MAFAP
SPAAA

Monitoring African Food and Agricultural Policies
Suivi des politiques agricoles et alimentaires en Afrique

ANALYSIS OF INCENTIVES AND DISINCENTIVES

FOR CATTLE IN KENYA

FEBRUARY 2013

SUMMARY OF THE NOTE

Product: Live Cattle
Period analyzed: 2005 – 2011
Trade status: Export (2005-06, 2008-2011), Import (2007)

- Livestock keeping is a major source of income for households in Kenya's Arid and Semi-Arid Lands (ASALs); 70 percent of the nation's cattle stocks are located in these regions.
- Kenya's total cattle stocks increased from about 14 million heads in 1990 to 18 million heads in 2010, with significant variability between years due to reoccurring drought and disease outbreak.
- Although official trade volumes are low, Kenya is generally considered an exporter of live cattle, with Uganda and Mauritius serving as its main export partners.
- Domestic beef consumption more than doubled over the past two decades, with beef accounting for about 73 percent of the total meat consumed by Kenyans. Sources indicate that Kenya meets its high national demand for beef by importing large volumes of cattle through informal, cross-border trade.
- Cattle marketing in Kenya is largely ad hoc and trade is poorly regulated. Additionally, producers remain highly unorganized, often leading to their exploitation by traders and middlemen.
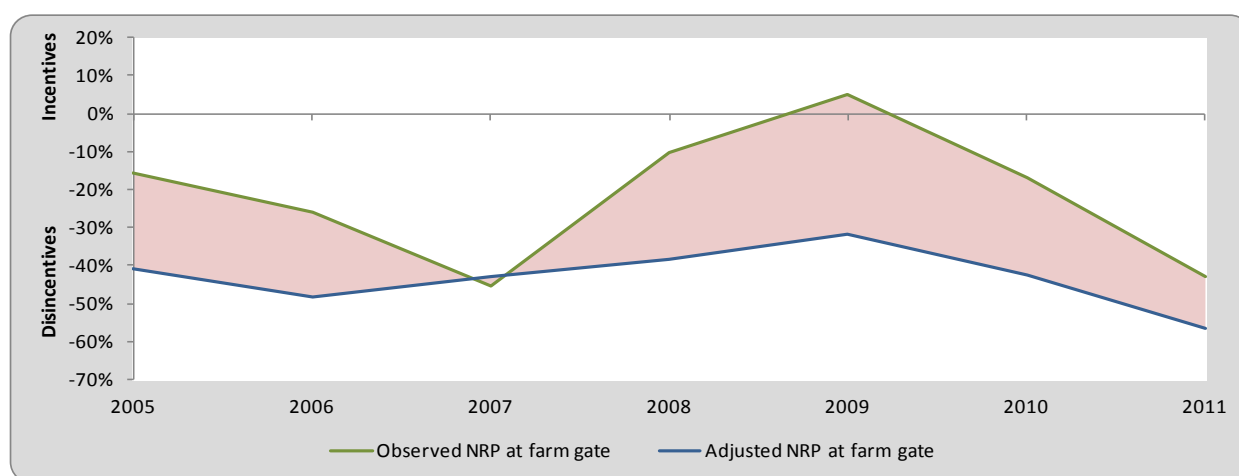
The observed Nominal Rate of Protection (NRP, green line) indicates that cattle producers generally received market price disincentives. The adjusted NRP (blue line) captures the effects of market inefficiencies on producers. The area in red shows the cost that these inefficiencies represent for producers in the years that Kenya was an exporter of live cattle. When Kenya was an importer in 2007, however, this area shows the net benefit that inefficiencies represent for producers.

- Our results show that disincentives arise from issues related to market structure, such as (1) traders' high profit margins due to rent seeking behaviour and information asymmetry along the value chain and (2) government taxes and fees imposed on cattle trekkers, though it is important to note that taxes and fees are somewhat marginal relative to traders' profit margins.

- Actions to be taken to reduce disincentives could include partnering with local producer organizations and other institutions to (1) carry out a review of existing taxes and fees affecting traders; (2) collect data to monitor cattle marketing, supply, trade flow and disease; and (3) disseminate critical market information to producers to reduce excessive profits realized by traders and improve the overall efficiency of the cattle market in Kenya.

Contents

1. PURPOSE OF THE NOTE

This technical note aims to describe the market incentives and disincentives for live cattle in Kenya. The note is a technical document and serves as input for the MAFAP Country Report.

For this purpose, yearly averages of farm gate and wholesale prices are compared with reference prices calculated on the basis of the price of the commodity in the international market. The price gaps between the reference prices and the prices along the value chain indicate to which extent incentives (positive gaps) or disincentives (negative gaps) are present at the farm gate and wholesale level. In relative terms, the price gaps are expressed as Nominal Rates of Protection (NRPs). These key indicators are used by MAFAP to highlight the effects of policy and Market Development Gaps (MDGs) on prices.

The note starts with a brief review of the commodity's production and consumption as well as trade and policies affecting the commodity. It also provides a detailed description of how the key components of the price analysis were obtained. Using this data, the MAFAP indicators were then calculated and interpreted in light of existing policies and market characteristics. The analysis is commodity and country specific and covers the period 2005-2011. The indicators were calculated using available data from different sources for this period.

The results of this analysis can be used by stakeholders involved in policy-making for the food and agricultural sector. They can also serve as input for evidence-based policy dialogue at the country or regional level.

This technical note is not to be interpreted as an analysis of the value chain or detailed description of production, consumption or trade patterns. All information related to these areas is presented merely to provide background on the commodity under review, help understand major trends and facilitate the interpretation of the indicators.

All information is preliminary and still subject to review and validation.

2. COMMODITY CONTEXT

The livestock sector contributes about 7 percent of Kenya's Gross Domestic Product (GDP) and 17 percent of the country's agricultural GDP (ASDS, 2010-2020). The sector is comprised of the red meat sub-sector (cattle, sheep, goats and camels), the white meat sub-sector (pigs and poultry) and by-products, including dairy, wool, skins and hides (Deloitte, 2006). Livestock keeping is a major economic and social activity for several communities in the high rainfall areas, where animals are primarily raised for dairy production, and in the country's Arid and Semi-Arid Lands (ASALs), where most animals are raised for meat production (Kiptarus, 2005).

Cattle production is an integral component of Kenya's livestock sector. Cattle are the country's main source of red meat, "supplying by value 80 percent of the nation's ruminant offtake for slaughter" (Behnke & Muthami, 2011). While Kenya produces and trades both live cattle and cattle meat, this note focuses solely on live cattle.

The aim of this analysis is to assess whether cattle producers in Kenya generally receive market price incentives or disincentives and to identify potential inefficiencies along the value chain that could be affecting the overall marketability of live cattle and the level of incentives for producers.

PRODUCTION

Kenya's population trend for live cattle from 1990 to 2010 is illustrated in Figure 1. As shown, the total number of cattle declined from almost 14 million in 1990 to 11.5 million in 1997/98, mainly due to an outbreak of the Rift Valley Fever (RVF), which killed off a portion of the country's cattle supply and prompted many producers to sell their cattle for slaughter prematurely to avoid the risk of losing their cattle to disease (Munyua et al., 2010). Cattle stocks started to recover in 1999, but decreased once again in 2000/01 due to severe drought conditions.

After the 2000/01 drought, cattle stocks increased gradually until 2004, when the population became stagnant, eventually dropping to about 12.5 million in 2006 due to a prolonged drought from 2004 to 2006 and another RVF outbreak in 2006/07 (Deloitte, 2006; Munyua et al., 2010). In the years following the drought and disease outbreak, however, cattle stocks increased dramatically, peaking at about 18 million in 2010.

In 2009, a comprehensive census of Kenya's livestock population was conducted for the first time since 1969, based on a set of questions attached to the human population census on the number of livestock kept by households (Deloitte, 2006; Behnke & Muthami, 2011). This new data indicates that cattle population estimates over the past decade were roughly three quarters of the 2009 census estimate for cattle (Behnke & Muthami, 2011). Based on this information, it is likely that the 30 percent spike in cattle stocks between 2008 and 2009 (shown in Figure 1) is mainly due to the underestimation of Kenya's cattle population in the years before the national census, especially since this trend is neither correlated with a significant increase in cattle imports nor a decrease in cattle offtake for slaughter.

Figure 1: Live Cattle Stocks in Kenya (Heads), 1990-2010
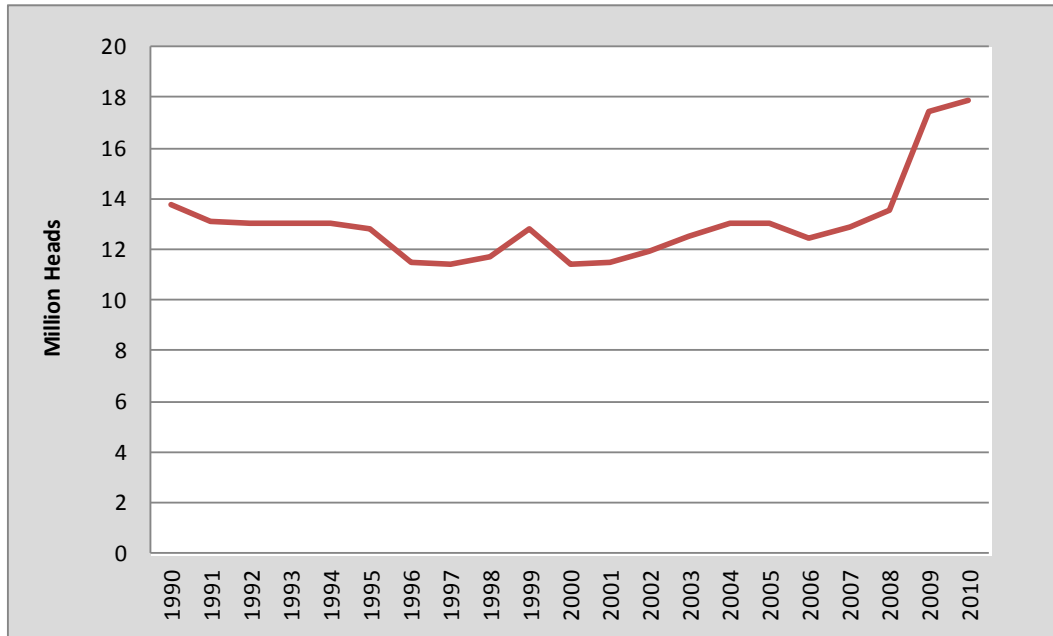
Source: FAOSTAT, 2012 (1990-1999, 2010); CountrySTAT, 2012 (2000-2009)

The distribution of cattle in Kenya is largely influenced by rainfall and climatic patterns. According to the 2009 livestock census, 70 percent of the country's cattle stocks are located in its ASALs, with arid regions accounting for 36 percent and semi-arid regions accounting for 34 percent of the total population (Behnke & Muthami, 2011). Kenya's ASALs comprise approximately 48.2 million hectares, or 84 percent of its total land area (Deloitte, 2006). Of these 48.2 million hectares, 9 million hectares (19 percent) can support some agriculture, 15 million hectares (31 percent) are only adequate for livestock keeping and the remaining 24 million hectares (50 percent) are dry and only used for nomadic pastoralism (Deloitte, 2006).

As shown in Figure 2, 65 percent of the country's cattle are concentrated within the western portion of Kenya, with the Rift Valley, Nyanza and Western provinces accounting for about 34, 21 and 10 percent of the cattle population, respectively. According to Kenya's Export Processing Zones Authority (EPZA, 2005), most of the country's cattle are kept in the ranches of the Rift Valley Province, such as Nakuru, Trans Nzoia and Kajiado. Another 15 percent of the country's cattle population is concentrated within the Eastern Province, which stretches across the central-east portion of the country, and about 19 percent is concentrated within the eastern portion of the country, with the Coast and North Eastern provinces accounting for 11 and 8 percent of the population, respectively.

Figure 2: Distribution of Live Cattle in Kenya by Province
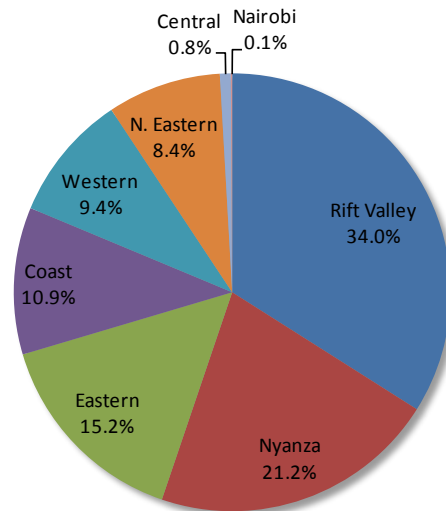
Source: Deloitte, 2006

Kenya faces many challenges and constraints with respect to cattle production and livestock development. These constraining factors are as follows:

- weak policy and legal frameworks;
- low livestock productivity;
- reoccurring drought and erratic weather conditions, which affect livestock feed and water supply;
- high cost and low quality of animal feed available to producers;
- the prevalence of transboundary animal and zoonotic diseases and pests, coupled with inadequate technical capacity for disease control;
- weak delivery of extension services;
- high transport costs and dilapidated marketing infrastructure;
- unreliable data and information management in the livestock industry.

CONSUMPTION/UTILIZATION

Red meat represents 80 percent of domestic meat consumption in Kenya, and cattle are Kenya's main source of red meat (EPZA, 2005). In fact, cattle meat accounted for 73 percent of the total meat consumed by Kenyans in 2009 (FAOSTAT Food Balance Sheet, 2012). As mentioned previously, a bulk of the cattle meat supply comes from the country's ASALs, while only a small portion comes from dairy herds (EPZA, 2005).

As shown in Figure 3, Kenya's total cattle meat consumption more than doubled over the past two decades, increasing steadily from about 200 000 tonnes in 1990 to almost 500 000 tonnes in 2009, despite a slight drop in 2000/01 and 2004/05 due to drought conditions that reduced cattle quality and killed off a portion of the country's beef supply. According to a 2006 Kenya Livestock Sector Study (Deloitte), meat consumption in Kenya is highest in Mombasa and Nairobi, where annual per capita beef consumption is estimated at 15 and 18.25 kg, respectively, while annual beef consumption in rural areas is estimated at only 3.25 kg per capita.

Figure 3: Total Cattle Meat Consumption in Kenya (1 000 tonnes), 1990-2009
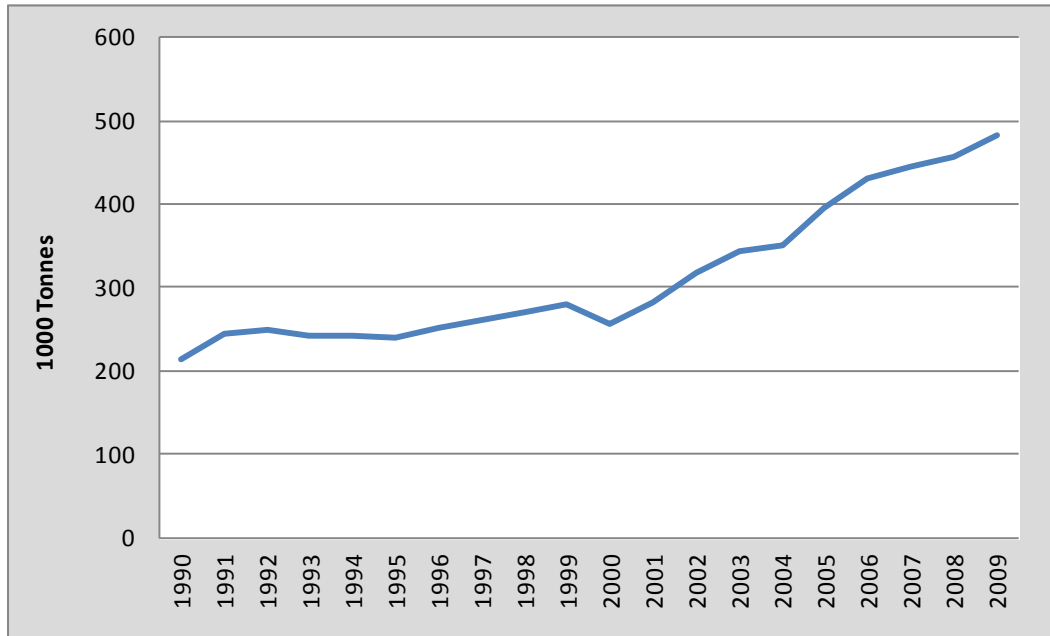
Source: FAOSTAT Commodity Balance Sheet, 2012

Figure 4 indicates that while cattle meat consumption increased in Kenya, cattle offtake for slaughter also increased by about 64 percent, from about 1.9 million heads in 1990 to 3 million heads in 2010. Between 1997 and 1999, there was a major spike in the total number of cattle slaughtered possibly due to the 1997/98 RVF outbreak, which may have prompted pastoralists to sell their cattle for slaughter prematurely out of fear that their cattle would contract the disease. Once the outbreak subsided, cattle offtake for slaughter decreased substantially, but increased steadily from 2000 to 2010 in response to the country's growing consumer demand for cattle meat, as well as periodic drought conditions and another disease outbreak in 2006/07, which once again prompted pastoralists to sell their stocks early to avoid the risk of losing their cattle.

Figure 4: Cattle Offtake for Slaughter (Heads), 2000-2010
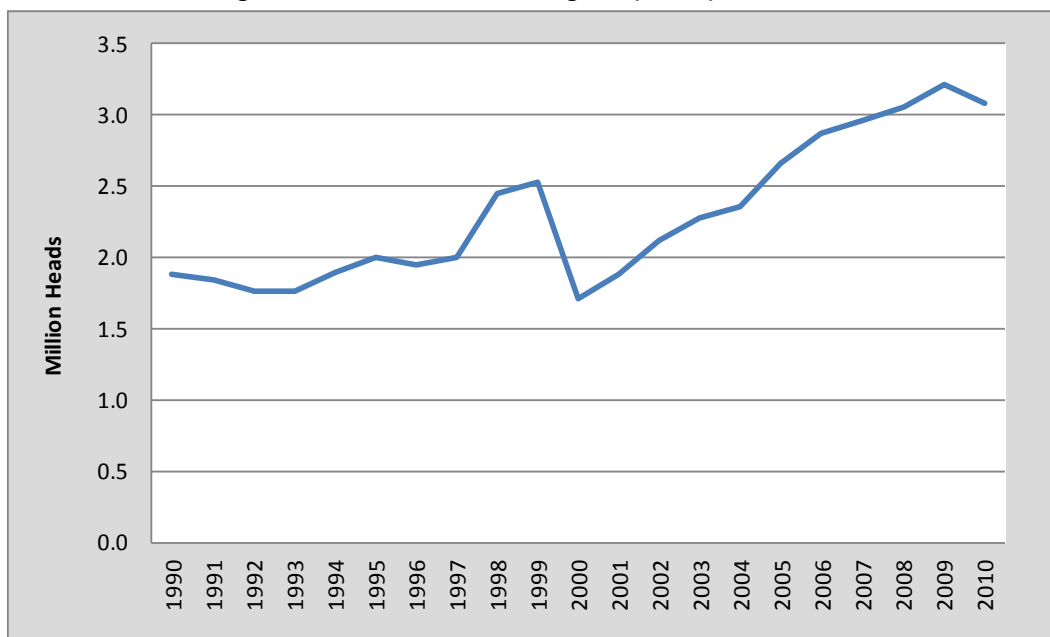
Source: FAOSTAT, 2012

MARKETING AND TRADE

UN Comtrade data indicates that Kenya was a net exporter of live cattle from 2005 to 2010, with the exception of 2007 (see Table 1). The 2007 spike in imports may have resulted from domestic cattle losses caused by the 2004-2006 drought and the 2006/07 RVF outbreak. Furthermore, the low trade volumes shown in Table 1 suggest that Kenya is generally self-sufficient in cattle production and is only a minor exporter of live cattle, possibly due to its high local demand for cattle meat.

Table 1: Live Cattle Imports, Exports and Trade Balance in Kenya (Heads), 2005-2010

	2005	2006	2007	2008	2009	2010
Import Quantity (M)	1	296	47,448	0	6	67
Export Quantity (X)	2,161	5,389	453	5,672	5,548	32,185
Trade Balance (X-M)	2,160	5,093	-46,995	5,672	5,542	32,118

Source: UN Comtrade, 2010

Contrary to UN Comtrade, some data sources suggest that while Kenya is self-sufficient in most livestock products, it is not self-sufficient in red meat production and consistently meets its shortfall through inflows of on-the-hoof animals trekked across its porous borders from neighbouring countries, such as Somalia, Ethiopia, Sudan, Uganda and Tanzania (Aklilu, 2008; Deloitte, 2006). It has been estimated that Kenya imports about 25-30 percent of its beef through unofficial movement of cattle across its borders, and about 2 million beef cattle enter the country annually, making the national herd highly variable (Deloitte, 2006). However, the lack of adequate data on informal, cross-border trade flow of live cattle makes it impossible to estimate how many cattle are actually imported and exported each year. Consequently, this analysis relies solely on official trade data.

Figure 5 shows Kenya's major export partners for live cattle based on the total number of heads exported during the 2005-2010 period. As illustrated, Kenya exports most of its live cattle to Uganda and Mauritius, which accounted for 62 and 34 percent of all live cattle exports, respectively. Burundi and Tanzania accounted for the remaining 4 percent of live cattle exports during this time period.

Figure 5: Share of Kenya's Live Cattle Exports by Trade Partner, 2005-2010
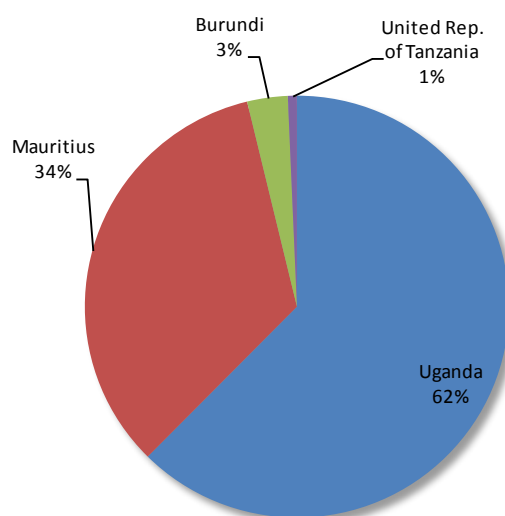
Source: UN Comtrade, 2010

Similarly, Figure 6 shows Kenya's major import partners for live cattle based on the total number of heads imported during the 2005-2010 period. As illustrated, Kenya imports most of its live cattle from Tanzania and the Netherlands, which accounted for 76 and 24 percent of all live cattle imports, respectively. However, it is likely that imports from the Netherlands are a higher grade of cattle used mainly for dairy production, whereas imports from Tanzania are a similar grade to the cattle produced in Kenya and are primarily used for meat production.

Figure 6: Share of Kenya's Live Cattle Imports by Trade Partner, 2005-2010
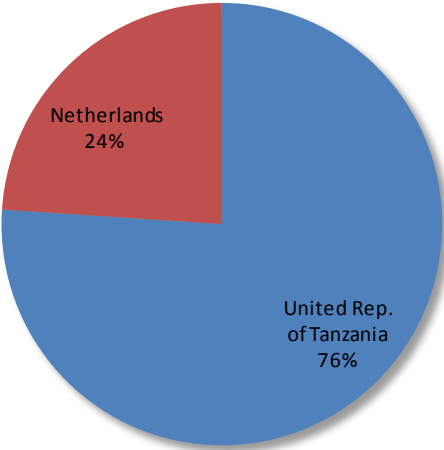
Source: UN Comtrade, 2010

DESCRIPTION OF THE VALUE CHAIN AND PROCESSING

Before liberalization of Kenya's livestock sector, cattle marketing was regulated by the Kenya Meat Commission (KMC), a monopolistic meat processing organization supplying major urban areas, and the Livestock Marketing Division (LMD), which carried out activities to facilitate organized livestock marketing in Kenya. With the support of the LMD, the KMC established several stock routes, holding grounds and quarantine areas to divide the country into disease prone and Disease-Free Zones. Additionally, meat and livestock prices were controlled, and other slaughterhouses were prohibited from entering major urban areas until 1977. Although the KMC collapsed after market liberalization in 1987/88, some of the its stock routes are still functioning today, despite their dilapidated state (Deloitte, 2006).

Kenya's existing stock routes are heavily reliant on livestock from ASAL areas. Animals traded in these value chains are not only from Kenya, but are also from neighbouring countries. This cross-border trade flow introduces the risk of Transboundary Animal Diseases (TADs) and has heightened the need for Disease-Free Zones (DFZs), especially if the country's export trade is to be developed (Deloitte, 2006).

Since liberalization, stock routes have been characterized by an increasing number of private agents, including traders, butchers and slaughterhouses. Additionally, much of Kenya's livestock marketing infrastructure (i.e. holding grounds, quarantine stations and stock routes) has broken down and

movement permits are not strictly adhered to despite veterinary requirements. This has had an adverse effect on the country's former Disease-Free Zones (DFZs).

Today, Kenya's cattle exports have remained low due to high local demand for cattle meat, the prevalence of disease and its inability to meet stringent Sanitary and Phytosanitary (SPS) requirements in importing countries. Furthermore, pastoralists and other livestock producers participating in the market have remained largely unorganized, leading to their exploitation by traders and middlemen. The formation of District Pastoralist Associations (DPAs), such as the Kenya Livestock Marketing Council (KLMC) and the Livestock Traders Marketing Society of Kenya (LTMS-K), may help to ameliorate this exploitation by passing critical market information on to pastoralists (Deloitte, 2006).

During the LMD and KMC's period of operation, 31 stock routes were developed throughout Kenya, but only 14 of these are still in use (refer to Annex I for a complete list of these routes). These active stock routes, illustrated in Figure 7, supply Kenya's main terminal markets in Nairobi and Mombasa. Nairobi's Dagoretti market is served by the Southern Routes (including supplies from Tanzania), Western Routes (Migori, Kuria), Northern and North Western Routes (including supplies from Uganda, Sudan and Ethiopia) and North Eastern Routes (Garissa). Nairobi's Dandora market is served by the Northern Routes (Moyale, Marsabit), Western Routes (Kuria), and North Eastern Routes (Garissa). In Mombasa, most of the livestock supplies come from the North Eastern Routes (including supplies from Somalia, Ethiopia, Garissa and the Tana River).

Figure 7: Map of Active Stock Routes in Kenya
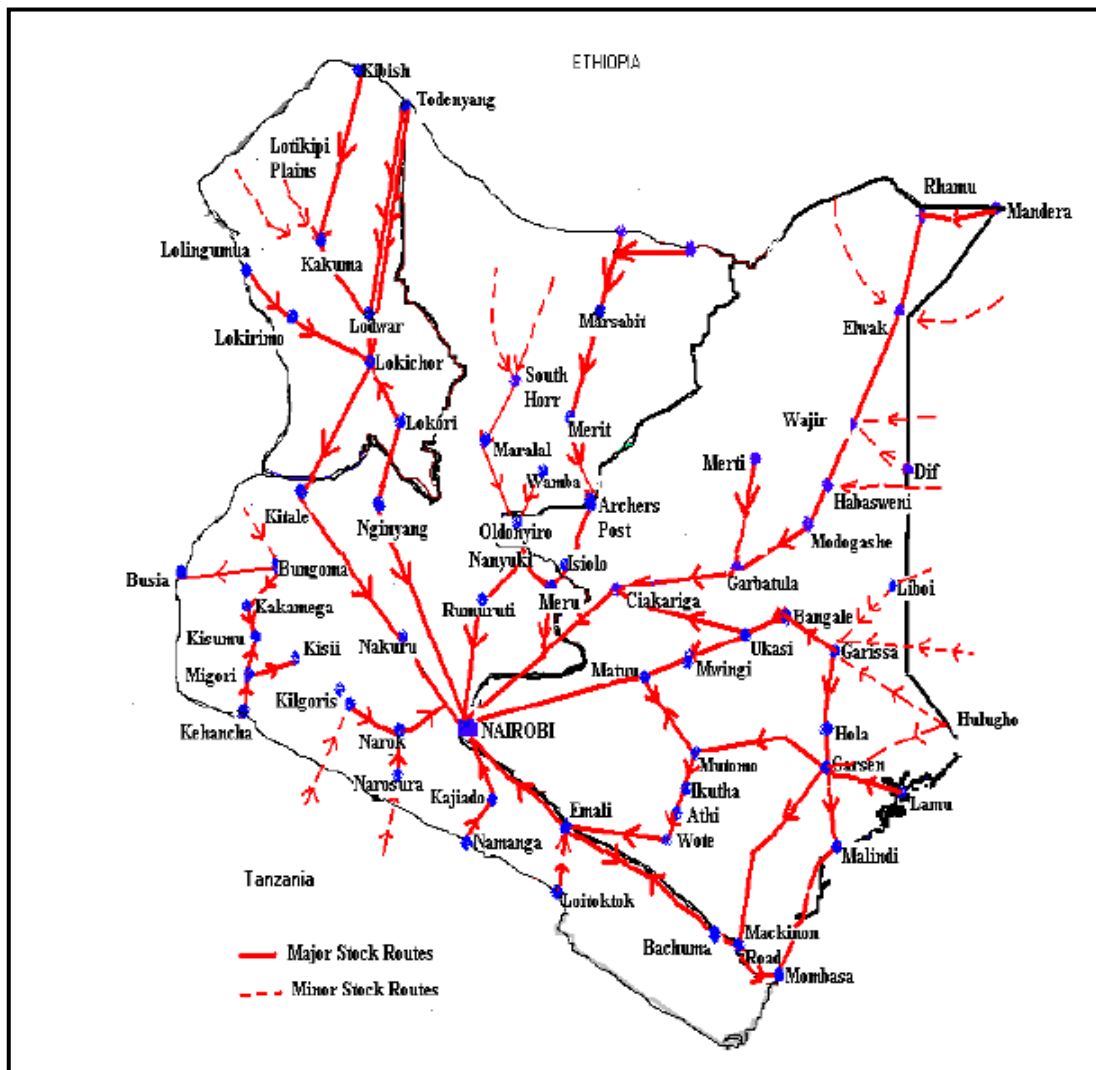
As shown in Figure 8, most cattle in Kenya are marketed along stock routes consisting of primary, secondary and terminal markets (EPZA, 2005). Cattle traded along these routes typically change hands once or twice and may even change hands three times, but only in very few cases (EPZA, 2005). In general, cattle are trekked from remote pastoral areas to primary and secondary markets and then trucked from secondary markets to Kenya's main terminal markets in Nairobi and Mombasa (Deloitte, 2006). However, in some cases, trekking is also the main system of transport from secondary to terminal markets, especially along the Garissa – Tana River – Mombasa Route (Deloitte, 2006).

Economic agents along Kenya's stock routes operate in a variety of ways. At the primary market in pastoral areas, some traders purchase young cattle, keep them for about two years and then sell them once they have matured. Other traders purchase animals at primary markets in Kenya, like Wajir, or in neighbouring countries, like Somalia and Ethiopia, and trek them to secondary markets in Kenya, such as Garissa, where they may receive a higher price. At Kenya's secondary markets, such as Garissa and Isiolo, middlemen often purchase cattle and truck them to terminal markets in Nairobi and Mombasa. Middlemen in Garissa also trek cattle to Mombasa, allowing them to graze and put on

weight along the way. Some of these traders rent ranches to fatten their cattle for several months before selling them for export or slaughter (EPZA, 2005).

Figure 8: Simplified Diagram of the Value Chain for Live Cattle in Kenya
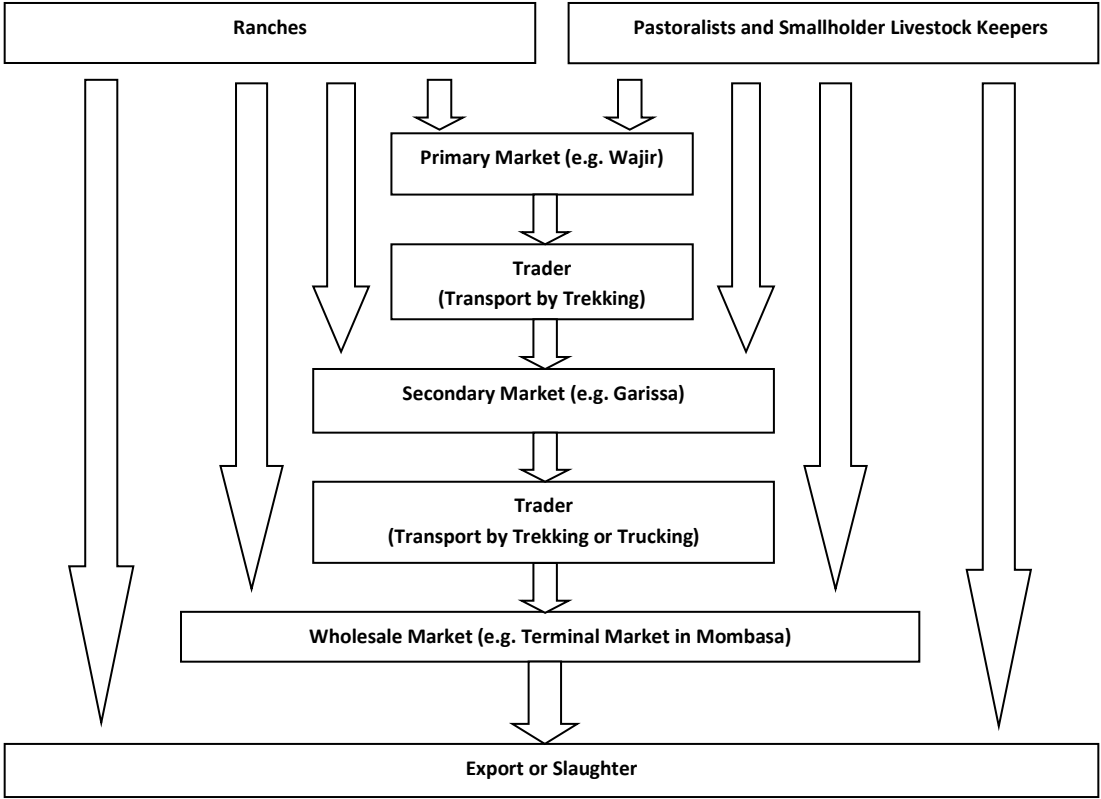
Source: Author's own elaboration

POLICY DECISIONS AND MEASURES

Government Strategies and Initiatives for Livestock Sector Development

The Government of Kenya (GOK) has laid out strategies to improve livestock in two key policy documents – the Economic Recovery Strategy for Wealth Creation and Employment Creation (ERS), 2003-2007 and the Agricultural Sector Development Strategy (ASDS), 2010-2020. The ERS specifically focuses on developing Kenya's ASAL areas to improve the welfare of communities that rely on livestock production as a main source of income. Under this strategy, the government gives priority to strengthening livestock marketing and infrastructure in these areas and aims to encourage private sector entrepreneurs to establish slaughterhouses and other channels for the export market. Specific objectives outlined in the ERS are as follows:

Provide adequate water for the rangelands by sinking boreholes and constructing dams at strategic locations in the region to avoid disruption of the migratory nature of communities.
Conduct research on livestock breeds, particularly on indigenous livestock, to improve local breeds.
Establish measures to control environmental degradation and carry out a periodic national livestock census.
Strengthen the animal health delivery system in the region by providing mobile animal health clinics and screening units, as well as disease surveillance mechanisms.
Address legal and policy barriers to livestock trade, such as livestock movement quarantines and cess/taxation.
Develop supporting infrastructure, including roads and stock routes with water facilities.
Strengthen disease control measures in partnership with regional animal health programs.
Create strategic Disease-Free Zones (DFZs) to facilitate export of live animals.
Increase cross-border disease surveillance and cross-border conflict resolution and management mechanisms.

The ASDS, which builds on and supersedes objectives outlined in the Strategy for Revitalizing Agriculture, 2004-2014, aims to develop Kenya's livestock sector by implementing the following interventions:

Reviewing policy, legal and institutional frameworks.
Increasing livestock productivity through the improvement of livestock breeds and feeds regulation, development of pastures and forage and enhancement of research and extension services.
Integrating development and management of rangeland.
Improving animal health and quality assurance services.
Improving access to markets through the organization of producers into marketing groups, the provision of market information to producers, the development of marketing infrastructure, value addition to increase revenues from exports and sanitary interventions.
Establishing a centrally coordinated livestock database.
Implementing the flagship Disease-Free Zones (DFZs) project.

According to Kenya's Poverty Reduction Strategy Paper, 2008-2012 (GOK, 2008), the GOK has invested Ksh 840 million into the rehabilitation of the KMC and procurement of livestock from local producers in recent years.

The revival of the KMC in June 2006 and the operationalization of the Landhies Road Depot in Nairobi and the Kibarani Factory in Mombasa in 2007 have increased market outlets for many livestock producers. Efforts have also been made to invest an additional Ksh 170 million for the construction of satellite abattoirs in Isiolo and Garissa and the rehabilitation of a slaughterhouse in Wajir. Furthermore, Kenya has sought to expand livestock export markets by increasing beef cattle exports to the Middle East and Mauritius (GOK, 2008).

Advancements have also been made in pest and disease control, as well as in livestock branding. The former is being addressed through integrated extension services and enhanced surveillance in collaboration with other stakeholders. The results of this approach have been positive, as outbreaks of major livestock diseases have been successfully contained over the last five years. To address the latter, the GOK spent Ksh 75 million in the 2006/07 FY on branding activities in pilot districts of the north rift and upper eastern provinces, where 1.4 million cattle were branded in order to improve traceability and promote livestock production. An additional Ksh 120,770, 040 was dispersed in the 2007/08 FY to complete the branding activities in the pilot districts and to expand branding activities to other cattle rustling-prone districts in the area (GOK, 2008).

Taxes and Fees

Cattle traders are subject to taxes and fees, including local taxes imposed by municipalities along the various stock routes, movement permits, vet and health inspection fees and other marketing fees. Along certain stock routes, especially Northern Routes, producers and traders are sometimes forced to pay illegal taxes and bribes. These taxes and fees can often be extremely costly, resulting in value chain inefficiencies that hinder livestock trade (Deloitte, 2006).

International Trade Policy

To encourage international trade in livestock, the government has waived import and export taxes on livestock.

3. DATA REQUIREMENTS, DESCRIPTION AND CALCULATION OF INDICATORS

To calculate the indicators needed to estimate market price incentives or disincentives for live cattle producers in Kenya, several types of data are needed. They were collected and are presented and explained hereafter.

TRADE STATUS OF THE PRODUCT

Official trade data indicates that Kenya was a net exporter of live cattle from 2005 to 2010, with the exception of 2007 (see Table 1). It is likely that a large number of cattle were imported in 2007 to replenish the country's cattle supply after the prolonged drought of 2004-06 and the RVF outbreak of 2006/07. Since 2011 trade figures for Kenya were not available from UN Comtrade, data was obtained from Global Trade Atlas for this particular year. The data collected indicates that Kenya imported 30 000 cattle from Tanzania and exported 15 381 cattle to various countries in 2011.

However, when Kenya's trade figures were cross checked with Tanzania's trade figures in the same year, Tanzania's exports to Kenya only amounted to 151 heads, which is much lower than the 30 000 heads reported by Kenya. Therefore, it was assumed that most cattle imports reported by Kenya in 2011 were actually live cattle stocks from Tanzania intended for re-export from Kenya's main port in Mombasa. For this reason, Kenya was considered a net exporter of live cattle in all years under review, except in 2007.

Official trade data also indicates that 34 percent of Kenya's live cattle exports were shipped to Mauritius between 2005 and 2010 (see Figure 5). Based on this information, it was assumed that a large portion of the country's live cattle are exported to Mauritius through the Mombasa Port. Thus, Mombasa was selected as both the border and the wholesale market in this analysis.

According to the 2006 Kenya Livestock Sector Study (Deloitte), Eastern Stock Routes supply a bulk of the live cattle in Mombasa. These routes cover much of the North Eastern Province and include inputs from Somalia and Ethiopia. Among the Eastern Stock Routes is the Wajir – Garissa – Tana River – Lamu – Mombasa route, which accounts for 25 percent of the total animals supplied to Mombasa. This route was selected for evaluation in this analysis and was used for estimating access costs. However, since domestic prices were only available at the secondary market in Garissa, rather than the primary market in Wajir, Garissa was taken as the farm gate (see Figure 9).

Figure 9: Stock Route Analyzed

Source: Author's own elaboration using Google Maps

BENCHMARK PRICES

Observed

The basis for calculating a reference parity price to determine whether cattle producers receive market incentives or disincentives is to establish a benchmark (border) price, which represents the prevailing market price for live cattle in the absence of domestic policies and market inefficiencies. Since Kenya is generally considered an exporter of live cattle, a nominal FOB price was taken as the benchmark price. However, in 2007, when the country was a net importer, a CIF price was taken as the benchmark price.

Since FOB prices for live cattle exports from Kenya are inconsistent, FOB prices were calculated using unit value CIF prices in Mauritius for live cattle imports from Kenya obtained from UN Comtrade. FOB price calculations were based on the assumption that the difference between the CIF price in Mauritius and FOB price in Kenya is composed of freight and insurance costs. According to the 2006 Kenya Livestock Sector Study (Deloitte), freight and insurance costs for live cattle exports from Kenya to Mauritius in 2004 were estimated at 7,742 Ksh per head. Since these costs were only available for a single year, Kenya's Consumer Price Index (CPI) obtained from the country's National Bureau of Statistics was used to extrapolate freight and insurance costs for each year based on 2004 figures. Once these costs were calculated, they were converted into US Dollars using the average nominal

exchange rate and then subtracted from the CIF price in Mauritius to derive the estimated FOB (benchmark) price in Kenya for live cattle exports to Mauritius, shown in Table 2.

The benchmark price in 2007, when Kenya was a net importer of live cattle, is also shown in Table 2. This figure is the unit value CIF price in Kenya for live cattle imports from the world. Since a reliable CIF price was not available from UN Comtrade for 2007, this CIF price was obtained from FAOSTAT Trade Statistics.

Table 2: Unit Value Benchmark Prices for Live Cattle in Kenya, 2005-2011

	Formula	2005	2006	2007**	2008	2009	2010	2011
1. Observed Unit Value CIF Price in Mauritius for Live Cattle Imports from Kenya (USD/Head)	–	566	627	–	782	712	831	811
2. Consumer Price Index	Base year = 2004	1.10	1.17	–	1.40	1.55	1.61	1.83
3. Freight and Insurance Costs (Ksh/Head)	7,742* x [2] =	8,516	9,058	–	10,839	12,000	12,465	14,168
4. Exchange Rate (Ksh/USD)	–	76	72	–	69	77	79	89
5. Freight and Insurance Costs (USD/Head)	[3] / [4] =	113	126	–	157	155	157	160
6. Unit Value FOB/CIF Price in Kenya for Live Cattle Imports/ Exports (Benchmark Price)	**[1] – [5] =**	**453**	**502**	**399****	**626**	**557**	**674**	**651**

*Estimated freight and insurance costs in 2004 for live cattle exports from Kenya to Mauritius.
**The unit value benchmark price for 2007 is a CIF price, since Kenya was a net importer of live cattle that year.
Source: UN Comtrade, 2010; FAOSTAT Trade Statistics, 2012; Deloitte, 2006

Adjusted

No adjustments to benchmark prices were made.

EXCHANGE RATES

Observed

Average nominal exchange rates between the Kenya Shilling and the US Dollar were used in this analysis. The average rates for each year under review (shown in Table 5) were obtained from the World Bank's World Development Indicators database.

Table 5: Nominal Exchange Rates, 2005-2011

Unit	2005	2006	2007	2008	2009	2010	2011
Ksh/USD	76	72	67	69	77	79	89

Source: World Bank

Adjusted

The observed (free market) exchange rate is believed to measure the equilibrium exchange rate. Therefore, no adjustment was necessary.

DOMESTIC PRICES

Since farm gate prices in Wajir (the primary market along the stock route analyzed) were not available, average annual producer prices in Garissa (the secondary market) were taken as the domestic farm gate prices in this analysis (shown in Table 3). These prices were obtained for Grade 2 cattle, since it is the higher quality cattle suitable for export.

Table 3: Domestic Farm Gate Prices for Live Cattle in Kenya, 2005-2011

Unit	2005	2006	2007	2008	2009	2010	2011
Ksh/Head	15,823	14,648	14,831	20,780	22,246	24,981	20,296

Source: http://www.lmiske.net/pages/Public/Product Report

Average annual wholesale prices in Mombasa were taken as the domestic wholesale prices in this analysis (shown in Table 4). These prices were also obtained for Grade 2 cattle, since it is the higher quality cattle suitable for export.

Table 4: Domestic Wholesale Prices for Live Cattle in Kenya, 2005-2011

Unit	2005	2006	2007	2008	2009	2010	2011
Ksh/Head	18,833	21,635	22,401	24,496	26,590	27,803	25,804

Source: http://www.lmiske.net/pages/Public/Product Report

ACCESS COSTS

Observed

Observed access costs reflect the actual cost of transporting cattle from the farm gate to wholesale and from wholesale to the border under current market conditions. These costs include all marketing margins and costs, whether they are paid-for services, bribes or taxes. All access costs in this analysis were obtained from the 2006 Kenya Livestock Sector Study (Deloitte) for the segment from Garissa to Mombasa along the Wajir – Garissa – Tana River – Lamu – Mombasa livestock marketing chain, as well as for the export/import marketing chain from the wholesale market in Mombasa to the border. These costs were assumed to be based on data and information from 2004.

Access costs from the farm gate in Garissa to the wholesale market in Mombasa include trucking and trekking costs obtained from the 2006 Kenya Livestock Sector Study (Deloitte). Since itemized costs for this segment of the marketing chain are only available for 2004, Kenya's CPI was used to extrapolate the costs for each year analyzed. Additionally, profit margins for trekkers and truckers were based on their total costs and margins reported in 2004. These margins were expressed as a percentage of their full financial costs, which include the purchase price (or the farm gate price) for their cattle and all other access costs. Once calculated, the percentages in 2004 (22.7 percent for trekkers and 34 percent for truckers) were used to estimate the profit margins for trekkers and truckers in years 2005-2011 based on their full financial costs in each respective year. Total observed trekking and trucking costs from Garissa to Mombasa are shown in Tables 6 and 7, while the composition of these costs is illustrated in Figures 10 and 11.

Table 6: Observed Trekking Costs from Garissa to Mombasa (Ksh/Head), 2005-2011

	2004* (base year)	2005	2006	2007	2008	2009	2010	2011
Purchase price (farm gate price)	15,000	15,823	14,648	14,831	20,780	22,246	24,981	20,296
County council cess	100	110	117	122	140	155	161	183
Municipal council	160	176	187	195	224	248	258	293
Branding	5	6	6	6	7	8	8	9
Movement permit	100	110	117	122	140	155	161	183
Contagious bovine pleuro-pneumonia (CBPP) test	50	55	59	61	70	78	81	92
Herding in Garissa - 1 mo., 6 herders at Ksh 22 000/mo.	40	44	47	49	56	62	64	73
Vet Costs	100	110	117	122	140	155	161	183
Trekking to Voi - 1 mo., 6 trekkers at Ksh 600/head + herding fees	600	660	702	732	840	930	966	1,098
Ranching - Ksh 160/mo./3 mo.	480	528	562	586	672	744	773	878
Vet costs in the farm	150	165	176	183	210	233	242	275
Herders' fees	60	66	70	73	84	93	97	110
Cost of marketing	150	165	176	183	210	233	242	275
SUB-TOTAL (excluding purchase price)	**1,995**	**2,195**	**2,334**	**2,434**	**2,793**	**3,092**	**3,212**	**3,651**
3% loss/mortality	531	584	621	648	743	823	855	972
Profit Margin	3,974	4,218	3,992	4,062	5,514	5,932	6,587	5,650
Margin (% of full financial costs)	22.7%							
GRAND TOTAL (excluding purchase price)	**6,500**	**6,996**	**6,947**	**7,143**	**9,050**	**9,847**	**10,653**	**10,273**

Source: Deloitte, 2006

Table 7: Observed Trucking Costs from Garissa to Mombasa (Ksh/Head), 2005-2011

	2004* (base year)	2005	2006	2007	2008	2009	2010	2011
Purchase price (farm gate price)	11,150	15,823	14,648	14,831	20,780	22,246	24,981	20,296
Broker	100	110	117	122	140	155	161	183
Trader costs	200	220	234	244	280	310	322	366
Marketing and other	1,495	1,645	1,749	1,824	2,093	2,317	2,407	2,736
Transport	200	220	234	244	280	310	322	366
Off-loading	30	33	35	37	42	47	48	55
Security/Boma fee	100	110	117	122	140	155	161	183
Auction fee	160	176	187	195	224	248	258	293
SUB-TOTAL (excluding purchase price)	**2,285**	**2,514**	**2,673**	**2,788**	**3,199**	**3,542**	**3,679**	**4,182**
Profit Margin	4,565	6,230	5,886	5,987	8,148	8,762	9,738	8,317
Margin (% of full financial costs)	34.0%							
GRAND TOTAL (excluding purchase price)	**6,850**	**8,744**	**8,559**	**8,774**	**11,347**	**12,304**	**13,417**	**12,499**

Source: Deloitte, 2006

Figure 10: Composition of Trekking Costs from Garissa to Mombasa (Excluding Purchase Price), 2004
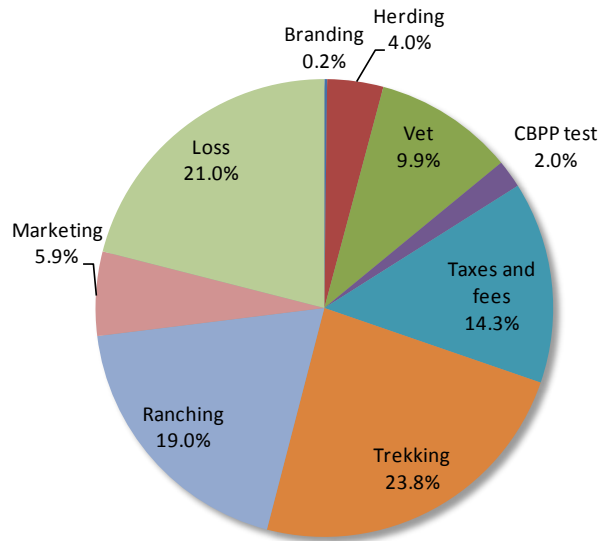
Source: Deloitte, 2006

Figure 11: Composition of Trucking Costs from Garissa to Mombasa (Excluding Purchase Price), 2004
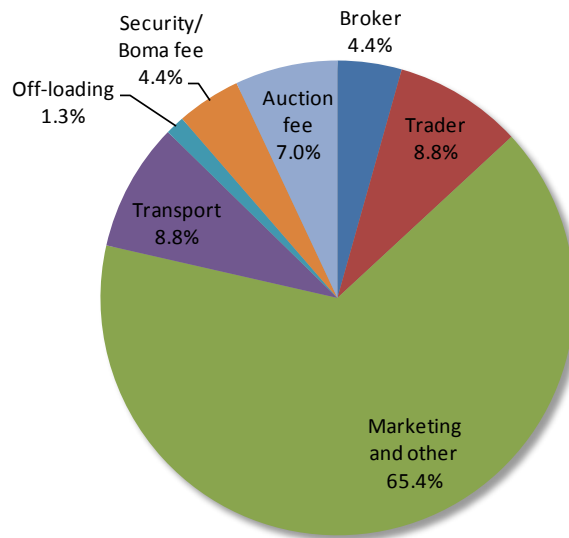
Source: Deloitte, 2006

The average between trekking and trucking costs from Garissa to Mombasa was taken as the total observed access costs from the farm gate to wholesale for each year. These total observed access costs are shown in Table 8.

Table 8: Total Observed Access Costs from Garissa to Mombasa (Ksh/head), 2005-2011

	2005	2006	2007	2008	2009	2010	2011
Total trekking costs	6,996	6,947	7,143	9,050	9,847	10,653	10,273
Total trucking costs	8,744	8,559	8,774	11,347	12,304	13,417	12,499
Average between trekking and trucking costs (total observed access costs)	**7,870**	**7,753**	**7,959**	**10,198**	**11,076**	**12,035**	**11,386**

Source: Deloitte, 2006

Access costs from the wholesale market in Mombasa to the border were also obtained from the 2006 Kenya Livestock Sector Study (Deloitte). Since itemized costs were only available for 2004, Kenya's CPI was used to extrapolate the costs for each year analyzed. Additionally, the profit margin for traders was based on their total costs and margins reported in 2004. This margin was expressed as a percentage of their full financial costs, which include the purchase price (or wholesale price) for their cattle and all other access costs. Once calculated, the percentage in 2004 (32.5 percent for exporters/importers) was used to estimate the profit margin for traders in years 2005-2011 based on their full financial costs in each respective year. Total observed access costs for live cattle exports (and imports in 2007) are shown in Table 9, while the composition of these costs is illustrated in Figure 12.

Table 9: Total Observed Access Costs from Mombasa to the Border (Ksh/head), 2005-2011

|	2004* (base year)	2005	2006	2007	2008	2009	2010	2011
Purchase price (wholesale price)	22,750	18,833	21,635	22,401	24,496	26,590	27,803	25,804
Movement permit	2	2	2	2	3	3	3	4
Herders	40	44	47	49	56	62	64	73
Feed in holding ground	20	22	23	24	28	31	32	37
Vet inspection 100	100	110	117	122	140	155	161	183
Clearing agent	300	330	351	366	420	465	483	549
Customs documentation	2	2	2	2	3	3	3	4
Port handling charge	140	154	164	171	196	217	225	256
Feed during freight	446	491	522	0	624	691	718	816
SUB-TOTAL (excluding purchase price)	**1,050**	**1,155**	**1,229**	**737**	**1,470**	**1,628**	**1,691**	**1,922**
Profit Margin	7,742	6,502	7,437	7,527	8,446	9,179	9,594	9,019
Margin (% of full financial costs)	32.5%							
GRAND TOTAL (excluding purchase price)	**8,792**	**7,657**	**8,666**	**8,263**	**9,916**	**10,806**	**11,285**	**10,940**

Source: Deloitte, 2006

Figure 12: Composition of Export/Import Costs from Mombasa to Border (Excluding Purchase Price), 2004
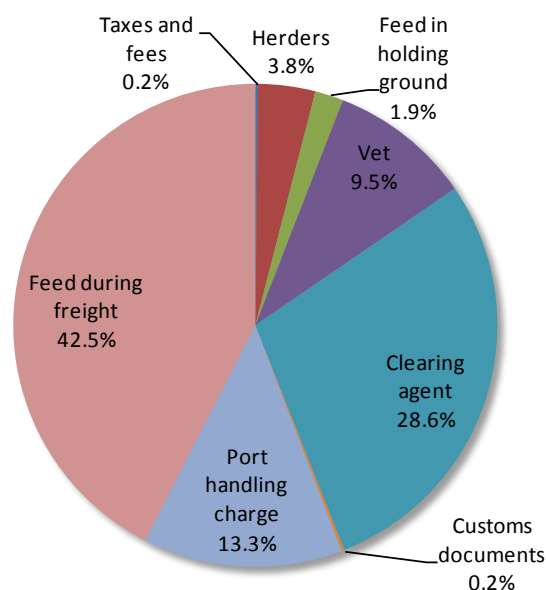
Source: Deloitte, 2006

Adjusted

Adjusted access costs reflect the cost of transporting the commodity from the farm gate to wholesale and from wholesale to the border in an efficient, well-functioning market. Thus, all taxes, fees (excluding fees for services), bribes and other non-tariff trade barriers are omitted and "excessive" costs adjusted. Additionally, "excessive" profit margins, defined as those exceeding 10 percent of the full financial costs borne by each economic agent along the value chain, are adjusted to "normal" profit margins equal to no more than 10 percent of full financial costs.

Adjusted access costs from the farm gate in Garissa to the wholesale market in Mombasa were calculated the same way as the observed access costs; however, government taxes and fees were omitted. Additionally, "excessive" profit margins were adjusted to "normal" profit margins equal to 10 percent of traders' full financial costs in each respective year. No other costs were identified as excessive and, therefore, were not adjusted. All itemized trekking and trucking costs are shown in Tables 10 and 11, and the total adjusted access costs from Garissa to Mombasa are shown in Table 12.

Table 10: Adjusted Trekking Costs from Garissa to Mombasa (Ksh/head), 2005-2011

	2004* (base year)	2005	2006	2007	2008	2009	2010	2011
Purchase price (farm gate price)	15,000	15,823	14,648	14,831	20,780	22,246	24,981	20,296
Branding	5	6	6	6	7	8	8	9
Contagious bovine pleuro-pneumonia (CBPP) test	50	55	59	61	70	78	81	92
Herding in Garissa - 1 mo., 6 herders at Ksh 22,000/mo.	40	44	47	49	56	62	64	73
Vet Costs	100	110	117	122	140	155	161	183
Trekking to Voi - 1 mo., 6 trekkers at Ksh 600/head + herding fees	600	660	702	732	840	930	966	1,098
Ranching - Ksh 160/mo./3 mo.	480	528	562	586	672	744	773	878
Vet costs in the farm	150	165	176	183	210	233	242	275
Herders' fees	60	66	70	73	84	93	97	110
Cost of marketing	150	165	176	183	210	233	242	275
SUB-TOTAL (excluding purchase price)	**1,635**	**1,799**	**1,913**	**1,995**	**2,289**	**2,534**	**2,632**	**2,992**
3% loss/mortality	531	584	621	648	743	823	855	972
Profit Margin	1,717	1,821	1,718	1,747	2,381	2,560	2,847	2,426
Margin (% of full financial costs)	10%							
GRAND TOTAL (excluding purchase price)	**3,883**	**4,203**	**4,252**	**4,390**	**5,414**	**5,918**	**6,334**	**6,390**

Source: Deloitte, 2006

Table 11: Adjusted Trucking Costs from Garissa to Mombasa (Ksh/head), 2005-2011

	2004* (base year)	2005	2006	2007	2008	2009	2010	2011
Purchase price (farm gate price)	11,150	15,823	14,648	14,831	20,780	22,246	24,981	20,296
Broker	100	110	117	122	140	155	161	183
Trader costs	200	220	234	244	280	310	322	366
Marketing and other	1,495	1,645	1,749	1,824	2,093	2,317	2,407	2,736
Transport	200	220	234	244	280	310	322	366
Off-loading	30	33	35	37	42	47	48	55
Security/Boma fee	100	110	117	122	140	155	161	183
Auction fee	160	176	187	195	224	248	258	293
SUB-TOTAL (excluding purchase price)	**2,285**	**2,514**	**2,673**	**2,788**	**3,199**	**3,542**	**3,679**	**4,182**
Profit Margin	1,344	1,834	1,732	1,762	2,398	2,579	2,866	2,448
Margin (% of full financial costs)	10%							
GRAND TOTAL (excluding purchase price)	**3,629**	**4,347**	**4,406**	**4,550**	**5,597**	**6,121**	**6,545**	**6,629**

Source: Deloitte, 2006

Table 12: Total Adjusted Access Costs from Garissa to Mombasa (Ksh/head), 2005-2011

	2005	2006	2007	2008	2009	2010	2011
Total trekking costs	4,203	4,252	4,390	5,414	5,918	6,334	6,390
Total trucking costs	4,347	4,406	4,550	5,597	6,121	6,545	6,629
Average between trekking and trucking costs (total observed access costs)	**4,275**	**4,329**	**4,470**	**5,505**	**6,019**	**6,439**	**6,510**

Source: Deloitte, 2006

Adjusted access costs from the wholesale market in Mombasa to the border were calculated the same way as the observed access costs; however, government taxes and fees were omitted from the total costs. Additionally, "excessive" profit margins were adjusted to "normal" profit margins equal to 10 percent of traders' full financial costs in each respective year. No other costs were identified as excessive and, therefore, were not adjusted. All itemized costs and total adjusted access costs from wholesale to the border are shown in Table 13.

Table 13: Total Adjusted Access Costs from Mombasa to the Border (Ksh/head), 2005-2011

	2004* (base year)	2005	2006	2007	2008	2009	2010	2011
Purchase price (wholesale price)	22,750	18,833	21,635	22,401	24,496	26,590	27,803	25,804
Herders	40	44	47	49	56	62	64	73
Feed in holding ground	20	22	23	24	28	31	32	37
Vet inspection 100	100	110	117	122	140	155	161	183
Clearing agent	300	330	351	366	420	465	483	549
Customs documentation	2	2	2	2	3	3	3	4
Port handling charge	140	154	164	171	196	217	225	256
Feed during freight	446	491	522	544	624	691	718	816
SUB-TOTAL (excluding purchase price)	**1,048**	**1,153**	**1,226**	**1,279**	**1,467**	**1,624**	**718**	**1,918**
Profit Margin	2,380	1,999	2,286	2,368	2,596	2,821	2,852	2,772
Margin (% of full financial costs)	10%							
GRAND TOTAL (excluding purchase price)	**3,428**	**3,151**	**3,512**	**3,647**	**4,063**	**4,446**	**3,570**	**4,690**

Source: Deloitte, 2006

EXTERNALITIES

No externalities have been taken into account in the analysis.

BUDGET AND OTHER TRANSFERS

There is no record of budgetary transfers to cattle producers and, therefore, were not included in this analysis.

QUALITY AND QUANTITY ADJUSTMENTS

Data on quality differences between imported and domestic cattle was not available. As a result, no quality adjustments were applied to the benchmark price in 2007. Quantity adjustments also were not applied in this analysis.

DATA OVERVIEW

Following the discussion above, a summary of the main data sources and methodological decisions taken for this analysis of price incentives and disincentives is provided below.

Table 14: Sources of Data Used in the Calculation of Indicators

Concept		Description	
		Observed	*Adjusted*
Benchmark price		1. *In the years when Kenya was a net exporter of live cattle, a unit value FOB price was taken as the benchmark price. The FOB price in these years was constructed by subtracting freight and insurance costs from the CIF price in Mauritius for live cattle imports from Kenya. CIF prices used in this analysis were from UN Comtrade, while freight and insurance costs were based on 2004 estimates from the 2006 Kenya Livestock Sector Study (Deloitte) and were calculated for each respective year using Kenya's CPI.* 2. *In 2007, when Kenya was a net importer, a unit value CIF price for live cattle imports from all trade partners was taken as the benchmark price. Since the CIF price from UN Comtrade in 2007 was unreliable, this price was obtained from FAOSTAT.*	*N.A.*
Domestic price at wholesale		3. *The average annual wholesale price for Grade 2 cattle in Mombasa.*	*N.A.*
Domestic price at farm gate		4. *The average annual producer price for Grade 2 cattle in Garissa.*	*N.A.*
Exchange rate		5. *Average nominal exchange rates reported by the World Bank.*	*N.A.*
Access cost from wholesale to the border		6. *Itemized costs from the wholesale market in Mombasa to the border were based on 2004 estimates from the 2006 Kenya Livestock Sector Study (Deloitte) and were calculated for each year using Kenya's CPI. However, profit margins were calculated as a percentage of full financial costs borne by each economic agent along the value chain.*	7. *Adjusted access costs were calculated the same way as observed access costs. However, government taxes, fees (excluding fees for services) and levies were omitted. Additionally, excessive profit margins exceeding 10% of the agent's full financial costs were adjusted to "normal" profit margins (equal to 10% of the agent's full financial costs).*
Access costs from wholesale to farm gate		8. *Itemized costs from the wholesale market in Mombasa to the farm gate in Garissa were based on 2004 estimates from the 2006 Kenya Livestock Sector Study (Deloitte) and were calculated for each year using Kenya's CPI. However, profit margins were calculated as a percentage of full financial costs borne by each economic agent along the value chain.*	9. *Adjusted access costs were calculated the same way as observed access costs. However, government taxes, fees (excluding fees for services) and levies were omitted. Additionally, excessive profit margins exceeding 10% of the agent's full financial costs were adjusted to "normal" profit margins (equal to 10% of the agent's full financial costs).*
QT adjustment	Bor-Wh	*N.A.*	*N.A.*
	Wh-FG	10. *Data on quality differences between imported and domestic cattle were not available. Therefore, no quality conversions were applied in this analysis.*	*N.A.*
QL adjustment	Bor-Wh	*N.A.*	*N.A.*
	Wh-FG	*N.A.*	*N.A.*

The data used for this analysis is summarized below.

Table 15: Data and Values Used in the Calculation of Indicators

DATA	Unit	Symbol	2005	2006	2007	2008	2009	2010	2011
		Year							
		trade status	x	x	m	x	x	x	x
	Unit	*Symbol*							
Benchmark Price									
Observed	USD/HEAD	$P_{b(int\$)}$	453	502	399	626	557	674	651
Adjusted	USD/HEAD	P_{ba}							
Exchange Rate									
Observed	Ksh/USD	ER_o	76	72	67	69	77	79	89
Adjusted	Ksh/USD	ER_a							
Access costs border - wholesale									
Observed	Ksh/HEAD	AC_{owh}	7,657	8,666	8,263	9,916	10,806	11,285	10,940
Adjusted	Ksh/HEAD	AC_{awh}	3,151	3,512	3,647	4,063	4,446	3,570	4,690
Domestic price at wholesale	Ksh/HEAD	P_{dwh}	18,833	21,635	22,401	24,496	26,590	27,803	25,804
Access costs wholesale - farm gate									
Observed	Ksh/HEAD	AC_{ofg}	7,870	7,753	7,959	10,198	11,076	12,035	11,386
Adjusted	Ksh/HEAD	AC_{afg}	4,275	4,329	4,470	5,505	6,019	6,439	6,510
Farm gate price	Ksh/HEAD	P_{dfg}	15,823	14,648	14,831	20,780	22,246	24,981	20,296
Externalities associated with production	Ksh/HEAD	E							
Budget and other product related transfers	Ksh/HEAD	BOT	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Quantity conversion factor (border - point of competition)	Fraction	QT_{wh}	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Quality conversion factor (border - point of competition)	Fraction	QL_{wh}	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Quantity conversion factor (point of competition – farm gate)	Fraction	QT_{fg}	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Quality conversion factor (point of competition – farm gate)	Fraction	QL_{fg}							

CALCULATION OF INDICATORS

The indicators and methodology used in this analysis are described in Box 1. A detailed description of the calculations and data requirements is available on the MAFAP website or by clicking here.

Box 1: Methodology and MAFAP Indicators

Nominal Rate of Protection (NRP)

MAFAP uses four measures of market incentives and disincentives. *First*, there are two observed nominal rates of protection – one at the wholesale and one at the farm gate – which compare domestic market prices to reference prices free from domestic policy interventions.

Reference prices are calculated from a benchmark price, such as an import or export price expressed in local currency, that is brought to the wholesale and farm gate by adjusting for quality, shrinkage and loss, and market access costs.

The *Nominal Rates of Protection - observed (NRP$_o$)* – is the price gap between the domestic market price and the reference price divided by the reference price at both the farm gate and wholesale:

$$NRP_{ofg} = \frac{P_b - AC_{ofg}}{RF_{ofg}} \;;\; NRP_{owh} = \frac{P_b - AC_{owh}}{RF_{owh}}$$

The NRP_{ofg} captures all trade and domestic policies, inefficiencies along the product's value chain and other factors affecting incentives or disincentives for the farmer. The NRP_{owh} helps identify where incentives and disincentives may be distributed in the commodity market chain.

Second, there are two *Nominal Rates of Protection - adjusted (NRPa)* – one at the wholesale and one at the farm gate – in which the reference prices are adjusted to eliminate any distortions found in the commodity value chain (e.g. excessive transport costs, taxes/levies or excessive profit margins of marketing agents). The equations to estimate the adjusted rates of protection, however, follow the same general pattern as those used to calculate the observed rates of protection:

$$NRP_{afg} = \frac{P_b - AC_{afg}}{RF_{afg}} \;;\; NRP_{owh} = \frac{P_b - AC_{awh}}{RF_{awh}}$$

Nominal Rate of Assistance (NRA)

If public expenditure allocated to any of the commodities analyzed (PE_{csp}) is added to the price gaps at the farm gate when calculating the ratios, the *Nominal Rate of Assistance (NRA)* is generated. This indicator summarizes the incentives (or disincentives) due to policies, market performance and public expenditure. Mathematically, the nominal rate of assistance is defined by the following equation:

$$NRA = \frac{(P_b - AC_{afg}) + PE_{csp}}{RF_{afg}}$$

Market Development Gap (MDG)

Finally, MAFAP methodology estimates the *Market Development Gap (MDG)*, which is the portion of the price gap that can be attributed to "excessive" or inefficient access costs within a given value chain, exchange rate misalignments, imperfect functioning of international markets and externalities. "Excessive" access costs may result from factors, such as poor infrastructure, high processing costs due to obsolete technology, government taxes and fees (excluding fees for services), high profit margins captured by various marketing agents, illegal bribes and other non-tariff barriers. Therefore, the total MDG at farm gate is comprised of four components – gaps due to "excessive" access costs (ACG_{wh}, ACG_{fg}), the exchange rate policy gap $(ERPG)$, international markets gap (IMG) and externality gap (EXG). When added together, these components are equivalent to the difference between the observed and adjusted price gaps at farm gate.

Similar to the price gaps calculated, the MDG is an absolute measure, which is also expressed as a ratio to allow for comparison across commodities and countries. Consequently, a relative indicator of the total MDG affecting farmers is derived by calculating the ratio between the total MDG at farm gate and the adjusted reference price at farm gate as follows:

$$MDG_{fg} = \frac{(ACG_{wh} + ACG_{fg} + ERPG + IMG + EXG)}{RP_{afg}}$$

In this analysis, only NRPs and MDGs were calculated. The NRA includes budgetary and other transfers to producers. In the case of live cattle in Kenya, calculations of transfers that can be assigned to live cattle production will be calculated and incorporated in a revised version of this technical note. When transfers have been included, the NRA will also be calculated.

Table 16: MAFAP Price Gaps for Live Cattle in Kenya, 2005-2011 (Ksh/head)

	2005	2006	2007	2008	2009	2010	2011
Trade status	x	x	m	x	x	x	x
Observed price gap at wholesale	(7,763)	(5,877)	(12,704)	(8,872)	(5,653)	(14,327)	(21,096)
Adjusted price gap at wholesale	(12,269)	(11,031)	(8,087)	(14,725)	(12,013)	(22,041)	(27,346)
Observed price gap at farm gate	(2,903)	(5,111)	(12,316)	(2,389)	1,079	(5,114)	(15,218)
Adjusted price gap at farm gate	(11,004)	(13,689)	(11,188)	(12,935)	(10,338)	(18,424)	(26,345)

Source: MAFAP

Note: The reference price at wholesale in 2007 was calculated differently relative to other years due to the change in trade status.

Table 17: MAFAP Nominal Rates of Protection (NRPs) for Live Cattle in Kenya, 2005-2011 (%)

	2005	2006	2007	2008	2009	2010	2011
Trade status	x	x	m	x	x	x	x
Observed NRP at wholesale	-29%	-21%	-36%	-27%	-18%	-34%	-45%
Adjusted NRP at wholesale	-39%	-34%	-27%	-38%	-31%	-44%	-51%
Observed NRP at farm gate	-16%	-26%	-45%	-10%	5%	-17%	-43%
Adjusted NRP at farm gate	-41%	-48%	-43%	-38%	-32%	-42%	-56%

Source: MAFAP

Note: The reference price at wholesale in 2007 was calculated differently relative to other years due to the change in trade status.

Table 18: MAFAP Market Development Gaps (MDGs) for Live Cattle in Kenya, 2005-2011 (Ksh/head)

	2005	2006	2007	2008	2009	2010	2011
International markets gap	-	-	-	-	-	-	-
Exchange rate policy gap	-	-	-	-	-	-	-
Access cost gap to wholesale	(4,506)	(5,154)	4,617	(5,853)	(6,361)	(7,714)	(6,250)
Access cost gap to farm gate	(3,595)	(3,424)	(3,489)	(4,693)	(5,057)	(5,596)	(4,876)
Externality gap	-	-	-	-	-	-	-
Market development gap	(8,101)	(8,578)	1,128	(10,546)	(11,417)	(13,310)	(11,127)
Market development gap ratio	-30%	-30%	4%	-31%	-35%	-31%	-24%

Source: MAFAP

Note: The access cost gap to wholesale in 2007 is expressed in positive terms, rather than negative terms, due to change in trade status.

4. INTERPRETATION OF THE INDICATORS

Figures 13-15 show the results for the set of MAFAP indicators generated, which include price gaps, Nominal Rates of Protection (NRPs) and Market Development Gaps (MDGs). Price gaps are market price differentials between the commodity's domestic and reference price in each respective year. More conceptually, they provide an absolute measure of price incentives or disincentives that live cattle producers face, while NRPs express this absolute measure as ratios that are comparable across countries and commodities. MDGs measure distortions in the value chain, such as excessive access costs, which affect price incentives for producers and wholesalers.

At the wholesale level, the average observed and adjusted NRPs throughout the period under review were -30 and -38 percent, respectively. As shown in Figures 13 and 14, the price gaps and NRPs at wholesale were negative in all years, indicating that wholesalers generally received market price disincentives. The observed NRP was least negative in 2009 at -18 percent due to a notable increase in the domestic wholesale price. This increase was most likely linked to the 2004-2006 drought and 2006/07 RVF outbreak, which caused the body condition of many cattle to deteriorate and prompted several livestock keepers to sell their cattle stocks prematurely out of fear that their cattle would depreciate in value. An overall reduction in cattle quality, coupled with an increase in cattle sales, put downward pressure on domestic prices. However, after the drought and disease outbreak subsided, domestic prices gradually recovered, thereby raising the NRP in 2009.

At the farm gate level, the average observed and adjusted NRPs throughout the period under review were -22 and -43 percent, respectively. As shown in Figures 13 and 14, the price gaps and NRPs were negative in all years, except in 2009, indicating that pastoralists and other livestock keepers generally face market price disincentives. The observed NRP was lowest in 2007 at -45 percent, when Kenya was a net importer, and highest in 2009 at 5 percent. Similar to the situation at wholesale, the higher NRP in 2009 was primarily due to an increase in domestic prices following the 2004-06 drought and 2006/07 RVF outbreak, though this increase was larger at the farm gate level than at the wholesale level.

Figures 13 and 14 indicate that the adjusted price gaps and NRPs were more negative than the observed in the years when Kenya was a net exporter of live cattle. For these years, the difference between the adjusted and observed price gap, referred to as the Market Development Gap (MDG), shows the cost that market inefficiencies represent for producers and wholesalers. In other words, it reflects what wholesalers and producers could potentially gain if market inefficiencies along the value chain were removed.

Figures 13 and 14 show that the situation was reversed in 2007 due to the change in the commodity's trade status. In this particular case, the adjusted price gap and NRP were less negative than the observed because access costs from the border to wholesale were added to the benchmark price rather than subtracted, as in the case of an export. Higher access costs along this segment of the value chain actually increase the cost of bringing the imported product from the port of entry to the domestic market and, therefore, raise the level of protection provided to local producers and wholesalers. When taking this into account, the difference between the adjusted and observed price gaps in 2007 (the MDG) shows the net benefit that market inefficiencies represent for producers and

wholesalers. In other words, it reflects what wholesalers and producers could potentially lose if market inefficiencies along the value chain were removed.

Since no international trade tariffs are levied on live cattle in Kenya, it was assumed that the negative observed NRPs at wholesale and farm gate are a direct result of market structure. As shown in Figure 15, the access costs gaps to wholesale and farm gate were substantial and generally increased during the period under review due to traders' rising costs and absolute profits. As shown in Tables 6 and 7, trekkers and truckers moving cattle from Garissa to Mombasa realize 22.7 and 34 percent of their full financial costs, respectively. Similarly, Table 9 indicates that exporters and importers of live cattle realize profits equal to 32.5 percent of their full financial costs. It is likely that these high profit margins stem from information asymmetry along the value chain, which suggests that traders have better access to data on cattle prices and market characteristics than wholesalers and producers.

Although government taxes and fees are marginal relative to traders' high profit margins, they still contributed to the access costs gaps measured in this analysis. As shown in Figure 10, trekkers moving cattle from Garissa to Mombasa are subject to taxes and fees equal to 14.3 percent of their total transport costs. However, cattle truckers, importers and exporters are subject to very few taxes and fees, if any. Therefore, the data suggests that government taxes and fees are applied disproportionately to the various agents along the value chain, with cattle trekkers bearing almost all of these costs. These measures may not only hinder the movement and export of domestic cattle through increased trekking costs, but they may also reduce the prices that trekkers are willing to pay producers for their cattle.

Figure 13: Observed and Adjusted Price Gaps at Wholesale and Farm Gate for Live Cattle in Kenya (Ksh/head), 2005-2011
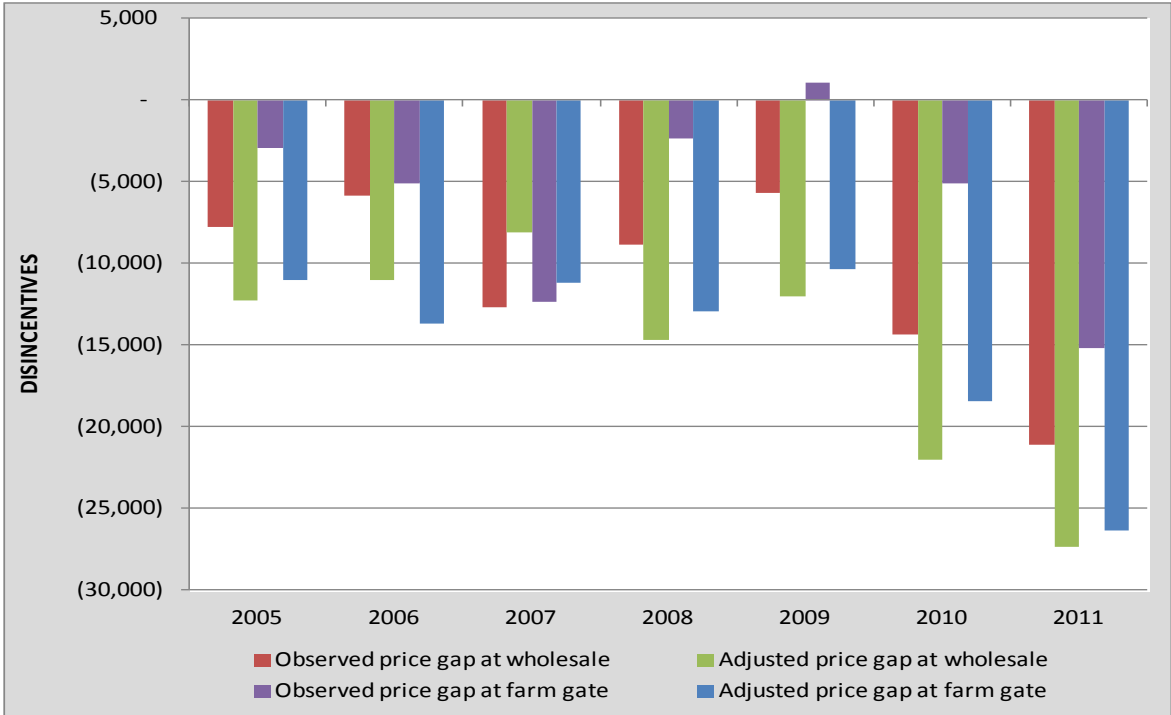
Source: MAFAP

Figure 14: Observed and Adjusted NRPs at Wholesale and Farm Gate for Live Cattle in Kenya (%), 2005-2011
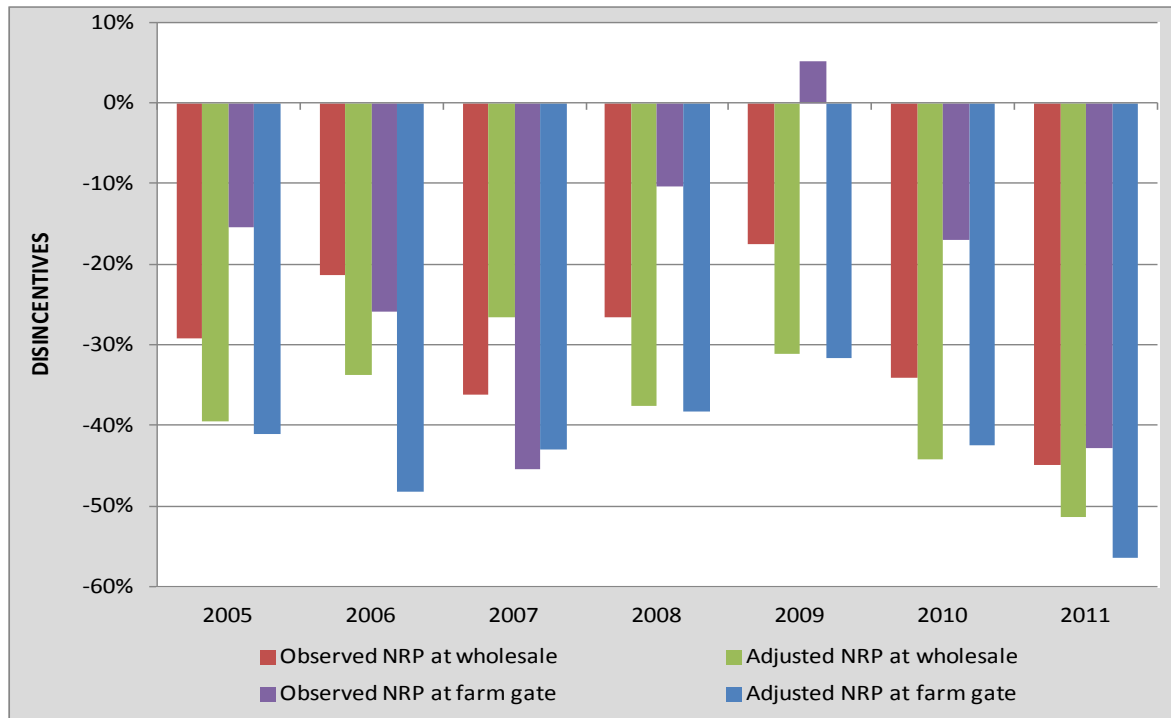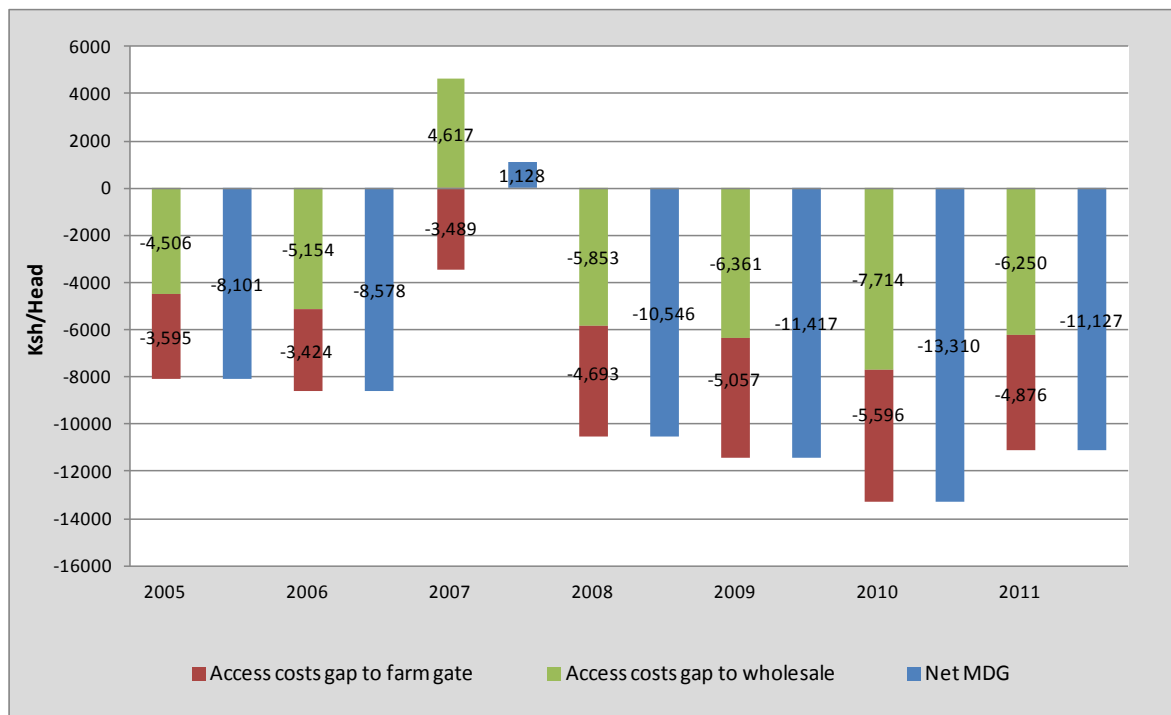

Source: MAFAP

Figure 15: Market Development Gaps (MDGs) for Live Cattle in Kenya (Ksh/head), 2005-2011

Source: MAFAP

5. PRELIMINARY CONCLUSIONS AND RECOMMENDATIONS

MAIN MESSAGE

The results of this analysis indicate that pastoralists and other cattle producers in Kenya generally faced market price disincentives. More specifically, the results suggest that cattle producers receive lower prices than they potentially could if the market were functioning efficiently and without government intervention. Since no international trade tariffs are levied on live cattle in Kenya, a large share of these disincentives can be explained by issues related to market structure, such as (1) traders' high profit margins due to rent seeking behaviour and information asymmetry along the value chain and (2) government taxes and fees imposed on cattle trekkers, though it is important to note that taxes and fees are somewhat marginal relative to traders' profits.

Based on this analysis, it is evident that the current market structure hinders cattle producers and wholesalers. If traders consistently realize high profit margins relative to their invested costs, then pastoralists and wholesalers will not be able to fully capture the benefits of rising domestic prices and high export prices. Furthermore, government taxes and fees imposed on trekkers may hinder the movement of cattle from remote pastoral areas to markets and even reduce the prices offered to producers. Unless these issues are addressed, they will continue to serve as major barriers to Kenya's stated goal of expanding its cattle export market as a strategy for poverty alleviation in ASAL regions.

PRELIMINARY RECOMMENDATIONS

The Government of Kenya, through its 2003-2007 ERS and 2010-2020 ASDS, has committed to increasing domestic cattle production and expanding the country's export market for cattle by implementing strategies that address many of the issues highlighted in this analysis. In general, these strategies aim to improve productivity by researching and improving indigenous cattle breeds, strengthening animal health through disease surveillance mechanisms and better delivery of veterinary services, improving stock routes and access to water facilities, developing and managing rangelands, addressing legal and regulatory barriers to trade (i.e. movement quarantines and local taxation/cess), organizing producers into marketing groups and improving market information as well as producers' access to this information.

Despite the government's pledge to address barriers to cattle trade, local taxes and fees imposed on cattle trekkers have yet to be reduced or eliminated. On a more positive note, however, several non-profit institutions, such as KLMC and LTMS-K, have been established in certain districts to organize producers into marketing groups. The government should look to partner with these local institutions to carry out a detailed review of existing taxes, fees and other non-tariff trade barriers affecting cattle traders. It should also work with these institutions to collect livestock data at the district level and carry out the government's initiative to develop a national livestock database for monitoring cattle marketing, supply, trade flow and disease. Furthermore, these institutions could assist the government in disseminating critical market information to producers to reduce profits realized by traders along certain segments of the value chain and to improve the overall efficiency of the cattle market in Kenya.

LIMITATIONS

The first limitation in this analysis was the lack of reliable FOB prices for live cattle exports from Kenya to the world or to Mauritius, one of its major export partners. As a result, FOB prices were constructed using the CIF price in Mauritius for live cattle imports from Kenya and estimated freight and insurance costs from the 2006 Kenya Livestock Sector Study (Deloitte). The lack of accurate FOB prices may have introduced some inaccuracy into the analysis, especially if freight and insurance costs were over or under estimated.

Another major limitation is that farm gate prices are only available in Garissa, which is the secondary market along the Wajir – Garissa – Tana River – Lamu – Mombasa marketing chain. In order to derive a measure of protection at the farm gate in the more remote production areas, average annual cattle prices at the primary market in Wajir are needed.

Lastly, estimated access costs from Garissa to Mombasa could be improved if data was available on the number of cattle trekked, as well as the number of cattle trucked along the Wajir – Garissa – Tana River – Lamu – Mombasa stock route. This information would allow for the calculation of total access costs from the farm gate to wholesale using a weighted average between trekking and trucking costs rather than a normal average, which would generate more accurate estimates.

FURTHER INVESTIGATION AND RESEARCH:

- conduct further research on the export/import value chain to verify the accuracy of estimated freight and insurance costs used to calculate the FOB (benchmark) price;
- collect more detailed information on the quality (cattle grade) and quantity of cattle traded along the Eastern Stock Route and other major stock routes in Kenya, as well as the number of cattle supplied through informal cross-border trade with neighbouring countries;
- gather price data at the primary market level along the Eastern Stock Route to strengthen this analysis;
- further investigate access costs along the Eastern Stock Route to verify estimated costs, especially government taxes and fees imposed on trekkers and profit margins of economic agents;
- conduct a similar analysis for other major stock routes in Kenya that would allow for the comparison of results.

6. BIBLIOGRAPHY

Aklilu, Y., Irungu, P. & Reda, A. (2002). *An Audit of the Livestock Marketing Status in Kenya, Ethiopia and*
        Sudan. Volume I. Community-Based Animal Health and Participatory Epidemiology Unit (CAPE).
        Nairobi,   Kenya.   Retrieved   from
http://www.google.co.uk/search?hl=en&q=An+Audit+of+the+
        Livestock+Marketing+Status+in+Kenya%2C+Ethiopia+and&meta=

Aklilu, Y. (2002). *An Audit of the Livestock Marketing Status in Kenya, Ethiopia and Sudan. Volume II Issues*
        and Proposed Measures. Community-Based Animal Health and Participatory Epidemiology
        Unit   (CAPE).   Nairobi,   Kenya.   Retrieved   from
        http://sites.tufts.edu/capeipst/files/2011/03/Aklilu-Marketing-vol-2.pdf

Aklilu, Y. (2008). *Livestock Marketing in Kenya and Ethiopia: A Review of Policies and Practice*. Feinstein
        International   Center,   Addis   Ababa.   Retrieved   from
https://wikis.uit.tufts.edu/confluence/download/
        attachments/24922042/Livestock+Marketing+in+Kenya+and+Ethiopia+-+Aklilu+2008.pdf

Behnke, R. & Muthami, D. (2011). *The Contribution of Livestock to the Kenyan Economy. IGAD LPI Working*
        *Paper   No.   03-11.*Retrieved   from   http://www.igad-
lpi.org/publication/docs/IGADLPI_WP03_11.pdf

Deloitte (2006). *AU-IBAR & NEPDP Kenya Livestock Sector Study: An Analysis of Pastoralist Livestock*
        Products, Market Value Chains and Potential External Markets for Live Animals and Meat.
Retrieved
        from http://www.value-chains.org/dyn/bds/docs/552/KenyaLivestockValuechainReport.pdf

Global Trade Atlas [GTA]. (2012). *Kenya Live Cattle Trade Data 2006-2011* [Data File]. Retrieved from
        http://www.gtis.com/GTA/

Government of Kenya [GOK] (2008). *Kenya Vision 2030: First Medium Term Plan, 2008-2012. Kenya Poverty*
        Reduction Strategy Paper. Retrieved from http://www.imf.org/external/pubs/ft/scr/2010/cr
        10224.pdf

Government of Kenya [GOK] (2010). *Kenya Agricultural Sector Development Strategy, 2010-2020.* Retrieved
        from http://www.kilimo.go.ke/kilimo_docs/pdf/ASDS_Final.pdf

Kenya Ministry of Planning and National Development [MPND] (2003). *Kenya Economic Recovery Strategy*
        for   Wealth   and   Employment   Creation,   2003-2007.   Retrieved   from
http://siteresources.worldbank.
        org/KENYAEXTN/Resources/ERS.pdf

Kenya National Bureau of Statistics (2011). *Kenya Consumer Price Index 2005-2011* [Data File]. Online
        Database. Retrieved from http://www.knbs.or.ke/consumerpriceindex.php

Kiptarus, J.K. (2005). *Focus On Livestock Sector: Supply Policy Framework Strategies Status and Links with*
Value Addition. Paper Presented at the Workshop of Value Asses Food and Export Investment at the Grand Regency Hotel in Nairobi on March 3rd 2005. Retrieved from http://www.chr.up.ac.za/chr_old /indigenous/documents/Kenya/Report/Focus%20on%20Livestock%20Sector.pdf

Munyua, P., Murithi, R. M., Wainwright, S., Githinji, J., Hightower, A., Mutonga, J. M.,…Njenga, M.K. (2010).
Rift Valley Fever Outbreak in Livestock in Kenya, 2006-2007. *The American Journal of Tropical Medicine and Hygiene, 83 (Suppl 2),* 58-64. doi:10.4269/ajtmh.2010.09-0292

Otieno, D., Omiti, J., Waiyaki, N. & Miencha, F. (2008). *Determinants of Kenya's Beef Export Supply. KIPPRA*
Discussion Paper No. 85. Productive Sector Division. Kenya Institute for Public Policy, Research and
Analysis. Retrieved from http://www.kippra.org/docs/DP85.pdf

PKF Consulting Ltd. (2005). *Meat Production in Kenya.* Kenya Export Processing Zones Authority. Nairobi,
Kenya. Retrieved from http://www.epzakenya.com/UserFiles/File/MeatIndustry.pdf

The World Bank (2011). *Kenya Exchange Rates 2005-2011* [Data File]. World Bank World Development
Indicators Online Database. Retrieved from http://databank.worldbank.org

UN Comtrade. (2010). *Quantity of Live Cattle Imports and Exports in Kenya by Trade Partner 2005-2010 and*
Unit Value Prices in Mauritius for Live Cattle Imports from Kenya 2005-2011 [Data File]. United Nations Commodity Trade Statistics Database. Retrieved from http://comtrade.un.org/db/dqBasic Query.aspx

UN Food and Agriculture Organization [FAO] (2012). *Kenya Cattle Stocks 2000-2009* [Data File]. CountrySTAT
Online Database. Retrieved from http://countrystat.org/ken/cont/pxwebquery/ma/114cpd035/en

UN Food and Agriculture Organization [FAO] (2012). *Kenya Cattle Stocks 1990-1999/2010 and Offtake for*
Slaughter 1990-2010 and the Unit Value Price in Kenya for Live Cattle Imports from the World in 2007 [Data File]. FAOSTAT Online Database. Retrieved from http://faostat.fao.org/default.aspx?lang=en

UN Food and Agriculture Organization [FAO] (2012). *Kenya Commodity Balance Sheet 1990-2009* [Data File].
FAOSTAT Online Database. Retrieved from http://faostat.fao.org/default.aspx?lang=en

ANNEX I: Methodology Used

A guide to the methodology used by MAFAP can be downloaded from the MAFAP website or by clicking here.

ANNEX II: Additional Contextual Information

Complete List of Active Stock Routes in Kenya

According to the 2006 Kenya Livestock Sector Study (Deloitte), the LMD developed 31 stock routes during its period of operation, but only 14 of these are still in use. Active stock routes in Kenya are listed below.

1. Moyale (Ethiopian border) – Marsabit – Isiolo- Embu-Nairobi
2. Moyale (Ethiopia border) – Merti – Isiolo – Nairobi
3. Mandera (Somali/Ethiopian border) – Wajir – Isiolo - Embu Nairobi
4. Mandera (Somali/Ethiopian border) – Garissa – Tana River – Lamu – Mombasa
5. Wajir – Garissa – Mwingi - Thika – Nairobi
6. Wajir – Garissa – Tana River – Lamu – Mombasa
7. Baragoi – Maralal – Nyahururu – Nakuru – Dagoretti/Dandora/Nairobi
8. Turkana – West pokot – Trans Nzoia – Nakuru – Nairobi
9. Turkana (Lokichogio (Sudanese border), Lodwar) – Kitale Nakuru – Nairobi
10. Namanga (Tanzanian border) – Kajiado – Kitengela/Kiserian Dagoretti/Rongai
11. Loitokitok (Tanzania border) Emali – Kitengela – Kiserian/Dagoretti/Nairobi
12. Kuria (Tanzanian border) – Migori – Narok – Ngong/Kiserian/Dagoretti Nairobi
13. Magadi – Ngong – Kiserian/Dagoretti/Rongai
14. Transmara – Narok – Suswa – Dagoretti – Nairobi

Legal and Regulatory Framework

There is an elaborate legal and regulatory framework for production, movement and slaughter of livestock in Kenya. Government laws affecting cattle production and trade include the Stock Traders Licensing Act; the Animal Diseases Act; the Stock and Produce Theft Act; and the Cooperative Societies (Amendment) Act (EPZA, 2005).

1. The Stock Traders Licensing Act, CAP 498 states that no persons shall carry on the trade or business of a stock trader without a license, whether as a principal, partner or agent. The exceptions are farmers who buy, sell or barter stock in the course of their business as farmers and residents in special areas set apart for the use of the tribe to which they belong. The Act empowers Provincial and District Commissioners to issue stock trader licenses, while the police, administrative, veterinary officers or inspectors to request and review the license on demand (EPZA, 2005).

2. The Animal Diseases Act, CAP 364, 1972 (revised 1989) provides the Veterinary Director with the following powers:

- Declare areas infected, issue provisions affecting infected areas (isolation, disinfections and movement of animals) and search for infected animals;
- Prohibit importation of animals, slaughter and disposal of forfeited animals and carcasses of infected animals and search and detain suspects;
- Indemnity and payment of compensation;
- Prescribe fees for drugs and vaccines and prohibit use of vaccines or drugs.

The Act also incorporates the Subsidiary Legislation of The Animal Disease Rules related to:

Importation of Animals; Movement of Animals; Infected Areas; Further provisions to prevent spread of disease; and, Miscellaneous Provisions. The Subsidiary Legislation also includes the requirement of a license for importation through Mombasa or Lamu ports or through Kisumu, Nairobi and Mombasa airports only. The legislation also covers the examination of imported animals, certificates required for imported animals, tests to be carried out, quarantine procedures and the requirements of other certificates if necessary (EPZA, 2005).

3. The Stock and Produce Theft Act Cap 355 provides for penalties imposed for the theft of stock or produce and to make persons liable to account for the possession of stock or produce in certain cases (EPZA, 2005).

4. The Cooperative Societies (Amendment) Act establishes cooperatives and gives powers to the minister of cooperatives to appoint a commissioner who is charged with the responsibilities of registering all cooperative societies provided they fulfil the basic requirements as stipulated by the law and to provide guidelines into the registration and the running of cooperatives (EPZA, 2005).

Regulatory Institutions

The main government institutions responsible for regulating the livestock sector and administering sector policies and programs are the **Ministry of Livestock and Fisheries Development (MoLFD) Department of Livestock Production**, which is responsible for providing production extension services to livestock keepers, and the **Veterinary Services Department (VSD)**, which is responsible for the provision of animal health extension services and disease control. This department certifies the health of the animal during movement, before and after slaughter. However, some districts in the ASALs are not covered by the VSD. In these areas, the Ministry of Health (MOH) provides services, but there is still a need to extend the coverage of the VSD to include all ASAL districts (Deloitte, 2006).

Other important institutions within the livestock sector include the **Kenya Livestock Marketing Council (KLMC)** and the **Livestock Traders Society of Kenya (LTMS-K)**, which are non-profit entities that promote organized marketing of livestock in pastoral areas. Both organizations were established to fill the gap left by the collapse of the Kenya Meat Commission (KMC) and the Livestock Marketing Department (LMD) after liberalization of the livestock market in 1980s. The KLMC and LTMS-K believe that pastoralism is a key economic activity in ASAL areas and can be harnessed to promote economic growth and improve the welfare of communities in the ASAL districts. These organizations have been working with development partners and stakeholders to access better markets and disseminate market information to producers and traders (Deloitte, 2006).

The general objectives of the KLMC and LTMS-K are as follows:
- To advocate for the interest and rights of the members on livestock matters in collaboration with other stakeholders;
- Promote livestock and livestock products marketing nationally, internationally and in particular in pastoral areas, in order to enhance and improve the economic well being of the pastoralists;
- To develop local and regional marketing research centres and marketing institutions;
- To enhance marketing information, dissemination and communication to producers and traders Lobby for policy change to favour appropriate livestock development;

- Build capacities of user groups to sustainably manage livestock related infrastructure and undertake community-based disease control measures.

Strategies employed by both organizations to achieve these objectives include the following:

- Lobbying and advocacy for better policies for the pastoralists;
- Capacity building of the pastoralists;
- Quality assurance of livestock and livestock product;
- Development of marketing strategie;
- Fundraising;
- Networking with other government institutions, NGOs, development partners and civil societies.

ANNEX III: Data and Calculations Used in the Analysis

Name of product			Live Cattle				
International currency			USD		Local currency	Ksh	

DATA		Unit	Symbol	Year trade status	2005 x	2006 x	2007 m	2008 x	2009 x	2010 x	2011 x	Notes
	Benchmark Price											
1	Observed	USD/Head	$P_{b(int\$)}$		453.36	501.77	398.73	625.71	556.53	674.14	651.27	
1b	Adjusted	USD/Head	P_{ba}									
	Exchange Rate											
2	Observed	Ksh/USD	ER_o		75.55	72.10	67.32	69.18	77.35	79.23	88.81	
2b	Adjusted	Ksh/USD	ER_a									
	Access costs border - wholesale											
3	Observed	Ksh/Head	ACo_{wh}		7,656.98	8,665.86	8,263.50	9,916.42	10,806.49	11,284.56	10,940.44	
3b	Adjusted	Ksh/Head	ACa_{wh}		3,151.38	3,512.28	3,646.52	4,063.47	4,445.84	3,570.17	4,690.02	
4	Domestic price at wholesale	Ksh/Head	P_{dwh}		18,833.00	21,635.00	22,401.00	24,495.50	26,590.00	27,803.00	25,804.00	
	Access costs wholesale - farm gate											
5	Observed	Ksh/Head	ACo_{fg}		7,870.22	7,752.99	7,958.83	10,198.40	11,075.68	12,035.22	11,385.74	
5b	Adjusted	Ksh/Head	ACa_{fg}		4,275.16	4,329.02	4,469.72	5,505.27	6,019.08	6,439.46	6,509.53	
6	Farm gate price	Ksh/Head	P_{dfg}		15,823.00	14,648.00	14,831.00	20,780.00	22,246.00	24,981.00	20,296.00	
7	Externalities associated with production	Ksh/Head	E									
8	Budget and other product related transfers	Ksh/Head	BOT		1.00	1.00	1.00	1.00	1.00	1.00	1.00	
	Quantity conversion factor (border - wholesale)	Fraction	QT_{wh}		1.00	1.00	1.00	1.00	1.00	1.00	1.00	
	Quality conversion factor (border - wholesale)	Fraction	QL_{wh}		1.00	1.00	1.00	1.00	1.00	1.00	1.00	
	Quantity conversion factor (wholesale - farm gate)	Fraction	QT_{fg}		1.00	1.00	1.00	1.00	1.00	1.00	1.00	
	Quality conversion factor (wholesale - farm gate)	Fraction	QL_{fg}		1.00	1.00	1.00	1.00	1.00	1.00	1.00	

CALCULATED PRICES		Unit	Symbol	2005	2006	2007	2008	2009	2010	2011	Formula
	Benchmark price in local currency										
9	Observed	Ksh/Head	$P_{b(loc\$)}$	34,253.10	36,177.82	26,841.84	43,283.75	43,049.01	53,414.51	57,840.06	[1]*[2]
10	Adjusted	Ksh/Head	$P_{b(loc\$)a}$	34,253.10	36,177.82	26,841.84	43,283.75	43,049.01	53,414.51	57,840.06	[1]*[2]
	Reference Price at wholesale										
11	Observed	Ksh/Head	RPo_{wh}	26,596.12	27,511.95	35,105.34	33,367.33	32,242.53	42,129.95	46,899.61	([9]*[QTwh]*[QLwh])-[3]
12	Adjusted	Ksh/Head	RPa_{wh}	31,101.72	32,665.54	30,488.36	39,220.28	38,603.17	49,844.35	53,150.03	([10]*[QTwh]*[QLwh])-[3b]
	Reference Price at Farm Gate										
13	Observed	Ksh/Head	RPo_{fg}	18,725.90	19,758.97	27,146.51	23,168.93	21,166.84	30,094.73	35,513.88	(([11]*[QLfg])*[QTfg])-[5]
14	Adjusted	Ksh/Head	RPa_{fg}	26,826.57	28,336.52	26,018.64	33,715.01	32,584.10	43,404.89	46,640.50	(([12]*[QLfg])*[QTfg])-[5b]

INDICATORS		Unit	Symbol	2005	2006	2007	2008	2009	2010	2011	Formula
Price gap at wholesale											
15	Observed	Ksh/Head	PGo$_{wh}$	(7,763.12)	(5,876.95)	(12,704.34)	(8,871.83)	(5,652.53)	(14,326.95)	(21,095.61)	[4]-[11]
16	Adjusted	Ksh/Head	PGa$_{wh}$	(12,268.72)	(11,030.54)	(8,087.36)	(14,724.78)	(12,013.17)	(22,041.35)	(27,346.03)	[4]-[12]
Price gap at farm gate											
17	Observed	Ksh/Head	PGo$_{fg}$	(2,902.90)	(5,110.97)	(12,315.51)	(2,388.93)	1,079.16	(5,113.73)	(15,217.88)	[6]-[13]
18	Adjusted	Ksh/Head	PGa$_{fg}$	(11,003.57)	(13,688.52)	(11,187.64)	(12,935.01)	(10,338.10)	(18,423.89)	(26,344.50)	[6]-[14]
Nominal rate of protection at wholesale											
19	Observed	%	NRPo$_{wh}$	-29.19%	-21.36%	-36.19%	-26.59%	-17.53%	-34.01%	-44.98%	[15]/[11]
20	Adjusted	%	NRPa$_{wh}$	-39.45%	-33.77%	-26.53%	-37.54%	-31.12%	-44.22%	-51.45%	[16]/[12]
Nominal rate of protection at farm gate											
21	Observed	%	NRPo$_{fg}$	-15.50%	-25.87%	-45.37%	-10.31%	5.10%	-16.99%	-42.85%	[17]/[13]
22	Adjusted	%	NRPa$_{fg}$	-41.02%	-48.31%	-43.00%	-38.37%	-31.73%	-42.45%	-56.48%	[18]/[14]
Nominal rate of assistance											
23	Observed	%	NRAo	-15.50%	-25.87%	-45.37%	-10.31%	5.10%	-16.99%	-42.85%	([17]+[8])/[13]
24	Adjusted	%	NRAa	-41.02%	-48.31%	-43.00%	-38.37%	-31.73%	-42.45%	-56.48%	([18]+[8])/[14]

Decomposition of PWAfg	Unit	Symbol	2005	2006	2007	2008	2009	2010	2011	Formula
25 International markets gap	Ksh/Head	IRG	-	-	-	-	-	-	-	
26 Exchange policy gap	Ksh/Head	ERPG	-	-	-	-	-	-	-	
27 Access costs gap to wholesale	Ksh/Head	ACG$_{wh}$	(4,506)	(5,154)	4,617	(5,853)	(6,361)	(7,714)	(6,250)	([3b]-[3])
28 Access costs gap to farm gate	Ksh/Head	ACG$_{fg}$	(3,595)	(3,424)	(3,489)	(4,693)	(5,057)	(5,596)	(4,876)	[5b]-[5]
29 Externality gap	Ksh/Head	EG	-	-	-	-	-	-	-	
Market Development Gap	Ksh/Head	MDG	(8,101)	(8,578)	1,128	(10,546)	(11,417)	(13,310)	(11,127)	[25]+[26]+[27]+[28]+[29]
Market Development Gap	%	MDG	-30%	-30%	4%	-31%	-35%	-31%	-24%	MDG/RPafg

Note: The reference price at wholesale in 2007 was calculated differently relative to other years due to the change in trade status.