality and addressing consumer concerns; members of such bodies should be held accountable and with clear consequences on the offenders. Such bodies would work closely with the department of public health and veterinary to mainstream food safety and quality enhancement in the meat industry
- Investment in equipment, technology and skills required for enhanced food safety and quality enhancement in the meat industry.
- Investment in traceability mechanisms as well as branding their products to increase consumer confidence and loyalty
- Establishment of a Strong and independent public policy oversight institution

4) Promote Industry Self-Regulation

This can be achieved by:

a) Establishing a Vibrant Regulatory Body

Establishing a regulatory body would create an enabling environment to the meat industry by providing leadership and a unified voice for the sector while also championing self-regulation. The council or board would ensure maintenance of highest standards of hygiene and meat products excellence. It would ensure capacity building of players in the industry to meet changing market needs, research and development on the Kenya meat industry to ensure it meets international standards.

A body like the Kenya Meat council or board would be led by the private sector and would comprise players in the Kenya meat industry who include producers, transporters, processors, exporters, companies involved in manufacturing feed, mineral supplements, dewormers, acaricides, antibiotics, antiprotozoal ,semen and vaccines production, Research Institutions (KARLO, ILRI), Universities , Kenya Meat Institute and other non-state actors that have an interest in the meat sector. The membership would



also include the Kenya Livestock market council and Meat and Livestock Exporters industry Council of Kenya. The veterinary, animal production departments and ministry of interior and coordination of National government would participate in the council as ex officio members.

b) Establishing a Franchise System for Kenya Meat shops to Enhance Self-regulation and Traceability

Cases of game meat on sale in butcheries in Kenya as well as usage of chemicals to make meat look fresh such as sodium met bisulphite, referred to in supermarket circles as SMS or *dawa ya Nyama* have been sited. These cases led to closure of meat outlets leading

to great loss to traders and reduction of meat consumption due to mistrust of the quality of meat. To mitigate these occurrences and restore confidence among the consumers, there is need to:

c) Classify Meat Shops / Butcheries.

Whereas Abattoirs and slaughter slabs have been classified (Category A for large slaughterhouses, Category B for Medium slaughterhouses and category C for slaughter slabs) under the meat control act, the same has not been done for butcheries. Classification of meat shops / butcheries

would enable the outlets that are compliant to be recognised by consumers and other stakeholders in order to inform consumers where to buy quality and safe meat products. Those classified as modernised should be held accountable to maintain the quality and food safety standards discussed in this report.



Above left: Meat display in a meat shop in Turkana and right, meat display in a supermarket in Nairobi. Classification of butcheries would enable consumers make choice based on the various categories of butcheries.

d) Brand as Well as Franchise Abattoirs, Slaughter Slabs and Butcheries.

To enhance meat industry self-regulation as well as enhance traceability, there is need to ensure butcheries carry the brand of the abattoir where the meat was drawn from. At the moment, the only indication for the source of meat in most butcheries is the code of the roller mark that is used by meat inspectors. However, in case the section bearing the roller mark is bought, it would be difficult to

trace origin of the meat. Butcheries bearing the brand of the abattoir would enable easy recognition of the brand by consumers. All butcheries under a certain brand would also ensure they regulate their practices in order to stay in business. They would also ensure game meat does not get into their supply chain or adulteration of the meat.



Left: Kenya Meat Commission affiliated butchery and right Kenya Meat Commission Abattoir

e) Invest in appropriate Livestock as well as meat transportation infrastructure

Hygiene and safety are the first considerations when it comes to meat transport. The current practice where meat is ferried by various carriers does not in some instances guarantee hygiene. There is need to modernise meat transport through investing in cold chain transportation system.



5) Enabling Policy and Legal Environment

The study has revealed significant food safety and quality issues that need to be addressed through modernisation. This will require the public sector to support the modernisation agenda by reviewing the current legal and policy framework with a view to identifying gaps that contribute to the existing food safety concerns and the industry performance. In addition, there is need for government agencies concerned to proactively monitor and crackdown any non-compliance with regulations governing slaughter, operations at the meat outlets, distribution, processing and manufacturing and slaughterhouses.

6) Exploring alternative Energy Sources Especially Green Energy to Reduce Costs of Production:

Use of green energy, especially in operating cold rooms in the slaughterhouses would significantly cut down the cost of production. With large amount of slurry produced at the slaughterhouses, there potential for generation of biogas to generate energy for powering all operations remain untapped. This can build on the learnings from the ongoing initiatives of bottling biogas at Keekonyokie slaughterhouses. In addition, solar power can still be explored to increase the energy supply to the slaughterhouses and manufacturing plants. This can be achieved by facilitating partnership between owners of slaughterhouses with programs supporting green energy.

7) Skills Development on Meat Processing:

The current practice involves use of knowledge acquired over time in appraising animals before sale, fraying and the entire slaughter process as well as meat processing. This means that there is an entry barrier in meat trade since only people who train as informal apprentices of the experienced traders can find employment in slaughtering and cutting meat (Processing). It also locks out opportunities

for innovation since new knowledge and technologies are not allowed to flow into the traditional practices. Going to modernisation means necessitates development of skills in meat cutting, grading of animals, carcasses and meat as well as trainings on food safety enhancements. There is need to sensitise the available training institutions like the Kenya Utalii College and the Meat training School to start developing curriculum for short courses in meat processing, handling, grading and promoting them to the industry.

8) Facilitate Access to Finance for Investors

Implementation of industry modernisation practise will require the private sector to invest on equipment, technology and human resource as shown in the financial analysis. To accelerate buy in from the investors especially for slaughterhouses, there will be need for agencies in support of modernisation, including the government to come up with some incentives for the early adopters. This could be in form of guaranteed credit schemes to buy down the risks for early adopters or negotiated facilities like the AFC loans as well as linkage to impact investment opportunities.

Implications on Government

- Real time data: The slaughterhouse being the anchor for modernisation, will be the custodian of data on all animals slaughtered, tracing them back to source market. This will address the current lack of data on actual slaughter figures generated from a manual process
- Improved revenues Application of inventory management systems at the slaughterhouses means that there will be accurate data on animals slaughtered and therefore seals loopholes for manipulation of data supporting the revenue collection. Revenue collection will also increase from fees and licences as a result of more investments that will be coming into the industry, especially the new manufacturing opportunities.

- It is expected that modernisation will ultimately improve consumer confidence in meat and therefore trigger increase in consumption. In addition, increased consumer education is expected to increase awareness of consumers on the quality and also value for high quality meat. The government will be expected to provide incentives to investors especially in feedlots, to supply quality livestock to meet the consumer demands.



07

**Summary Key Findings,
Conclusion and
Recommendations**

Summary Findings

This study was designed to achieve a number of objectives in order to inform decisions on meat industry modernisation to deliver safe and high-quality meat and meat products to consumers.

» **Objective 1: To assess the economics and the value of the meat sector in adopting technologies for value addition for sector growth.**

» **Objective 2: To establish the economics of adapting cold chain supply system and how this will impact prices of the meat and also provide detailed insight of the opportunities of adapting cold chain in terms of meat quality, preservation and value addition.**

» **Objective 3: To establish the economics of adoption of food safety across the meat industry. This will clearly provide a number of models for missed opportunity.**

Modernisation of slaughterhouses will involve investment in process mechanisation to replace the current manual processes; investment in animal traceability system and inventory management systems, utilisation of cold chain to enhance quality, reduce shrinkage and preserve the meat as well as investment in more skilled employees to manage the operations. Economic analysis reveals very positive gross margin break even safety margins especially for the medium to large scale operations. The small-scale operations reveal a negative gross margin, which however improves with time as capacity utilisation and efficiency improves, surpassing performance of the non-modernised slaughterhouses. As a result of other services like sale of manure (treated), cold room service and slaughter services, the study

shows that the slaughter fee charges would be increased by about KES 100 in exchange of high food safety standards, efficiency from mechanised services as well the assurance of traceability of meat they buy. Modernised slaughterhouse will require an investment period of 2 - 4 years. With the expected positive financial performance, the business will guarantee investors good returns on exit, and will support expansion of operations over the period. Supported by economies of scale, modernised slaughterhouses will generate significant free cash flow from operating activities with adequate cash flow to repay commercial funds borrowed to finance capital expenditure while creating a reserve for rewarding the investors.

Modernisation of Live animal and meat trade will involve investment at appropriate mode of live animal transport at about KES 8,000,000 which provides high capacity and therefore making transport efficient and safe for the animal, by reducing pre-slaughter stress on the animal. Modernising this segment of the meat supply chain further involves investment in the traceability and inventory management system, as well as refrigerated vans for meat transport. Economic analysis shows that modernisation of live animal/meat trade is not economically viable for small scale and medium scale operations. Although analysis of large-scale operations shows very positive margins starting from year 1, overall analysis reveals that investment in animal and meat trade will require long-term payback period irrespective of the scale of operations. Compared with the level of investment required, live animal and meat trade will record weak free cash flows from operating activities as well as cash and bank balances that will not be adequate to repay commercial funds raised to finance capital expenditure as well as create a reserve to reward the trader and any other investor.

Modernisation of the processing segment of the value chain, aims at increasing value of meat through differentiation of meat cuts, use of health and hygienic equipment, investing

in traceability and inventory management system and engagement of skilled personnel. Use of cold chain will be a key enabler for processing with high value creation potential through reduced shrinkage and maintenance of meat quality. Greatest value will be extracted by targeting high quality animals that can yield at least 38 per cent prima meat and about 52 per cent dressing percentage. Economic analysis shows that modernised slaughterhouse will yield very positive margins even at a retail price of KES 495 per Kg of prime beef. There is potential for higher price per Kg depending on the type of differentiated and value-added products that a modernised butchery will be selling, since some cuts go to as high as 800–1200 per Kg. Good returns from modernisations will motivate butcheries to invest in modern equipment that will promote meat quality and safety with a payback period of two to three years. With the expected positive financial performance, modern butcheries will guarantee good returns. Supported by economies of scale, modern butcheries will generate significant free cash flow from operation activities and significant cash to repay funds borrowed to finance capital expenditure as well as create a reserve to reward the owner and any other investor.

Modernisation of manufacturing practices aimed at presenting a value proposition for more innovations in meat manufacturing, to produce a variety of safe products that can be sold to consumers in all the market segments. The bottom of Pyramid, which constitutes approximately 60 per cent of consumers, presents a large market that if reached with quality and affordable products, would significantly increase meat consumption in the country. Bringing in more actors in manufacturing of quality and safe products will also make the manufacturing more competitive, hence and appropriately priced. Manufacturing will replace expensive meat with cheaper ingredients to reduce costs and increase volumes. Along with meat, a wide range of non-meat ingredients including meat extenders and fillers will form an important part of the manufacturing process of the meat

products. Use of cold chain and food safety standards will be a key enabler for safe and efficient manufacturing process. Economic analysis shows positive margins at all scale of production and price improvements of between 18 –40 per cent from the current prices of different manufactured products in the market. Meat manufacturing will however require long-term investment period particularly in the processing equipment, and renovation of production premises. With the expected positive financial performance, the business will guarantee investors good returns on exit, and support expansion of asset base over the period.

» **Objective 4: To establish the value proposition of the untapped domestic market taking into consideration the proposed modernisation and industry self-regulation:**

The economic analysis shows that meat industry modernisation presents a significant opportunity for investors in the meat industry to yield significant returns. The study has demonstrated positive returns from meat processing, slaughter and manufacturing which should incentivise investments in the sector. The proposed investments will be:

- Improved slaughter services, where meat traders and processors will have access to cold chain services, live animal holding grounds, appropriate animal handling structures, use of more mechanised slaughter operations, utilise the traceability and inventory management services, with a difference of KES 100 from the current practices.
- Traders would buy enough meat for the day to minimise on losses through spoilage and shrinkage. With modern processing models, the retailers will invest in cold chain which will enable them not just benefit from the reduced spoilage and shrinkage, but also cut short the time and money spent in visiting the slaughterhouse every day, to buy stock. This will further grow

their business through a better managed stock.

- Results show that butcheries stand to earn better returns once they invest in appropriate equipment for cutting meat along with deliberate focus on good quality carcasses. This will see their margins grow from selling prime cuts and value-added products, and reduce non-edible parts.
- The study shows that there is an opportunity to invest in manufactured meat products with attractive returns. The study shows that the bottom of pyramid presents a large untapped market for manufactured products since price remains a barrier for this consumer segment. The results of economic analysis show price differential of 18-40 per cent meaning that there is an opportunity to manufacture quality and safe products that are affordable to the bottom of the pyramid.
- Investment in modernisation, which the study has found to be economically feasible, coupled with enhanced consumer education and sensitisation, will ultimately improve customer confidence in the red meat, and ultimately increase consumption of red meat.
- Having proved a viable case for meat industry modernisation, the study further shows that this will trigger other business opportunities in the industry. These include the livestock finishing and feedlots, which will be required to make available quality animals with high primal cuts and dressing percentages to bring more value to the meat traders, meat processors and consumers. Secondly there are opportunities for investing in holding grounds where such investors provide meat traders with space to rest their animals, especially those that have travelled long distances. Slaughterhouses have an opportunity to set up places

for cleaning meat carriers, as a way of shifting the current practice by some meat transporters who clean the carriers in the carwash facilities.



Objective 5: To generate a critical economic analysis on the meat market intervention and a business case that will spur meat industry modernisation by the actors in the meat industry.

Results of the economic analysis shows that there are strong business cases for meat processing, slaughterhouses and manufacturing, strongly justifying investment in modernisation of the sector. Cold chain system is a key enabler for meat industry modernisation by enhancing shelf life, safety, quality and scale. There are a number of enablers for modernisation of meat industry. These include supportive policy and legal framework and enforcement of the same, consumer education and sensitisation; increased private sector investments in the meat industry for instance in the provision of quality equipment and financing the modernisation. In addition, there is need to put mechanisms in place to organise the sector to come up with self-regulating mechanisms.

Key Recommendations

- 1) The study has proved business cases for slaughter, processing and manufacturing that have potential to trigger growth of the industry. The following need to be done to ensure that the investments are easily adopted by the private sector:
- 2) Review of policy and regulatory framework, in order to effectively regulate meat sector. This will create a favourable environment for investors in the meat industry
- 3) The study shows that modernisation will be required investment in equipment, machinery and software. There is need to come up with forums that can

link the investors in slaughterhouse, manufacturing and processing with appropriate equipment and machinery. There need to link to work with financial institutions to come up appropriate products for investors in the meat industry

- 4) As an incentive to the investors, the government should consider zero rating the tax on the equipment and machinery required for the sector modernisation.
- 5) In addition to the formal rule and given the unstructured market system in which meat industry operates, there is need to come up with mechanisms for self-regulations like ta meat industry council, which will bring together the industry actors and come up with rules to promote modernisations, Other options include supporting business models like franchised meat outlets.
- 6) There is need to stratify butcheries modelling on the slaughterhouse classification and licencing. This will help consumers differentiate butcheries

that are fully compliant with industry modernisation standards from those that have not.

- 7) Branding of butcheries supported by appropriate legal framework will endear customers to buy meat from outlets that they are confident to buy meat and meat products.
- 8) Promotion of livestock feedlots and other finishing models in order to increase supply of better-quality animals required especially by the processors.
- 9) Consumer education is highly recommended, to not only counter negative publicity on red meat, but also to educate farmers/producers on important food safety measures on demand from the retailers for instance traceability, roller mark on carcasses, use of cold chain as quality and food safety tool, system for traceability as well creating awareness on differentiated products in the market.



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Annexes

9.1 Annex 1: Assumptions used in Financial Modelling

A. Assumptions for Slaughterhouse

Land required in acres	Number of acres		Area under construction	
	Non-mod-ernised	Modernised	Non-mod-ernised	Modernised
Slaughter house	1.00	2.00	30.0%	30.0%
Holding ground	0.30	1.00	0.0%	90.0%
Solid waste disposal	0.25	0.50	40.0%	60.0%
Liquid waste disposal	0.25	0.50	30.0%	60.0%
Biogas system	0.10	0.20	30.0%	60.0%
Open space	0.60	0.60	0.0%	0.0%
Total	2.50	4.80	20.2%	46.3%
Cost of Land	750/Acre			
Permanent Employees	Non Mod-ernised	Modernised	Monthly Salary Modernised	Monthly Salary - Modernised
Manager	1	1	30,000	100,000
Bleeders	1	1	15,000	30,000
Hide and skins	1	1	15,000	30,000
Stunner	1	1	15,000	30,000
Accountant	1	1	20,000	50,000
Boma attendants	1	1	15,000	30,000
Security	2	2	30,000	40,000
ICT	-	1	-	70,000
Total	8	9		
Number of Casual workers (paid per piece in the current model)	Non-mod-ernised	Modernised		
Flayers	50	-		
Offal Cleaners	25	-		
Cattle lead	30	-		
Eviscerating	50	-		
Chain pullers	25	-		
Splitters	50	-		
Offal Transporters	25	-		
Carcass Cleaners	25	-		
Bleeding	25	-		
Stunner	20	-		
Total	325			
Production Equipment	Non-mod-ernised	Modernised	Units	Total Costs
Weighing scale - meat	-	250,000	5	250,000
Electric Chain hoist	-	898,500	4	1,480,000
Fraying / De-hider	-	750,000	1	300,000
Overhead rails	-	1,000,000		
Skinning cradles	-	107,500		
Evisceration machine	-	600,000		
Carcass trolleys	-	158,500		

Stainless steel Landing table	-	158,000		
Electrical carcass spreader	-	100,000		
Head washing cabinet	-	500,000		
Carcass washing cabinet	-	600,000		
Carcass split saw				
Carcass split saw	-	1,000,000		
Breastbone saw	-	500,000		
Stunning box	-	389,000	1	
Generator	-	250,000	1	
Total	-	7,261,500		
Software				
	Non-modernised	Modernised	Units	Units Costs
Traceability software	-	7,700,000	1	7,700,000
Computers	-	350,000	5	70,000
Livestock weighing scale	-	400,000	1	400,000
Tag harvester	-	50,000	1	50,000
Total	-	8,500,000		
Cold room				
Cost of cold room	8,700,000	8,700,000	300	29,000
Waste management				
Biogas system (30 cubic meters)	-	1,000,000	1	1,000,000
Other overheads				
Overheads include; water, electricity, permits and licenses etc.	256,000	294,000		

B. Assumptions for Live Animals and Meat Trade

i) Number of Animals, Cost of Sales and Other Overheads

Number of animals	No of cattle handled	Trips per month
Small-scale	20	1
Medium-scale	30	1
Large-scale	40	1
Number of trips	Non modernised	Modernised
Per month	1.0	1.5
Cost of Sales	Non-modernised	Modernised
Cost per kg of live animal	112	112
Transport per live animal	700	-
Holding fees	1,000	1,000
Slaughter charges	700	800
Transport per carcass	800	800
Cess and permits	150	150
Other overheads	Non-modernised	Modernised
Transport for trader	30,000	30,000
Security	15,000	-
Meals and accommodation	20,000	20,000
Telephone and communication	5,000	5,000
Total	70,000	55,000

ii) Kg Per Animal, Meat Conversion Ratio

Kilograms per animal	Mean (kgs)	Distribution	Non-Modernised	Modernised
131 - 150	141	20%	28	29
151 - 180	166	20%	33	34
181 - 210	196	20%	39	40
211 - 400	306	20%	61	63
> 400	400	20%	80	82
Average		100%	241	247
Expected improvement				2.5%

Meat conversion ratio	Conversion	Distribution	Non-Modernised	Modernised
131 - 150	48%	20%	10%	10%
151 - 180	50%	20%	10%	10%
181 - 210	52%	20%	10%	10%
211 - 400	54%	20%	11%	11%
> 400	56%	20%	11%	11%
Average		100%	52%	52%
Gain by modernisation			0%	5%

iii) Salaries and Wages

Description	Salaries and wages		Number of staff		Wages
	Non-modernised	Modernised	Non-modernised	Modernised	Modernised
Driver	-	35,000	-	1	35,000
Conductor	-	30,000	-	1	30,000
Total	-	65,000		2	

iv) Price per Kg of Meat

Average price per kilogram	Price (KES)	Distribution	Average
Commercial	250	40%	100
Standard	270	30%	81
Prime	300	30%	90
Average		100%	271

v) Assets

Assets	Cost		Units		Unit Cost
	Non-modernised	Modernised	Non-modernised	Modernised	
Transport truck	-	8,000,000	1	1	8,000,000
Refrigerated van	-	3,500,000	1	1	3,500,000
Total	-	11,500,000			

Repair and maintenance	-	2.5%
Insurance per annum	-	7.5%
Distance in kilometres	-	1,000
Kilometres per litre of fuel	-	8
Cost per litre of fuel (KES)	-	100

C. Assumptions for Processing

vi) Butchery equipment, Furniture and Fitting

Description	Cost		Units		
Butchery Equipment	Non-processing	Processing	Non-processing	Processing	Unit Cost
	Cutting Tools and Equipment	10,000	10,000	1	1
Stainless Steel Meat Choppers	10,800	10,800	1	1	10,800
Electrical Bone Saw Machine	-	80,000	-	1	80,000
Electrical Mincing Machine	-	55,000	-	1	55,000
Weighing Scale	10,000	20,000	1	2	10,000
Display Counter Chiller	-	200,000	-	1	200,000
Freezers	45,000	90,000	1	2	45,000
Generator	-	35,000	-	1	35,000
Total	75,800	500,800			
Furniture and fittings	Non-processing	Processing	Non-processing	Processing	Unit Cost
	Buckets	5,000	10,000	1	2
Lighting system	10,000	20,000	1	2	10,000
Chairs and benches	7,000	7,000	1	1	7,000
Air conditions	-	70,000	-	1	70,000
Miscellaneous	2,000	2,000	1	1	2,000
Total	24,000	109,000			

vii.) Other Overheads, Office Equipment

Other overheads	Small-scale	Medium-scale	Large-scale
Electricity	5,000	7,500	10,000
Water	2,000	3,000	4,000
Transport and communication	5,000	7,500	10,000
Cleaning and sanitation	3,000	4,500	6,000
Repair and maintenance	3,000	4,500	6,000
System management			-
			12,500

Miscellaneous	2,000	3,000	4,000
Total	20,000	30,000	52,500
Office equipment	Small-scale	Medium scale	Large scale
Telephone	20,000	30,000	40,000
UPS	30,000	45,000	60,000
Computer and accessories	150,000	225,000	300,000
Inventory management system	70,000	105,000	2,700,000
Total	270,000	300,000	3,100,000
Average price per kilogram	Price (KES)	Distribution	Average
Commercial	250	40%	100
Standard	270	30%	81
Prime	300	30%	90
Average		100%	271
Kilograms per animal	Non-prime sales (%)	Distribution	Average
131 - 150	75%	10%	7.5%
151 - 180	70%	30%	21.0%
181 - 210	60%	30%	18.0%
211 - 400	50%	20%	10.0%
> 400	50%	10%	5.0%
Average		100%	61.5%

viii) Losses, Employees, Capacity Utilisation and other Direct Costs

Losses	Non-processing	Processing
Shrinkage	5.0%	1.0%
Spoilage	4.0%	1.0%
Non-saleable parts	0%	15%
Achieved capacity	Non-Processing	Processing
Current status	50.0%	50.0%
Incremental	0.0%	5.0%
Capacity in Kg	No of kilograms	Intensity of scale
Small -scale	100	1.0
Medium scale	150	1.5
Large scale	300	2.0
Permanent employees	Non-processing	Processing
Manager	25,000	35,000
Butcher	20,000	30,000
Accounts Clerk	-	25,000
Other direct costs	Non-processing	Processing
Packaging	5	10
Utilities	5	7
Miscellaneous	2	1

ix) Meat Prices

Meat Prices	KES
Prime cuts	600
Non-prime cuts	400
Non-saleable parts	100

D. Assumptions for Manufacturing

1. Equipment

Equipment	Small scale	Medium scale	Large scale	Small scale	Medium scale	Large scale	Unit Cost
Meat grinder	1,000,000	1,500,000	2,000,000	1	1	1	1,000,000
Curing machine	600,000	900,000	1,200,000	1	1	1	600,000
Meat tumbler (massager)	580,000	870,000	1,160,000	1	1	1	580,000
Meat pickle injector machine	850,000	1,275,000	1,700,000	1	1	1	850,000
Meat cutter	450,000	675,000	900,000	1	1	1	450,000
Sausage stuffer machine	580,000	870,000	1,160,000	1	1	1	580,000
Meat cooking machine	500,000	750,000	1,000,000	1	1	1	500,000
Sausage linker	300,000	450,000	600,000	1	1	1	300,000
Meat smoke house	600,000	900,000	1,200,000	1	1	1	600,000
Meat vacuum filler	400,000	600,000	800,000	1	1	1	400,000
Total	5,860,000	8,790,000	11,720,000				

2. Administrative Staff

Administration staff	Small scale	Medium Scale	Large scale	Monthly Salary (KES)
Factory manager	1	1	1	50,000
Accountant	1	1	1	40,000
Marketing manager	-	1	1	30,000
Driver	1	1	1	20,000
Total	3	4	4	140,000

3. Price/Kg of Meat, Production Staff and Rental

Average price per kilogram of meat	Price (KES)	Distribution	Average
Commercial	250	40%	100
Standard	270	30%	81

Prime	300	30%	90
Average		100%	271
Administration staff	Number of staff	Average Salary (KES)	Total monthly salary
Producer manager	1	40,000	40,000
Supervisor	1	25,000	25,000
Cutting and trimming	2	20,000	40,000
Chilling	2	20,000	40,000
Meat curing	2	20,000	40,000
Chopping and stuffing	2	20,000	40,000
Cooking	2	20,000	40,000
Smoking	2	20,000	40,000
Cleaning and sanitation	3	20,000	60,000
Total	17	205,000	365,000
Rental expenses	small	Medium	Large
Space (sq. metres)	1,615	2,421.88	3,229.17
Cost per square foot	45	45	45

4. Price/Kg of Manufactured product, other production costs and Overheads

Price per kilogram	KES
Sausage	370.0
Burgers	400.0
Minced Meat	350.0
Smokies	320.0
Salamis	380.0
Brawns	350.0
By-products	100
Other costs of production	KES
Chemical ingredients (salt, spices etc.)	1%
Electricity and gas	15.0
Packaging	10.0
Miscellaneous	5.0
Overheads	KES
Electricity	15,000
Water	10,000
Cleaning and sanitation	7,000
Telephone and communication	5,000
Miscellaneous	4,500
Total	41,500
Overheads	KES
Electricity	15,000
Water	10,000

Cleaning and sanitation	7,000
Telephone and communication	5,000
Miscellaneous	4,500
Total	41,500

5. Ingredients per kilogram

Ingredient	Sausage	Burgers	Minced Meat	Smokies	Salamis	Brawns
Meat	0.25	0.45	0.70	0.10	0.18	0.13
Corn/soya additive	0.40	0.35	0.30	0.30	0.70	0.60
Filler materials	0.35	0.20	-	0.60	0.12	0.27
Total	1.00	1.00	1.00	1.00	1.00	1.00
Expected protection	16.7%	16.7%	16.7%	16.7%	16.7%	16.7%

9.2 Annex 2: Terms Of Reference