PASTORALIST LIVELIHOODS, LIVESTOCK HERD DYNAMICS AND TRADE IN GARISSA COUNTY, KENYA

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University:

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DEDICATION

I dedicate this thesis to my wife,

Phoebe Mwambi.

With all my love and gratitude.

For the support and encouragement in my life and during this work.

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LIST OF ABBREVIATIONS AND ACRONYMS

AEZ	Agro-ecological zone
ALIVE	Partnership for Africa Livestock Development, Poverty Alleviation and Sustainable Growth
ASAL	Arid and Semi-Arid Land
COMESA	Common Market for Eastern and Southern Africa
CBPP	Contagious Bovine Pleuro-pneumonia
DFID	Department for International Development
DLMC	District Livestock Marketing Council
FAO	Food and Agricultural Organization of the United Nations
FEWS NET	Famine Early Warning Systems Network
FGD	Focused Group Discussion
GDP	Gross Domestic Product
GoK	Government of Kenya
HACCP	Hazard Analysis Critical Control Point
IFAD	International Fund for Agricultural Development
IGAD	Inter-Governmental Authority on Development
ILCA	International Livestock Center for Africa (the predecessor of ILRI)
ILRI	International Livestock Research Institute
IUCN	International Union for Conservation of Nature
KLMC	Kenya Livestock Marketing Council
KMC	Kenya Meat Commission
KNBS	Kenya National Bureau of Statistics
KShs	Kenya shillings (1 USD equaled KShs 87 in August 2012)

LPP	League for Pastoral Peoples and Endogenous Livestock Development
n	Sample size, number of respondents
NGO	Non-Governmental Organizations
NTFP	Non-Timber Forest Products
P	P-value, the probability of obtaining the observed results in a hypothesis test if the null hypothesis is true
REGLAP	Regional Learning and Advocacy Program for Vulnerable Dryland Communities
SCP	Structure, Conduct and Performance
SD	Standard Deviation
SPSS	Statistical Package for Social Sciences
TEV	Total Economic Value
TLU	Tropical Livestock Units
USAID	United States Agency for International Development
USD	United States Dollar
WISP	World Initiative for Sustainable Pastoralism
χ^2	Chi-square test, a non-parametric test used to compare proportions

GLOSSARY OF TERMS AND PHRASES

Biodiversity, Genetic diversity, Livestock diversity	The variety of biological organisms, genetic resources and livestock
Carbon sequestration	Absorption of harmful carbon dioxide emissions by vegetation and soil
Feedlot	A livestock production system for increasing the growth of livestock by enhanced feeding
Herd dynamics	Changes in herd structure and composition over time
Informal cross-border trade	Trade that is done away from the official Government system and therefore not recorded or taxed
In-situ conservation	Conservation of a species in its natural environment
Market stratification	A form of marketing which allocates different functions to different geographical areas and organizations according to their comparative advantages
Monopoly	A single controlling supplier in a market
Monopsony	A single controlling buyer in a market, a buyer's monopoly
Niche market	A subset of the mainstream market for a specific product
Oligopoly	A few sellers holding a relatively large portion of business in a market
Product differentiation	Variation of product type or formulation in order to attract customers

ABSTRACT

In the arid and semi-arid areas of northeastern Kenya, pastoralists are facing increasing risks such as drought, insecurity, animal diseases, increasing human populations and land fragmentation. These, together with subsistence and market demands, influence households' characteristics and how they interact with livestock resources at their disposal to meet livelihood objectives. Livestock trade plays a key role in local food security and poverty alleviation. It also has poorly understood implications on indigenous animal genetics utilization; conservation; importation of 'exotic' genetics; and transmission of trans-boundary diseases. This study was done in Garissa county to analyze current pastoralist socio-demographics, production objectives and livelihoods strategies; to evaluate livestock herd dynamics and reproduction; and to analyze the county livestock market and destinations of marketed livestock. The study was done using a cross-sectional survey of 146 households and by observation of the market functions, interviews with market players and longitudinal recording of sales and purchases. Livestock were the main source of income for 93% of households though 35% of households had plans to diversify. Most households were sedentary (68.5%), moving their livestock only at times of drought. Most households' members had low levels of education and provided 57% of the grazing labour. The mobile phone was a significant means of getting reports of distant livestock, second to owner visits. Goats provided most of the milk and market animals at 49% and 46% respectively. Households last sold their livestock a mean of 72 days before the interview date. Constraints cited arose from droughts, movement, livestock diseases and in marketing. Most households combined traditional strategies with relief aid to cope with these constraints. Within livestock herds, reproductive age females formed over 50% of all species. Livestock were not evenly

distributed among households with 58%, 27%, 28% and 2% of respondents having no camels, cattle, sheep and goats respectively. All species had a 12 months negative balance with 58% exits and 42% entries. Cows calved first at four years and lived up to a maximum of 22 years, but the mean age of reproductive animals was 8 years. There were many (62%) cow pregnancies after the rains and abortions were rare. In the livestock market, incoming animal consignments were 71% local, 29% cross-border and 75% on foot. Local consignments accounted for 54%, 38% and 87% of all animals, cattle and camels respectively and all the small stock. Somalia contributed 46%, 65% and 14% of all animals, cattle and camels respectively. Over 85% of the purchased animals were trucked to long distance destinations for slaughter, fattening and breeding. The market concentration ratio was 24% and 10% for sales and purchases respectively. The market value of the animals passed on to the producers was 86% and the wholesale margin was 17% comprising of 8% marketing costs and 92% profit. It was concluded that livestock herds were resilient, structured to provide milk and reproduce reasonably well. The market facilities were not adequate for livestock disease control, human and animal welfare and general hygiene, but business was competitive. It is recommended that participatory interventions to support local animal productivity, diversification and market facilities be set-up and households should balance between livestock labour and education needs of their dependants.

Key words: demographic parameters, livestock distribution and equity, livestock cycles, livestock inventory, livestock market competitiveness.

CHAPTER 1

1.0 INTRODUCTION

1.1 Background and justification

Pastoralism is facing increasing risks due to several factors including population and land pressures, animal diseases, policy issues and climate variability (Bailey *et al.* 1999). In Kenya's Northeastern province, pastoralism is the main means of livelihood and livestock trade consists of indigenous livestock of local and cross-border origin. Livestock contribute about 10% of the country's GDP, about 42% of the agricultural GDP and 50% of the agricultural sector employment (GoK, 2008). Over 60% of these livestock are found in the Arid and Semi-arid Lands (ASALs) where they employ 90% of the local population and the ASALs form about 80% of the country's land area.

Bailey *et al.* (1999) noted that it is not known how much herd structures have changed in the region in the last ten years as a result of increased commercialization and other factors and that the availability of beef animals may be far less than development planners acknowledge. However, The Government of Kenya (2008) admits in the National Livestock Policy that Kenya is currently not self-sufficient in beef and mutton and further that unless appropriate intervention measures are taken, the country may soon register deficits in other livestock products.

Marketing can provide opportunities for sustainable production in marginal areas and serve as a stimulating factor to increase production and in-situ conservation of indigenous species. However, depending on the reasons for selling, trade can be detrimental to production. For instance, selling productive assets such as breeding or milking cows is likely to be detrimental to sustainability, production and productivity of the herd. Pastoralist livestock trade,

especially with cross-border involvement, also has implications of indigenous animal genetics utilization and conservation; importation of exotic genetics; and transmission of trans-boundary diseases. Aklilu *et al.* (2002) and Pavanello (2010a) reported that growing financial pressures, food insecurity and frequent droughts are increasingly pushing pastoralists to sell more animals than before and regardless of productivity, age or sex.

Bailey *et al.* (1999) highlighted livestock marketing problems as accumulation and lack of return options at markets caused by long and costly transport distances; lack of market information; insecurity, environmental and social stress along trekking routes; mortalities and weight loss of trekked animals; lack of or inadequate feeding and watering facilities in markets and slaughterhouses and the non-exit quarantine nature of slaughterhouses. These factors make it difficult for producers to move animals to alternate markets or back home and place them in a weaker bargaining position. The above authors noted that pastoralists' recognition and fear of these problems lowers marketing volumes and results in a vicious cycle affecting investment in slaughtering capacity and marketing infrastructure and the response of demand and supply and price variability.

Hesse and MacGregor (2006) recommended that understanding environmental and market drivers are critical to appreciating the rationale of pastoralism in East Africa, and Hoffmann (2011) linked the conservation of livestock diversity to its sustainable use. Galaty and Aronson (1980) listed the impact of external changes and altered constraints on traditional range practices, the effects of consumer preferences on past broad mix of animal classes and the significance of increased use of the market as some of the priorities of research on pastoralist systems. Little and Dube (2011) added that there is need for new research approaches and analyses of pastoral domestic and local livestock markets that are rapidly

changing and that have received less research attention than regional cross-border and export markets.

1.2 Problem statement and objectives of the study

In Kenya, the effect of pastoralist livestock exploitation has not been adequately analysed and specifically its effect on livelihoods, herd stability and supply of marketable animals. Consequently domestic supply of livestock to markets is uncertain leading to cross-border livestock trade. Past Government and donor interventions focused on increasing off-takes without due consideration of pastoralist livelihoods.

The overall aim of this study was therefore to evaluate how livestock exploitation affected pastoral livelihoods, herd dynamics and potential uses and value addition options of marketed livestock. This consideration is important to all stakeholders to enable formulation and implementation of policies, plans and interventions for value chain up-grading. The specific objectives of the study were to:

1. Analyze the current pastoralist socio-demographics, production objectives and livelihoods strategies in Garissa County;
2. Evaluate the livestock herd dynamics and reproduction in the study area; and
3. Analyze the Garissa County livestock market and destinations of marketed livestock.

CHAPTER 2

2.0 LITERATURE REVIEW

2.1 Overview of livestock production in Kenya and the Horn of Africa

Jahnke (1982) grouped livestock production systems in Tropical Africa in several ways. By ecological zones, he distinguished three large classes namely range livestock production systems i.e. pastoralism and ranching in arid and less humid areas; crop-livestock production systems e.g. dairying in more humid areas; and landless production systems such as pig, poultry and intensive beef.

The Horn of Africa comprises of Eritrea, Somalia, Djibouti, Ethiopia, Sudan, Uganda and Kenya (the IGAD countries). This region occupies an area of 5.2 million km^2, 80% of which is arid and semi-arid lands (ASALs) and sub-humid lands supporting the livelihoods of mainly pastoralists and agro-pastoralists (Zeremariam, 2008).

According to Aklilu *et al.* (2002) the livestock sector contributes about 3.3% of the total GDP in Kenya, 20% of the total GDP in Ethiopia and 20% of the agricultural GDP in Sudan. However, in 2008 the Government of Kenya (GoK, 2008) revised the contribution of livestock to about 10% of the entire GDP, about 42% of the agricultural GDP and 50% of the country's agricultural sector employment. Over 60% of these livestock are found in the ASALs which form about 80% of the country's land area and where they employ 90% of the local population. Table 2.1 below shows the livestock population in the country.

Table 2.1: Kenya livestock population by species

Species	Number
Cattle	11,746,774
Camels	2,971,111
Sheep	1,719,606
Goats	27,740,153
Donkeys	1,832,519
Pigs	334,689
Indigenous Chicken	25,756,487
Commercial Chicken	6,071,042
Bee hives	1,842,496

Source: 2009 Kenya Population and Housing Census (GoK, 2010)

2.2 The role of livestock in livelihoods and values of pastoralism

Sansoucy (1994), Dalibard (1995) and ILRI (2006) listed the roles of livestock as food; cash income, employment; insurance; draught power and manure. Manure can be used for soil conditioning, cooking, feed for other animals and in some cases material for housing. Other roles are weed control and conversion of marginal and waste products (crop residues and common property resources) into high value products; materials and fibers in form of hides, skins, wool and feathers; and socio-cultural roles.

Hesse and MacGregor (2006) presented a framework for assessing the full contribution of pastoralism through the concept of Total Economic Value (TEV) that goes beyond conventional economic criteria. Globally, pastoralism is a mode of livestock production and a consumption system that supports more than 200 million pastoralists and also a natural resource management system that provides a wide range of services and products which are valued beyond the immediate production area (Hatfield and Davies, 2006). The latter authors use the TEV framework to categorize the values of pastoralism as direct and indirect. Direct values are the diverse range of livestock products and by-products that are consumed by pastoralists themselves or offered for sale in local, domestic, regional and international markets. Indirect values are products and services not directly produced by pastoralists but that emanate from their environment, practices, and culture.

In eastern Africa, pastoralism is the main production system in the arid and semi-arid areas. The system contributes significantly to employment opportunities, food security, livestock trade, leather industry, slaughterhouses, butcheries, transport and tourism and plays important social and cultural roles (Odhiambo, 2006).

Davies (2007) discussed the values of Kenyan pastoralism as livestock and milk sales, hides and skins, subsistence, transport, employment, social capital, inputs to tourism and agriculture, and taxes and levies. Others were Non-Timber Forest Products including honey, gum and charcoal; ecosystem services such as carbon sequestration and aversion of desertification; socio-cultural values and animal genetic resources conservation. Aklilu *et al.* (2002) estimated the contribution of Kenya pastoral areas to the supply of the country's beef as 72% with 46% being internal and 26% cross-border. In a drought monitoring report on Garissa County specifically, the Government of Kenya (2011), valued livestock sales as the main contributing source (59%) to household income, with the others being petty trading (13%), formal employment (7%), casual labour (7%), sale of charcoal (6%), sale of wood products (5%), and remittances (3%).

2.3 Threats to pastoralism and coping strategies

Pastoralism is facing increasing risks due to several factors including population and land pressures, animal diseases, policy issues and climate variability (Bailey *et al.*, 1999). These threats are clarified by FAO (2007) as changes in production systems, mechanization, loss of rangeland grazing resources, natural calamities, disease outbreaks, inappropriate breeding policies and practices, inappropriate introduction of exotic breeds, loss of animal keepers' security on land tenure and inadequate access to other natural resources. Others are changing cultural practices, erosion of customary institutions and social relations, influence of population growth and urbanization and the failure of Governments to assess the sustainability of interventions/practices and develop adequate policies and economic measures.

Pastoralist communities have a wide range of traditional activities to cope with some of these threats and protect their livestock production system and livelihoods (Pavanello, 2010b). World Initiative for Sustainable Pastoralism (WISP) (2007) discussed the risk management strategies as livestock mobility; species diversity; maximizing stock densities; redistributing assets among relatives and friends; livelihood diversification; herd splitting; use of wild foods to supplement reduced yields during droughts and opportunistic rain-fed or flood recession cultivation. Rota and Sperandini (2009) added that pastoralist keep livestock that are adapted to the prevailing climatic conditions and that they also reserve areas with rich patches of vegetation to use during dry seasons or droughts.

2.4 Pastoral livelihoods, sustainability, vulnerability and resilience

Chambers and Conway (1991) defined livelihoods as comprising of people, their capabilities and their means of living, including food, income and assets. Figure 2.1 is an illustration of the Sustainable Livelihoods Framework developed by the Department for International Development (DFID) (1999).

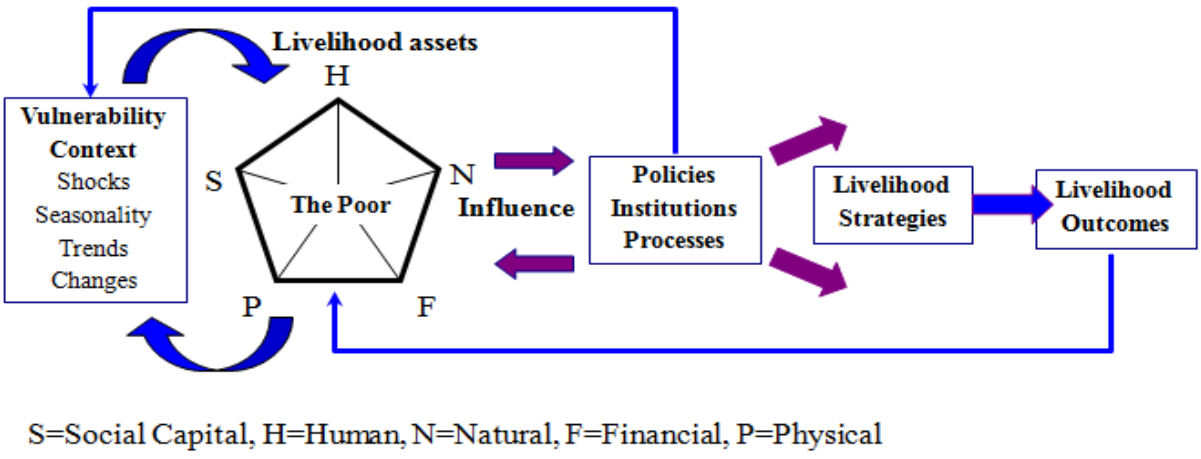

Figure 2.1: Sustainable livelihoods framework. Source: DFID (1999).

The Sustainable Livelihoods Framework presents the main factors that affect people's livelihoods and how they influence each other. The framework lists the livelihood assets as social capital, human capital, natural capital, financial capital and physical capital. The shape of the assets pentagon can show the variation in peoples' access to assets.

Chambers and Conway (1991) also described sustainability of livelihoods as a function of how assets and capabilities are utilized, maintained and enhanced so as to preserve livelihoods. The authors further defined sustainability as environmental or social. Environmental sustainability concerns the external impact of livelihoods on other livelihoods and its effects on local and global resources and other assets. Social sustainability concerns the internal capacity to withstand outside pressures, the ability to cope with stress and shocks and to continue and improve.

Ayantunde *et al*. (2011) highlighted the key issues in sustainability of pastoral systems in East and West Africa as mobility, livestock diversity, livelihood diversification options and preservation of traditions and indigenous knowledge. The authors noted that sustainability of pastoralism is of concern because the system is facing multiple pressures – demographic, economic, socio-political and climatic. The authors discussed the challenges and complexity of assessing the sustainability of pastoral systems and gave the reasons as the different aspects (ecological, productivity, socio-economic and institutional) that should be addressed over time and at different scales and also the data requirements for such an analysis. Data to inform the key issues in sustainability are many and varied and include household size, labour and education; herd size, structure and management; credit and market access; livelihood strategies; agro-ecological zone, rainfall patterns and soil fertility; land use patterns and policies; and Government development programs.

Vulnerability and resilience are opposite facets of the same coin. The drought management tool kit developed by the Partnership for Africa Livestock Development, Poverty Alleviation and Sustainable Growth (ALIVE) defines resilience as the capacity to cope with or adapt to hazards such as drought so that they don't turn into disasters and vulnerability as the lack of resilience to the occurrence of hazards. Sustainability therefore is a function, if not the sum, of vulnerability and resilience. Vulnerability and resilience are more important to livelihoods than the opposing shocks as they are 'system properties' i.e. internal whereas shocks are external. Shocks such as drought may be cyclic and largely un-avoidable. Thus, livelihood interventions usually aim at decreasing vulnerability and increasing resilience.

2.5 Regional livestock trade and dry-lands development policies and practices

The Kenya Vision 2030 (GoK, 2007) recognizes the current decline of the livestock and fisheries subsector and its high potential for growth and puts the development of this potential as one of its objectives. The National Livestock Policy (GoK, 2008) recognizes the role of pastoralism and its constraints and commits to support the system while encouraging livelihoods diversification. The Draft National Policy for the Sustainable Development of Arid and Semi-arid Lands of Kenya (GoK, 2004) provides a vision and framework for achieving multiple and sustainable development objectives in the ASALs and a vital link between public policy and the needs of ASAL communities.

Other policy and development initiatives aimed at integration of the development of ASALs into the national development priorities include Agricultural Sector Development Strategy 2010-2020, Strategy for Revitalizing Agriculture, Land Policy, Wildlife Policy, Forest Policy, Water Policy and Food and Nutrition Security Policy. Aklilu *et al.* (2002) recommended a

complete review of the situation and handing over most trade related activities to the private sector while maintaining the regulatory and supervisory roles of governments.

Pica-Ciamara *et al.* (2011) found that there are several livestock related policies, programs and projects implemented in Africa, in the IGAD region and at country level, but the majority of interventions focus on increasing off-takes and assume that these interventions are the major, if not the only, ways to enhance the contribution of livestock to household livelihoods. This view was also taken by Holtzman and Kulibaba (1994). The authors recommended that it is not the number of livestock-livelihoods focused policies designed and implemented that matters, but that the dominant narratives in the policies appreciate and support poor producers' views that their livestock are not mere end products, but economic units producing continuous benefits for their subsistence. Thus there is need to analyse the roles of livestock in the herds and in the market in pastoralist livelihoods.

2.6 Internal and cross-border livestock trade in Kenya and the Horn of Africa

Aklilu *et al.* (2002) gave the reasons for cross-border livestock trade as the excess number of livestock in the source country over what its domestic markets can absorb and/or proximity to the cross-border rather than to the domestic markets and not as wrongly perceived to be as a result of better price offers. However, Little (1996) had emphasized that the quick growth in the Kenya – Somalia cross-border livestock trade was mainly due to the collapse of the Somalia State and its domestic and export livestock marketing infrastructure. The same author in a later paper (Little, 2007) also argued that while market liberalization efforts of the 1980s and 1990s were supposed to re-direct informal cross-border trade into formal market channels, this did not happen, especially for livestock trade. This was due to significant price

differences and market opportunities between countries; inconsistent legal and policy environments; and continued poor infrastructure and security in border areas.

Thus, according to a report by the COMESA (2009), regional cross-border livestock trade is still a major and growing economic activity that contributes to local and regional food security, supply of meat to urban areas, government revenues and pastoralist poverty alleviation. Little (1996) also noted that livestock marketing patterns and incomes provide good indicators of the status of the pastoral sector and local food security. The COMESA report identified Garissa as the largest market in eastern Africa and a key outlet to the Kenya-Somalia cross-border livestock trade.

2.7 Niche marketing and livestock diversity

Livestock marketing can be used to promote almost all the objectives of pastoral development such as increase or stabilization of output and incomes or environmental conservation (Sandford, 1983). Niche marketing, especially, can provide opportunities for sustainable production in marginal areas to improve the livelihoods of livestock keepers and other value chain players and also help to conserve the livestock diversity (LPP, LIFE Network, IUCN-WISP and FAO, 2010).

A niche market is the subset of the mainstream market on which a specific product is focusing by using specific product features aimed at satisfying specific market needs such as price range, product quality or taste and customer demographics. Niche markets address consumer demand for product differentiation while enabling producers to take a more active role in price determination. In Kenya, although pastoralist areas have a harsh climate, they have substantial natural and economic potential, including comparative advantages in livestock and

livestock products which, if developed, could be the basis for alternative livelihood options for the local people (Muigai, 2011).

Ithondeka (2010) in his study on 'Global animal health standards and their effect on the livestock and meat exports in Kenya' noted that organically produced meat from Kenya has demand in the export market. He recommended that the country addresses the sanitary and competitiveness challenges and that there should be increased awareness creation of trade sensitive diseases, export geared husbandry and refocusing formulation and implementation of tailor made strategies at all levels of the livestock and meat value chain.

2.8 Livestock population dynamics in dry-lands

The population dynamics of livestock in dry-lands shows a pattern of 'booms and busts' due to the non-equilibrium nature of the environments and in most periods, population densities rarely reach a stable ecological carrying capacity (Scoones, 1996). According to Bailey *et al.* (1999) these sudden increases and severe declines, known as livestock cycles, are common throughout the world, but are more severe in developing countries because livestock systems rely more heavily on extensive grazing than on feedlot operations which are less closely tied to climatic and ecological shocks.

Bailey *et al.* (1999) also reported that during normal rainfall periods, when herds build up, Government interventions such as good animal health services and sometimes trade and movement bans due to disease quarantines can result in excessive local stocking rates and influence pastoralist supply of livestock to markets. However, animal health services provision has become a big problem in Kenya after the privatization of some Government

Services (Oruko *et al.*, 2000) and this is especially so in pastoralist areas due to the vastness of the areas, low population densities and general hardship conditions.

Behnke (2006) noted that the dynamics of large and small cattle herds in communal areas are different. Large cattle herds are managed on a commercial basis and small herds on a subsistence basis to meet family needs. Bailey *et al.* (1999) found that with the greater proportion of animals being female and only a few bulls, immatures and steers, pastoral herds in the region are structured to provide supplies of milk, reproduction of replacement stock and herd recovery following disasters, but added that annual herd off-take rates that exceed 8 or 9 percent can compromise these functions. The authors cited Little (1985) as having shown in a study in Baringo, Kenya, that typical herd structures included more than 60 percent female animals, 4 percent bulls, 10 percent immature bulls, 7 percent steers and the rest calves. Horowitz (1980) cited Brown (1977) as having calculated in a simulation, in East Africa, that the minimum herd size for subsistence of a family of eight consisted of 20 adult cows, 2 bulls, 7 female and 5 male calves under 1 year old, 4 female and 2 male calves 1-2years old and 3 female and 1 male immature.

Aklilu (2002) observed that the gradual integration into the cash economy and the recurrence of droughts at short intervals are increasingly pushing pastoralists to sell more animals than before. In the Kenya-Ethiopia border areas, Pavanello (2010a) reported that growing financial pressures and food insecurity during drought push pastoralists to sell their livestock regardless of productivity, age or sex, in order to purchase basic food items. Thus, Awuor (2007) recommended that monitoring the direction, extent and mix of livestock trade is an important element of early warning information on pastoralist food security.

2.9 Feedlots as an option for value addition of pastoralist livestock

Feedlots are described by Jahnke (1982) as one of the 'landless', intensive, livestock production systems in which the importance of land is significantly reduced and there is less dependence on the prevailing ecological conditions. The author noted that feedlots in Kenya were introduced in the late 1960s, but they are still rare in Tropical Africa. However, in recent years other countries in the region have made studies on feedlots and the factors affecting the profitability of the system (Norris *et al.* 2002; Malope *et al.* 2007; GebreMariam *et al.* 2010; Mlote *et al.* 2012; Maciel *et al.* 2013). These studies concluded that the system can add value to beef production in terms of animal finishing weight, stabilizing supply and reducing the range stocking pressure. The financial returns depend on the animal purchase and selling prices; the animal breed and starting age; the source, type and cost of feed; other fixed and variable costs such as financing, transport, veterinary costs, water, labour, housing; farmer skills; and the policy environment.

Maree and Casey (1993) observed that feedlotting can be done by individual or groups of farmers, communal grazers and also as an extension to ranching. The authors discussed the advantages of feedlotting as destocking of the animal origin areas, better control in market preparation of animals and a valuable escape in times of drought.

In the Forward to McPeak and Little (2006) Stephen Sandford summarizes the options to reduce the pressure on pastoralism in Eastern Africa' as 1) emigration to other livelihoods; 2) diversification of livelihoods; 3) increasing herd productivity by purchasing supplementary feed from non-pastoral areas and 4) increasing off-takes and sale of pastoralist livestock. Feedlotting achieves the third and fourth options.

Mahmoud (2006) observed the case of pastoralist traders purchasing and transporting animals from North-Eastern Kenya to Coast Province ranches for fattening as a value addition tactic and risk reducing mechanism in response to marketing constraints. Muigai (2011) also identified development of fattening feedlots as one of ten niche products and business opportunities for livestock value addition of pastoralist animals in the same value chain. Thus, feedlots are a possible option of improving the efficiency of opportunism and pastoral development as discussed by Sandford (1994).

2.10 The livestock value chain concept

The livestock value chain is defined by IFAD (2010) as the full range of activities required to bring a product (e.g. live animals, meat, milk, eggs, leather, fiber, manure) to final consumers passing through the different phases of production, processing and delivery. This holistic approach is essential to an understanding of markets, their relationships, the participation of different actors, and the critical constraints that limit the growth of livestock production and consequently the competitiveness of livestock owners.

A value chain is both an analytical and operational model since different descriptions, analyses and upgrading interventions can be done on individual stages, segments or the whole chain. Value chain analysis is an important tool that can be used to identify key constraints and opportunities in a livestock production system and the people and organizations that need to be involved for any interventions to succeed (FAO, 2012). Examples of stages in a livestock value chain are the producer level and the market.

Rich *et al.* (2009) underscored the importance of the value chain approach to livestock production and marketing chains because they are characterized by long distances, numerous

phases of weight gain/loss and feeding regimes, many levels of traders and transactions, many stages of processing and a variety of employment-creating services and inputs. Moreover, marketing patterns are driven more by income needs than by price movements. The authors indicated that value chain analyses are done by a combination of qualitative and quantitative methods including primary surveys, focus group discussions, participatory rapid appraisals, informal interviews and sourcing of secondary data.

2.11 Markets Structure, Conduct and Performance

The Structure-Conduct-Performance (S-C-P) Model is a theoretical framework developed by economists to understand the relationship among a firm's environment, behaviour and performance. The model is based on the hypothesis that markets structure influences conduct which in turn influences performance. The performance of livestock markets is determined by the behaviour of the traders, their business environment and the linkages in the value chain from producers, traders/intermediaries/transporters and processors to consumers. Thus, livestock marketing, like other businesses, also lends itself to analysis by the Structure, Conduct and Performance model.

The "Famine Early Warning Systems Network" project in Kenya (USAID FEWS NET, 2008) recommended deeper (S-C-P) analyses of food markets, other than the traditional focus on household access to markets, as a means of describing and analyzing market dynamics, providing early indicators of changing food security conditions and informing decisions on market interventions in normal or emergency times. The publication provides guidelines for collection of data on the elements of structure, conduct and performance of markets.

Other theoretical approaches to the study of markets and marketing include Transaction Cost Theory and the Commodity Chain Approach (Williams *et al.*, 2003). However, the authors noted that since such studies have been very dynamic and have witnessed many paradigm shifts, there is no single approach that is adequate on its own and there is need to adopt useful elements of different approaches.

Singh (2004) as cited by Shiimi *et al.* (2010) defined transaction costs to include costs associated with market exchange, including costs of searching for options, negotiating contracts and enforcing agreements. The authors distinguished these costs from physical marketing costs such as transport and storage. Williams *et al.* (2003) cited Leplaideur (1992) as having defined the commodity chain approach as one in which analyses are made at each stage along the value chain of the costs and margins; spatial flows (places, volumes and directions of commodity movements) and the social relations of trade (including key points of asset concentration).

2.12 Livestock commercialization and market price formation

Commercialization was defined by Negassa *et al.* (2011) as the degree to which households are connected to the market and that it can be represented as the proportion of households who participated in the market and the percentage of the output they sold. In common usage however, the term is taken to mean a higher degree of market connection than needed for purely subsistence purposes.

The main reason for selling livestock is to earn income to meet needs that cannot be met by direct livestock and products consumption or utilization such as other types of food, clothing, travelling, education and even capital for income diversification. Thus, Adugna (2006)

underscored the importance of livestock markets and price levels to pastoralists' livelihoods and welfare. The author noted that prices affect livestock keepers in their levels and also in their variation over time and citing Jabbar and Ayele (2003) further added that prices are an important measure of livestock market performance and efficiency and are an indicator and basis of incentives to producers and Government revenues.

Barret (2001) reported that low and unstable livestock prices are among the high ranking problems of pastoralists in the Greater Horn of Africa. Knowledge of factors determining formation of livestock prices is thus important in developing interventions to increase the trade share of pastoralists and also to motivate pastoralists to make production and marketing decisions such as quality of animals, herd composition, and when and to whom to sell (Adugna, 2006; Teklewold, 2009). The distribution of livestock among households, and the herd sizes and composition determine the role of livestock and the commercialization potential (Negassa *et al.*, 2011).

CHAPTER 3

3.0 GENERAL METHODOLOGY

3.1 Description of the study area

The study was undertaken in Garissa County, in northeastern Kenya, where pastoralism is the main livestock production system and means of livelihood. Garissa County lies between latitude 1 °N and 2 °S and longitude 39 °E and 41 °E and borders Somalia to the east, Wajir County to the north, Isiolo County to the north-west, Tana River County to the west and Lamu County to the south. The County lies at an elevation of 1,138 meters above sea level, the area topography is flat and the climate is semi-arid to arid (AEZ IV-VI). A map of Kenya showing the Arid and Semi-arid Districts is shown in Figure 3.1.

The annual rainfall ranges from 300 – 700 mm in two seasons, long rains in March – May and short rains in October – December often in isolated heavy downpours. Maximum daily temperatures range from 34 °C between June and August to 38 °C in February and March. The climate is thus hot and dry with high rates of evapo-transpiration, interspersed with occasional flooding in poorly drained areas.

Garissa has an area of 44,952 km² and a human population of 623,060 (KNBS, 2009). The inhabitants are pastoralists and agro-pastoralists keeping camels, cattle, sheep goats and donkeys and doing some crop farming along the river Tana. The County is the immediate catchment for Garissa livestock market which is the largest in East Africa and serves to supply livestock for both the local market and export.

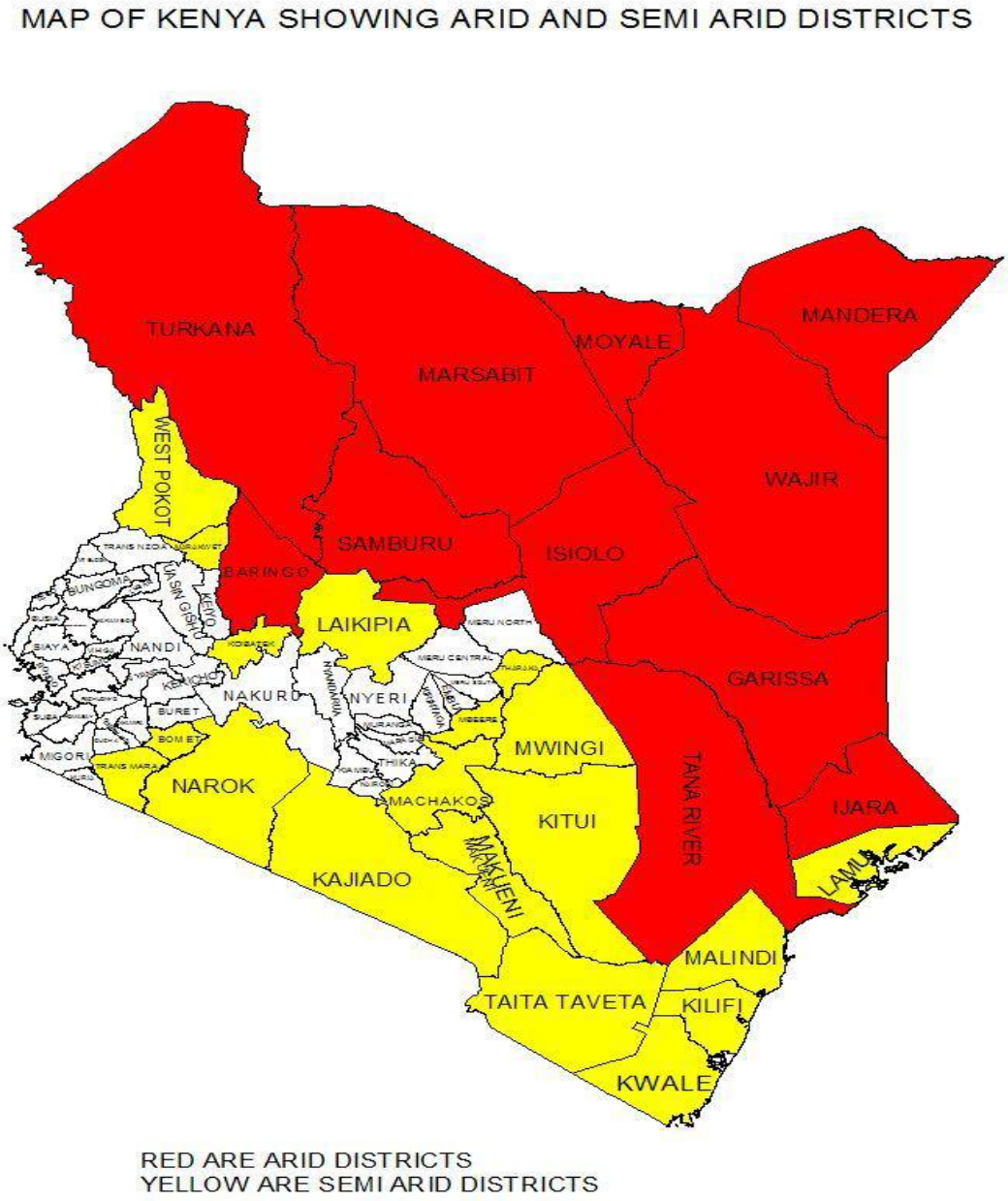

Figure 3.1: Map of Kenya showing Arid and Semi-arid Districts

Note: This map shows the country after the creation of more Districts in 2007 when Ijara was cut out of Garissa.

3.2 Data collection and analysis

One hundred and forty six (146) respondents were interviewed in a cross-sectional survey undertaken on households selected from the County using multi-stage cluster sampling technique with random sampling at each level. The calculated sample size was 138 from the formula by Pfeiffer (2010).

The formula:

$$n = Z^2 [p (1-p)/L^2]$$

Where: n = the sample size;

Z = 1.96, the Standard Normal Deviate at the desired Confidence interval, 95%;

p = 0.9 (90%), the assumed proportion (prevalence) of the households who own livestock and engage with the other segments of the value chain;

L = 0.05 (5%), the precision.

The calculation of the sample size is shown below.

Sample size $= 1.96^2 [0.9 (1 - 0.9)/0.05^2]$
$= 3.84 [0.9 (0.1/0.0025)]$
$= 3.84 [0.9 (40)]$
$= 3.84 [36]$
$= 138.24$

The method was applied with the objective of getting at least 144 completed questionnaires using eight enumerators. Three Districts were randomly selected from among five out of seven in the County in the first stage. Two Districts, Fafi and Dadaab were left out due to security reasons. Three Divisions were randomly selected, one from each of the three Districts, in the second stage and nine locations, three from each Division, in the third stage.

Sixteen households were then selected from each of the nine locations by roughly dividing it into imaginary quadrants. Eight enumerators interviewed two randomly selected households in each quadrant daily.

The nine locations selected were Dujis, Jarajara and Balambala in Balambala Division, Balambala District (48 households); Saka, Raya and Shimbir in Sankuri Division, Garissa District (51 households); and Hara, Masalani and Korisa in Masalani Division, Ijara District (47 households). The data was entered and analyzed in Microsoft Excel 2007 and Statistical Package for Social Sciences (SPSS) 18.

Where referred to in the results and discussions, 1 Tropical Livestock Unit (TLU) is taken to equal 1 Camel; Cattle equal 0.7 TLU and 1 Sheep or Goat equals 0.1 TLU (Jahnke, 1982). Figure 3.2 shows an illustration of the multi-stage cluster sampling while Figure 3.3 is a map of Kenya showing Garissa County and the study areas Balambala, Sankuri and Masalani Divisions.

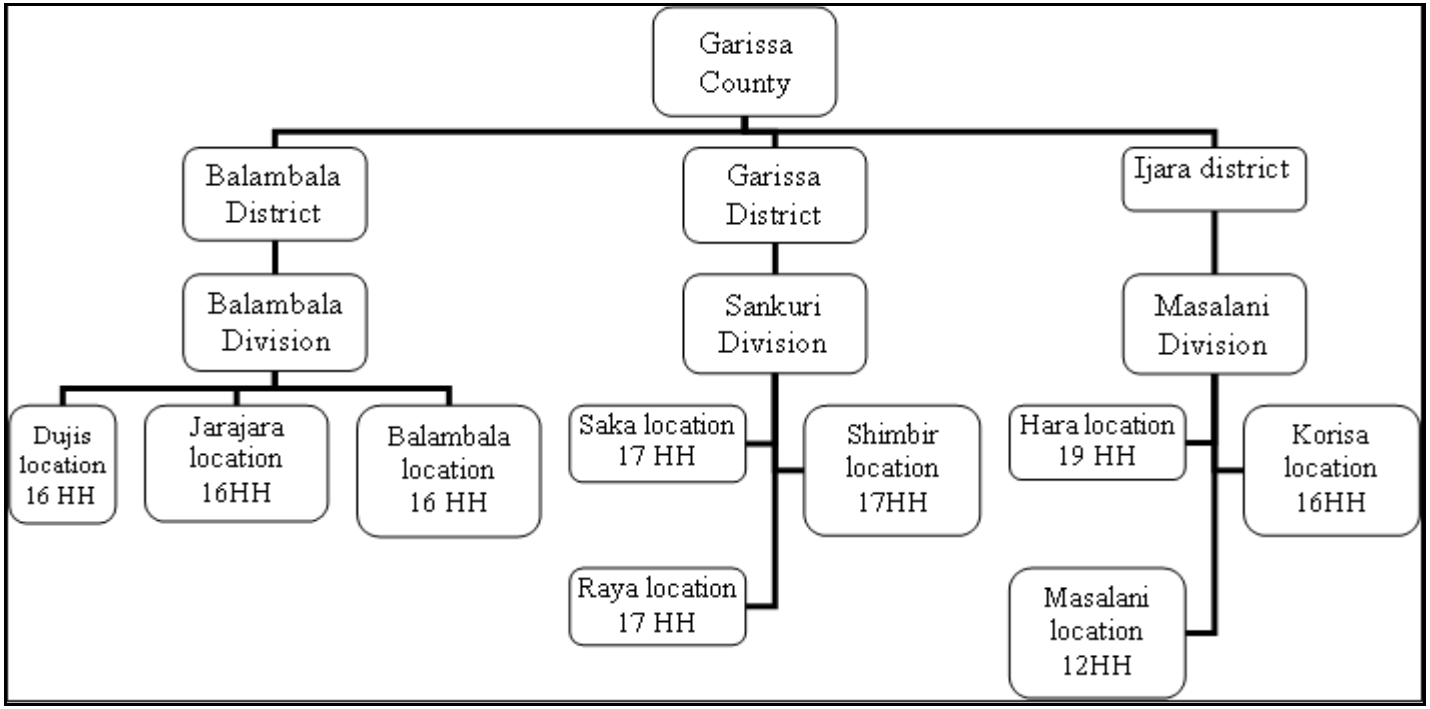

Figure 3.2: Illustration of the multi-stage cluster sampling used during the study (HH = Households)

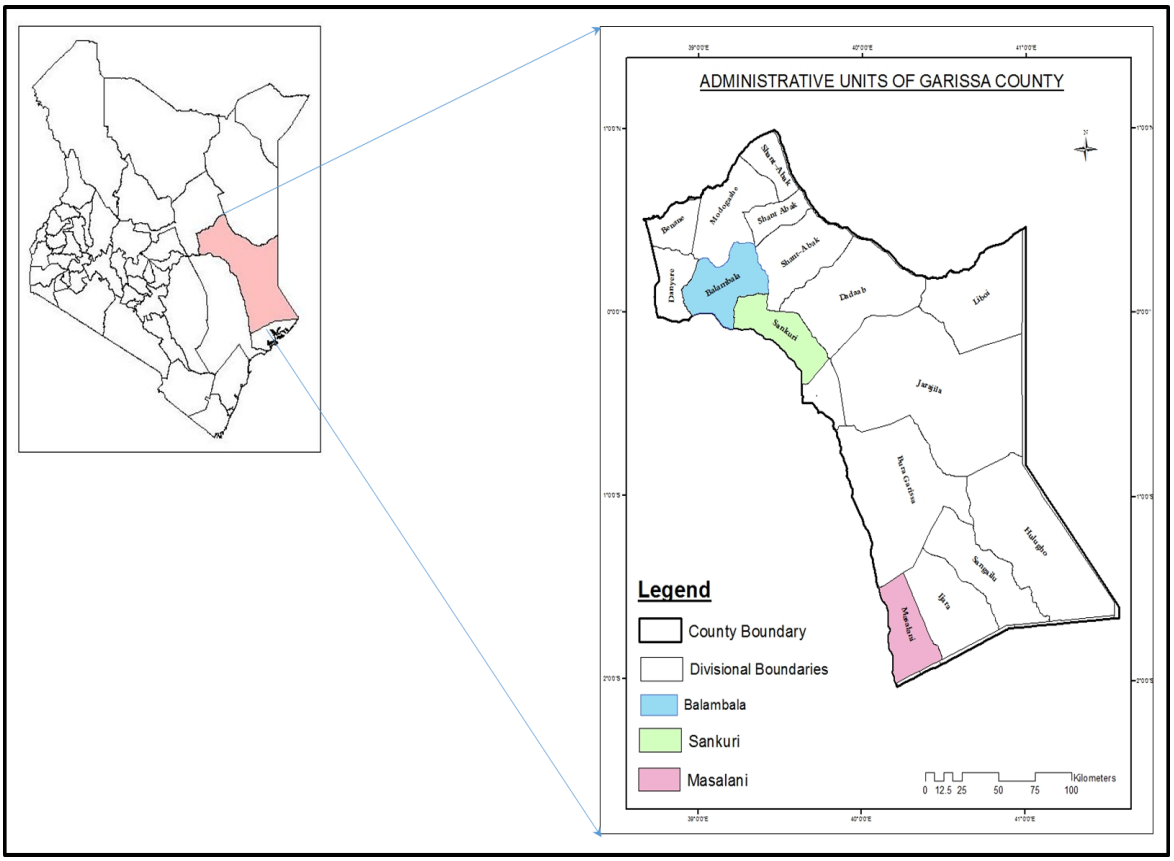

Figure 3.3: Map of Kenya showing location of Garissa County and the study areas

3.3 Study assumptions

The study was done with the following assumptions.

1. That the study area was homogenous for the attributes under study.

2. That the study period was average and did not affect the attributes under study in any extraordinary manner.

3. That the respondents' answers and recall of events of the preceding 12 months was an adequate and truthful record.

5. That the traders and other players in the livestock market who were willing to be interviewed were representative of the others.

CHAPTER 4

4.0 PASTORALIST LIVELIHOODS, RESOURCES AND STRATEGIES IN GARISSA COUNTY, KENYA

Abstract

In the arid and semi-arid areas of northeastern Kenya, increasing risks and market and subsistence demands influence households' characteristics and how they interact with resources at their disposal to meet livelihood objectives. This study was conducted to analyze current pastoralist socio-demographics, production objectives and livelihoods status and strategies. It was done in Garissa County using a cross-sectional survey of 146 households. Subsistence was the livestock production objective for 96% of household heads and livestock were the main source of income for 93% of households. There was low level of education and family members provided 57% of the grazing labour. Most households were sedentary and 69% of respondents moved only their livestock at times of resource scarcity. The mobile phone accounted for 23% of the methods used to get reports on livestock grazed far from homesteads. Goats were the most sold species at 46% and also accounted for 49% of the milking animals. Households last sold their livestock a mean of 72 days before the interview date. Constraints cited arose from droughts, movement, diseases and marketing. Most households combined traditional coping strategies and relief aid. Interventions should be undertaken to increase productivity and support diversification, commercialization and marketing. At the same time households need to balance between livestock labour and education of their children/dependants to ensure current outcomes and future livelihoods viability.

4.1 Introduction

Pastoralism in Kenya is threatened by several factors including over-exploitation of resources and assets, climate variability, increasing human population and land fragmentation (Bailey *et al.*, 1999). Aklilu *et al.* (2002) observed that the gradual integration into the cash economy and the recurrence of droughts at short intervals are increasingly pushing pastoralists to sell more animals than before. In the Kenya-Ethiopia border areas, growing financial pressures and food insecurity during drought pushed pastoralists to sell their livestock regardless of productivity, age or sex (Pavanello, 2010).

Drought has been the most frequent disaster in the arid and semi-arid areas of Kenya. In the 2008-2011 drought, livestock the most affected sector, sustained negative effects of approximately KShs 699,336 million in damages and losses (GoK, 2012). The damages arose from direct deaths of animals caused by the drought and the losses were incurred from increased costs of veterinary care, feeds and water, as well as loss in production due to disease and death of animals. In 2011 livestock mortality in Northern Kenya was estimated at 15% and about 0.2% of the Country GDP (The World Bank, 2011).

At the same time the relationships between people, their livelihoods, herd stability and trade are complex and not properly understood. The aim of this study was therefore to evaluate how households manipulated their resources and assets and were in turn affected by them in fulfilling their livelihood objectives. This was done by analysis of their demographics, production objectives and strategies. This larger picture needs to be created and communicated to relevant stakeholders for meaningful and adoptable interventions.

4.2 Materials and methods

The study area and data collection are described in Chapter 3. The respondents were asked questions on their household composition and personal details; their objectives and future plans; herd management and labour; production and marketing constraints; access to services, resources and market information; and livelihood strategies and tactics including marketing. The questionnaire is attached in appendix 1.

The data was entered into Microsoft Excel 2007 and Statistical Package for Social Sciences (SPSS) 18 and analyzed for descriptive statistics. Chi-square ($\chi 2$) test was used to test the null hypothesis of there being no difference among the proportions of the household, livestock and resource variables. Multiple correlations and cross-tabulations were done to analyze the relationships among various attributes of household characteristics, their livestock inventory and market interaction.

4.3 Results and discussions

4.3.1 Description of household heads

Table 4.1 below shows demographic and socio-economic characteristics of pastoralist household heads, their objectives and future plans. The main occupational source of income and production objective was subsistence livestock. Other mentioned sources of income and future plans represent opportunities for diversification. Almost all respondents had never taken a bank loan for any interventions on their livestock. This was mainly because keeping livestock in ASAL areas is risky and households might have lacked collateral or ability to pay such loans. The other reasons could be the mainly subsistence livelihoods so that households have no extra-subsistence or investment needs requiring a loan and also religious reasons as it is prohibited for Muslims to pay interest on loans.

Table 4.1: Demographic and socio-economic characteristics of pastoralist household heads in Garissa County, Kenya (n =146)

Description	Frequency	Percentage	*[1] Chi-square (χ^2) (P < 0.001)
Household heads' gender:			
Male	138	94.5	115.8
Female	8	5.5	
Household heads' education:			
None	114	78.1	
*[2] Some/all primary	23	15.8	411.1
Some/all secondary	5	3.4	
Some/all tertiary	2	1.4	
Some/all University	1	0.7	
Household heads' main source of income:			
Livestock	136	93.2	361.7
Formal employment	4	2.7	
Crop farming	3	2.1	
Self employment	3	2.1	
Household heads' production objective:			
Subsistence livestock production	139	95.9	255.3
Commercial livestock production	5	3.4	
Household heads' future plans:			
Continue with livestock production	70	47.9	
Increase herd size	25	17.1	
Mix livestock with business	24	16.4	
Mix livestock with crops	10	6.8	
*[2] 7 others combined	12	8.3	368.0
History of taking a loan for purposes of undertaking any interventions on their livestock:			
No	142	97.3	268.5
Yes	3	2.1	

*[1] Chi-square P < 0.001 means that there are significant differences between the variables in the groups. The size of the coefficients indicates the size of the differences. The larger the coefficient the larger the difference and variety between the values in each group.

*[2] The education level is indicated as some or all to include all those who had done part or all of that level.

*[3] Increase herd size and business; Modernize/commercialize their livestock management ; Reduce herd size; Mix livestock, crops and business; vary their livestock numbers according to the prevailing or forecast weather conditions; Reduce livestock numbers and start crop farming; Sell all livestock and turn to business – combined because of their small proportions individually.

4.3.2 Description of household characteristics

Household characteristics describe livelihoods in numerical and descriptive terms. Livelihoods as defined by Chambers and Conway (1991) comprise of people, their capabilities and their means of living, including food, income and assets. Table 4.2 shows the demographic characteristics of pastoralist households in the study area. The ownership of livestock by household heads of a wide range of age showed the ability of households to pass on traditional skills and knowledge between generations and therefore preserve the capability to pursue their main source of livelihood, livestock. However, most household members were young people and lack of or inadequate education will deny them choices and opportunities for other careers and livelihoods. Chambers and Conway (1991) observed that education confers livelihood choices and that adaptable capabilities to exploit new opportunities will become more important in a future of accelerating change.

The households' livestock ownership was 5.1 TLU, 0.9 (number) camels, 4.0 cattle, 3.4 sheep and 9.9 goats per capita. Brown (1977) as cited by Horowitz (1980) had calculated in a simulation, for East African pastoralists, that the minimum herd size for subsistence of a family of eight consisted of 20 adult cows, 2 bulls, 7 female and 5 male calves under 1 year old, 4 female and 2 male calves 1-2 years old and 3 female and 1 male immature. The authors considered a pastoralist diet of milk, meat and blood. However, tastes and basic subsistence needs change over time and will vary from household to household according to their level of income. Hence, the numbers needed by each household today will be much higher. It is necessary therefore for households to ensure their current needs while investing in securing their future and their children's.

Table 4.2: Demographic characteristics of pastoralist households in Garissa County, Kenya (n =146)

Characteristic		Mean		Minimum	Maximum	SD
Household head age (years)		48.4		20	88	15.6
Household size (number of persons)		7.5		1	19	3.3
Number of other dependants (excluding the spouses)	Male	3.1	(57.9%)	0	11	2.1
	Female	2.3	(42.1%)	0	9	1.8
No. of dependants' aged (years)	0 - 12	3.4	(63.1%)	0	10	2.3
	13 – 19	1.2	(22.2%)	0	8	1.4
	20 and above	0.8	(14.7%)	0	9	1.5
Dependants' education	None	2.8	(52.8%)	0	14	2.4
	*[1] Some/all primary	2.2	(40.3%)	0	9	1.9
	Some/all secondary	0.3	(5.9%)	0	3	0.7
	Some/all tertiary	0.02	(0.4%)	0	2	0.2
	Some/all university	0.03	(0.6%)	0	2	0.2
Formal/Self Employed dependants		0.12	(2.2%)	0	2	0.4
Count of household livestock: Number, (% of total number), [TLU]						
Camels		7.1 (5.2%) [7.1]		0 [0]	93 [93]	14.3
Cattle		30.1 (22.0%) [21.1]		0 [0]	503 [352]	66.4
Sheep		25.2 (18.5%) [2.5]		0 [0]	464 [46.4]	51.2
Goats		74.3 (54.4%) [7.4]		0 [0]	468 [46.8]	84.3
Total Count		136.7 (100), [38.1]		0 [0]	1,528 [538.2]	

TLU = Tropical Livestock Units where 1 Camel = 1 TLU, Cattle = 0.7 TLU, 1 Sheep or Goat = 0.1 TLU, Jahnke (1982)

SD = Standard Deviation, the average of the deviations of the observations from the means. The size of the values shows the spread of the measurements and indicates the gap between the minimum and maximum.

*[1] The education level is indicated as some or all to include all those who are ongoing or had done part or all of that level.

4.3.3 Herd Management

Herd management describes how livestock are maintained, utilized and enhanced for continued reproduction and productivity. Table 4.3 shows some attributes of herd management in the study area.

The practice of sourcing breeding stock from the same herds points to the possibility of inbreeding and loss of heterogeneity and hybrid vigour that would be gained from outsourcing. Separation of herds and the bigger proportion of separate compared to mixed herds agreed with known pastoralist coping strategies to minimize risk (Rota and Sperandini, 2009). This allows the owners to better manage the species separately as each has different feeding habits and needs and therefore would do better in different ecological habitats. Some of the separate herds were milking animals for the family and goats were the main milking species. The choice of goats as the main milking animals can be explained by the fact that they have shorter gestation periods and are therefore in milk more often. However, mixing with the other species ensures that the family does not lack milk at all times.

A greater proportion of grazing labour was sourced from the family (cumulative 56.6%) and thus most respondents had no problems in getting labour. Those that had labour problems cited reasons such as high cost of salaries; unavailability of youth; absconding and dishonesty in workers. Youths were said to be unavailable because most had gone to school or would rather work in farms or other jobs and preferred to stay in towns. The participation of women and children to graze animals may appear to outsiders to be gender or child abuse. It was in fact a strategy to build human capital (skills and traditional knowledge) and also an opportunity for gender empowerment, giving livelihood contributing roles and product rights to all family members (Rota *et al.* 2010).

Table 4.3: Livestock management attributes of pastoralist households in Garissa County, Kenya (n =146)

Attribute description	Frequency	Percent	Chi-square (χ^2) (P < 0.001)
Source of breeding stock:			
Own herds	99	67.8	
Mixed own, neighbours and market	34	23.3	232.8
Neighbours	10	6.8	
Market	1	0.7	
Herd separation:			
Separate herds	85	58.2	
One herd	60	41.1	76.5
Herd (group) composition:			
Separate species	109	74.7	123.4
Mixed species	35	24.0	
Ownership of separate milking herd:			
Yes	76	52.1	70.5
No	69	47.3	
Species of milking herd:			
Goats	72	49.3	
Mixed goats, cattle and camels	40	27.4	147.5
Cattle	13	8.9	
Camels	6	4.1	
Herding labour constraints:			
No	78	53.4	71.3
Yes	67	45.9	
Type of herdsperson:			
Family boys	56	38.4	
Hired labour	38	26.0	
Mixed herdspersons	26	17.8	120.1
Family men	15	10.3	
Family girls	8	5.5	
Family women	2	1.4	

Chi-square P < 0.001 means that there are differences between the variables in the groups. The size of the coefficients indicates the size of the differences. The larger the coefficient the larger the difference and variety between the values in each group.

4.3.4 Resources, constraints, livelihood strategies and marketing

Resources are the physical factors and services that are the basis for generating the products that people need in their livelihoods (Otte and Chilonda, 2001). Resources, stores, claims and access are examples of assets and means of living that combine with peoples' capabilities to define their livelihoods (Chambers and Conway, 1991). Constraints are the opposing forces to the enjoyment of livelihoods. Livelihood strategies are defined by DFID (1999) as the range and combination of activities and choices that people make in order to achieve their livelihood objectives. Table 4.4 (a) shows the frequencies of some of the resource, constraint and strategy variables of pastoralist households in the study area.

The greater proportion of respondents (76.7%) received animal health services from mixed sources. This mixing seems to be a coping strategy to the erratic nature of official animal health services and only 12.3% of the respondents rated the services as poor. This is probably due to the many NGOs operating in the area and assisting the Government in animal health and production. The use of mixed strategies to cope with drought by most (84.9%) of respondents is a good sign as there is less chance of failure of any one strategy. However, the small proportion (3.4%) of respondents who migrated to seek pasture and water elsewhere may be an indication of the erosion of traditional coping strategies and a strong pointer to sedentarization.

Different households gave different ratings of the year 2012 in terms of weather and livestock conditions compared to the last five years, but the figures gave a cumulative percentage of 82.9% to the brighter outlook side.

Table 4.4 (a): Frequencies of some resource, constraint and strategy variables of pastoralist households in Garissa County, Kenya (n =146)

Attribute description	Frequency	Percent	Chi-square (χ^2) (P < 0.001)
Source of animal health services:			
Mixed sources (various combinations of below methods)	112	76.7	298.7
Self using modern drugs bought from agro-vets	16	11.0	
Government and NGOs	13	8.9	
Self using traditional medicines	4	2.7	
Rating of animal health services:			
Poor	18	12.3	
Fair	53	36.3	76.9
Good	56	38.4	
Very good	15	10.3	
Coping strategies in last drought:			
Mix of two or more of all strategies	124	84.9	
Relief food	12	8.2	
Migration	5	3.4	493.3
Government/NGOs livestock off-takes (away)	1	0.7	
Government/NGOs off-takes (local slaughter)	1	0.7	
Comparison of year 2012 with last 5 years:			
Average	11	7.5	
Slightly better	57	39.0	
Much better	53	36.3	120.5
Slightly worse	15	10.3	
Much worse	9	6.2	
Proportions of livestock/family moved:			
Part of the herds	53	36.3	
All the herds	47	32.2	29.7
Whole family	10	6.8	

Note: Chi-square P < 0.001 means that there are differences between the variables in the groups. The size of the coefficients indicates the size of the differences. The larger the coefficient, the larger the difference and variety between the values in each group.

Most households moved only their livestock and left their families sedentary meaning that this study area practiced transhumance pastoralism rather than nomadic as was indicated by Rakotoarisoa *et al.* (2008). Table 4.4 (b) shows the means of some of the resource, constraint and strategy variables.

The fairly short distances to water shows possible enhancement of water supply with boreholes and water pans in most areas. Most settlements in this District were also near the river Tana. Migrations still occurred, showing that mobility is still an important strategy in pastoralism. However, it seems there was little need to move very far for dry season pasture probably because such reserves are becoming scarcer due to population pressure and climate change. The duration since last migration was less than one year, but most respondents had spent all their lifetimes in the same village. This gives better opportunities for provision of social services such as education and healthcare, but will have implications on land use and ecosystem dynamics.

Households kept their livestock away from their homesteads and did not see them every day. They however, relied on regular visits or other ways of getting reports of their animals to keep track of their status. Sheep and goats were kept nearer to the households, followed by camels while cattle were driven farthest. This was a reflection of the livestock species support for livelihoods and their nutrient resource requirements.

Table 4.4 (b): Means of some resource, constraint, strategy and marketing variables of pastoralist households in Garissa County, Kenya (n =146)

Attribute description		Mean	Minimum	Maximum	SD
Travel to water, pasture and migration destination	Water (km)	2.5	0	16	3.1
	Dry season Pasture (days)	2.6	0	30	3.9
	Migration destination (days)	3.4	0	30	5.6
Intermigration interval (years)	Herds	0.8	0	8	1.1
	Households	26.4	0	88	22.7
Frequency of Owner herd visits and/or feedback (days)	Cattle herd Visit	15.1	0	180	31.9
	Reports on cattle	4.3	0	60	11.1
	Camel herd visit	7.4	0	120	17.6
	Reports on camel	2.7	0	60	8.7
	Sheep and goats visit	6.9	0	60	13.7
	Reports on sheep and goats	2.9	0	60	8
Livestock losses in the last drought (numbers)	Camels	4.8	0	50	10.2
	Cattle	11.8	0	100	17.8
	Sheep	17.9	0	150	23.4
	Goats	39.3	0	300	55.1
Days since the last sale of livestock	All species	71.7	0	700	108.4
Daily milk production, consumption and sales (litres)	Production	3.4	0	20.00	3.6
	Consumption	2.4	0	9.00	1.7
	Sales	1	0	17	2.8

Respondents listed the risks they face as drought; livestock thefts; wildlife attacks; and conflicts in grazing areas. The listed constraints were long distances to pasture; shortage and contamination of water; diseases; ticks and other external parasites; unavailability and high cost of labour; migration; loss of animals; irregular animal health services and high cost of drugs; arrests and restriction to grazing in wildlife conservancies; and lack of market. The common diseases were Foot and Mouth Disease; Contagious Bovine Pleuropneumonia, Contagious Caprine Pleuropneumonia; Peste des Petits Ruminanti; Rift Valley Fever; Lumpy Skin Disease; Trypanosomosis; Anthrax; Blackquarter; Sheep and Goat Pox; Enterotoxoamia; Haemorrhagic Septicaemia; Mange; and Helminthosis.

The mean livestock losses per household in this study area amount to 40.5% of the camels, 28.2% of the cattle and 38.2% of the sheep/goats considering that the mean herd sizes this year were 7.05 camels, 30.08 cattle and 99.55 sheep/goats. Bailey *et al.* (1999) quoted off-take rates higher than 8 – 9% as likely to compromise the herd functions of milk supply, reproduction and recovery after disasters.

Pastoralists sell livestock to earn income to meet needs other than those met by direct consumption or utilization of livestock and products such as other types of food, clothing, travelling, education, health care and capital for income diversification and other investment. However, households will have different needs depending on their incomes and thus will sell their livestock as and when necessary. Out of 146 respondent households, 132 (90.4%) indicated recent interaction with the market and they had last sold their livestock a mean of more than two months before the interview date. This was the market participation level to satisfy their subsistence needs as indicated in their production objectives. It is worth noting that this figure equaled the proportion (prevalence, 90%) of households assumed, in the study

sample size calculation, to own livestock and engage with the other segments of the value chain.

The mean milk production per household per day was low but, because of their subsistence needs, families consumed more than they sold. Still, because of the low production, the average per capita consumption of animal products in the Horn of Africa is very low leading to under-nutrition especially in children (Knips, 2004). However, the value of milk sales in this region was second only to sales of live animals (Rakotoarisoa *et al.* 2008), but this may be a pointer only to the scarcity of alternatives rather than any form of magnitude. Table 4.4 (c) shows frequencies of some strategy and marketing variables of the households in the study area.

Among the methods of getting reports, owner visits were the most used, followed by mobile phones, herder visits and messenger. Various combinations of mobile phones and the other methods were also used. Mobile phone technology, therefore, presents an opportunity for ease of communication with pastoralists on such matters as market information, disease control and other extension.

The results on herd migration and residence duration in the same village show that mobility was an important strategy to track resources for most households. However, this was done for livestock herds only and families remained sedentary or came back to the same villages and rarely relocated.

Table 4.4 (c): Frequencies of some strategy and marketing variables of pastoralist households in Garissa County, Kenya (n =146)

Attribute description		Frequency	Percent
Methods used to get reports of livestock grazed far from homesteads	Owner visit to herd	43	29.5
	Mobile phone	34	23.3
	Herder visit to owner	18	12.3
	Messenger visit between owner and herd	3	2.1
	Combinations of mobile phone and other methods	42	28.8
	Combinations of other methods	5	3.4
Years since last herd migration	Moved this year (2012)	91	62.3
	Last moved 1 year ago	41	28.1
	Last moved 2 - 8 years ago	14	9.7
Years respondent has been in the same village	22 – 88 years	71	49.3
	10 – 20 years	30	20.6
	6 – 9 years	12	8.3
	This year – 5 years	33	22.7
Livestock price determining factors	Body condition	47	32.2
	Body condition and age	35	24.0
	Body condition, age and sex	37	25.3
	Combinations of body condition and other factors	23	15.9
Source of Market Information	Visit to market	43	29.9
	Neighbours	27	18.8
	Buyers	14	9.7
Livestock species sold in the last market interaction	Goats	71	46.4
	Various combinations of the species	59	38.7
	Cattle	15	9.8
	Camels	5	3.3
	Sheep	3	2.0

Among the declared livestock price determining factors, body condition alone scored highest; followed by body condition and age; body condition, age and sex; while the rest were various combinations of body condition with other factors. The other factors included market conditions, animal productivity, market distance, animal fertility, animal parity and season. Animal body condition, age, sex, productivity, fertility and parity and season of sale are factors which the pastoralists can manipulate to their advantage with proper management and market information. Most of the factors, though, were dependent on environmental conditions which as discussed by Bailey *et al.* (1999) play an important role in livestock marketing. These are therefore possible intervention areas for projects to assist in pastoral commercialization, response to market demand and niche marketing.

The sources of market price information included visiting the market, neighbours, buyers and own decision. Travel to markets must have been quite time consuming as the distances were long and visits were probably made with the sale animals already in tow. The long distances plus other constraints along the way and within the markets exposed producers to exit costs (costs of returning with the animals if they are not bought), weakening their bargaining position and giving market powers to buyers, a situation likely to cause reduced marketed volumes (Bailey *et al*., 1999).

Since 9.7% of respondents depended on buyers for market information even at the 'homestead gate', together with their weak position at the market level it meant that most producers were at the mercy of buyers from the beginning to the end of the supply chain. It appeared, therefore, that the 6.3% of the respondents who decided on their own price without outside information were better off. These findings emphasize the importance of pastoralists getting

market information before they leave for the market to enable decision making and guide marketing behaviour.

Goats were the most sold species followed by cattle, camels, sheep and then various combinations of the species. As seen in Table 4.2 goats came first in proportions of herd size, followed by cattle, then sheep and lastly camels. In Table 4.3 goats also formed the greater proportion of milking animals followed by a mixture of the three milking species, cattle then camels. These results indicate that goats were the main pillar of subsistence. Any restocking interventions after disasters should therefore prioritize this species. However, since goats are only a part of the herds, it would be more prudent to offer restocks of all species proportional to their herd fractions and mortality rates.

The constraints to marketing cited by respondents included high transport and labour costs; lack of markets and shortage of buyers; buyers taking animals on credit and defaulting on payment; insecurity, risk of theft and wildlife attacks along the way; lack of or inadequate forage and water along the way; lack of or unreliable market information; poor animal health and body condition; fluctuating and poor prices especially during drought; exploitation by middlemen; competition; high fees in the markets and lack of feed or cost of feeding during the market day. These are all potential intervention areas to enhance benefits accruing to pastoralists.

4.3.5 Relationships between principle components of pastoralist livelihoods

Livestock herds are both biological and socio-economic units and the animals therein are also individual entities (Konandreas and Anderson, 1982). Livestock, households and other components of the production system will therefore affect each other in a variety of ways

depending on the changes in the environment, household or owner socio-economic needs and animal physiological functions.

Tables 4.5 (a) and (b) show the relationships between household characteristics and livestock ownership. Most households (84%) had herd sizes in the lower category of 0-60 TLUs. Owners of large herds (120 and above TLUs) were the least at 6%. This skewed distribution of wealth is further discussed in chapter 4 and is in fact reflected in society in general. At 44.7%, 35.6% and 19.9% respectively, there were more young household heads who owned livestock than those in middle and old age. There were more mid-sized households who owned livestock than small and large households at 57%, 31% and 12% respectively. At 81%, 13.7% and 5.3% respectively there were more uneducated household heads who owned livestock than those educated up to primary and secondary schools. These relationships could be explained by the different opportunities to accumulate and utilize livestock and even to get other livelihood choices and reduce or drop out of pastoralism.

The many owners of small herds had fewer animals each, but collectively had more animals than owners of medium and large herds. This distribution has implications on trade in terms of lack of economies of scale for producers as the many individuals with small herds lose on the cost advantages of larger scale outputs. Such individuals sell frequently, in small amounts, bargain on their own and each time incur all the costs and risks alone.

Table 4.5 (a): Proportions (%) of households owning different herd sizes in Garissa County, Kenya (n=132)

Age of household head (years)	Household sizes (number of persons)	Education of household head	Percentages of households by herd size (TLUs) category			Totals (%)
			0 – 60	61 – 120	120 and above	
20 – 45	1 – 5	None	12	0.8	1.5	14.3
		Primary School	1.5			1.5
		Secondary and above	2.3			2.3
	6 – 10	None	15.2	0.8		16
		Primary School	5.3	0.8		6.1
		Secondary and above	3			3
	11 and above	None	1.5			1.5
46 – 60	1 – 5	None	6.8	3		9.8
	6 – 10	None	15.9	1.5		17.4
		Primary School	1.5		0.8	2.3
	11 and above	None	1.5	0.8	1.5	3.8
		Primary School	2.3			2.3
61 and above	1 – 5	None	2.3		0.8	3.1
	6 – 10	None	7.6	2.3	0.8	10.7
		Primary School	1.5			1.5
	11 and above	None	3.8		0.8	4.6
	Totals		84%	10%	6%	100%

Note: 14 respondents who had not indicated interaction with the market were subtracted from the original sample size of 146 to make a sub-sample of 132.

Table 4.5 (b): Average herd sizes per household in different categories of TLU in Garissa County, Kenya

HH Head Age Categories	Categories of HH Sizes	HH Head Education	Herd sizes (TLUs)		
			0 – 60	61 – 120	120 and above
20 – 45	1 – 5	None	17	76	176
		Primary School	40		
		Secondary and above	24		
	6 – 10	None	25	114	
		Primary School	13	90	
		Secondary and above	20		
	11 and above	None	13		
46 – 60	1 – 5	None	18	83	
	6 – 10	None	17	67	
		Primary School	1		223
	11 and above	None	13	69	286
		Primary School	28		
61 and above	1 – 5	None	21		148
	6 – 10	None	19	101	191
		Primary School	22		
	11 and above	None	19		202

This is in contrast to producer cooperatives which have the potential to improve marketing efficiency by reducing costs and enhancing bargaining power (ILRI, 1995). Buyers also incur greater cost and time to collect from many producers, but get the advantage of 'divide and rule' in terms of bargaining power.

Table 4.6 shows correlations among households, livestock inventory and market interaction. Market interaction or frequency of participation is indicated here by the proxy 'Days since last sale of livestock'. Less number of days since the last sale of livestock means more participation and therefore more negative correlation.

The correlations that were significant at $P< 0.05$ are shaded in light grey and include household head age with herd size (+), with number of sheep (+) and with number of goats (+); household head education with period since last sale of livestock (+); household size with number of goats (+); herd size with number of camels (+); number of camels with number of cattle (-); number of camels with number of goats (+); and number of camels with period since last sale of livestock (-).

The correlations that were significant at $P< 0.01$ are shaded in darker grey and include household head age with household head education (-) and household size (+); number of uneducated dependants with household size (+); herd size with number of cattle (+), number of sheep (+) and number of goats (+); number of cattle with number of sheep (+); and number of sheep with number of goats (+). Other correlations were not significant.

Table 4.6: Correlations among household characteristics, their livestock inventory and market interaction in Garissa County, Kenya (n =132)

	Household attributes									
Spearman's rho	HH head age	HH head education	Uneducated dependants	Household size	Herd size	Number of camels	Number of cattle	Number of Sheep	Number of goats	Days since last sale of livestock
HH head age	1.000	-.236**	.022	.354**	.186*	-.053	.014	.220*	.194*	-.162
HH head education		1.000	-.039	-.045	-.062	-.038	-.012	-.096	-.040	.195*
Uneducated dependants			1.000	.567**	.008	.030	-.097	.074	.086	.034
Household size				1.000	.112	.070	-.117	.072	.180*	-.084
Herd size					1.000	.202*	.509**	.647**	.786**	-.025
Number of camels						1.000	-.187*	.113	.214*	-.216*
Number of Cattle							1.000	.299**	.091	.123
Number of Sheep								1.000	.468**	-.127
Number of goats									1.000	-.038
Days since last sale of livestock										1.000

** (P< 0.01)

* (P< 0.05)

Household and Herd size in numbers; Household head age in years

Note: The sample size was reduced to those 132 who indicated interaction with the market

The significant positive correlations of household head age with household sizes and household head age with herd sizes indicated accumulation over time. The history of poor education standards in this area, also discussed by Rakotoarisoa *et al.* (2008), is evidenced by the significant negative correlation of household heads ages with their education.

Older household heads had more frequent market interaction possibly because of their bigger household and herd sizes. Higher educated household heads had less uneducated dependants; smaller household and herd sizes and less frequency of market interaction possibly due to more family and herd 'planning' and other sources of income. Larger households had more uneducated dependants and this relationship may be either causative or incidental. These larger households also had bigger herd sizes and more goats which was a good match of needs with assets. Larger households and bigger herd sizes also showed more frequent market interaction which reflected increased needs and ability. Herd size was more significantly correlated with cattle, sheep and goats than with camels confirming the smaller (5.2%) contribution of camels to herd size as seen in Table 4.2.

The number of camels was negatively correlated with that of cattle, but positively with sheep and goats. Mace and Houston (1989) observed that households have to make trade-offs between different livestock species characteristics and utilities when allocating resources between them. They presented a model of how household wealth should be divided between camels and small stock for long term viability in a camel and small stock pastoral system. The authors recommended that the optimal level at which households should invest in camels is when the herd size is just above the subsistence requirements. When the process is reversed and there is a large decrease in herd size, households would be better off exchanging camels

for small stock. Thus the species ratio depends on the size and requirements of the household and all its incomes including from the herd.

The findings in this current study indicate that in a system with camels, cattle and small stock, when goats increase in number, most households either up-grade to camels or cattle, but not both. The inter-species structure of herds can reflect management objectives, constraints and availability of resources such as browse, grass and water (ILCA, 1990).

4.4 Conclusions

The following conclusions were made from this study.

i. Households had the ability to preserve traditional knowledge and livelihood skills, but the high levels of illiteracy might affect future generations' livelihood options.
ii. The production system tended to sedentary with high dependence on assisted coping strategies.
iii. Goats were the main pillar of subsistence, but market interaction was low and traders were the main source of market information.

4.5 Recommendations

It was therefore recommended that households need to balance between livestock labour and education of their dependants to ensure current outcomes and future viability in livelihoods. The Government and Development partners also need to give more support to participatory interventions in livestock productivity and livelihoods diversification.

CHAPTER 5

5.0 LIVESTOCK HERD STRUCTURES, DYNAMICS AND REPRODUCTION IN GARISSA COUNTY, KENYA

Abstract

In Kenya's Northeastern Province, pastoralism is the main livestock production system and means of livelihood. This study sought to evaluate household livestock herd dynamics and reproduction. The study was conducted in Garissa County of Kenya using a cross-sectional households' survey. The data was analysed for descriptive statistics of household livestock status and dynamics and for herd reproductive characteristics and demographic parameters. The results showed that females of reproductive age formed over 50% of all livestock species. Livestock were not evenly distributed and 58% of respondents had no camels while 27%, 28% and 2% had no cattle, sheep and goats respectively. Cows calved first at four years and lived up to a maximum of 22 years, but the mean age of reproductive animals was 8 years. There were many (62%) cow pregnancies after the rains, abortions were rare and this offset the lower than ideal reproductive parameters. The study concluded that the livestock herds were resilient, structured to provide milk and able to reproduce reasonably well. Livestock were unevenly distributed and the 12 months dynamics ended in herd declines. It was recommended that the Government and development partners should undertake interventions to improve equity of livestock distribution such as risk financing and social protection; balance the herd dynamics in favor of entries by improvement of reproduction and reduction of mortalities; and support livelihoods diversification to reduce dependence on livestock.

5.1 Introduction

In Kenya's Northeastern province, pastoralism is the main means of livelihood and livestock trade consists of indigenous livestock of local and cross-border origin. However, there is worldwide concern on the conservation and utilization of these breeds which are also an important source of genetic diversity that can be used for disease resistance and for coping against climate change (FAO, 2007). Indigenous breeds are adapted to local often harsh environments, are less susceptible to diseases and can be conserved and used in breeding programs with other higher producing but more vulnerable breeds to produce high producing hardy crosses. Aklilu *et al.* (2002) and Pavanello (2010) reported that growing financial pressures, food insecurity and frequent droughts are increasingly pushing pastoralists to sell more animals than before and regardless of productivity, age or sex.

Galaty and Aronson (1980) cited the impact of external changes and altered constraints on traditional range practices, the effects of consumer preferences on herd structures and the significance of increased use of the market as some of the research priorities for the pastoralist livestock production system. Bailey *et al.* (1999) noted that variability in herd structures in the Horn of Africa has not been documented in the past and the factors responsible have not been elucidated though they are suspected to influence availability of market meat animals. The National Livestock Policy (GoK, 2008) documented that the country is currently not self-sufficient in beef and mutton and recommended that appropriate interventions be put in place to avoid deficits in livestock products. This study therefore, clarified the livestock herd dynamics and contributing factors.

5.2 Materials and methods

The study area and other data collection are described in Chapter 3. Data on the herd structures and changes was collected using the retrospective twelve months approach discussed by Lesnoff *et al.* (2010) which depends on the respondents' recall of events of the preceding 12 months. The respondents were asked questions on their livestock inventory, transactions and changes over the preceding 12 months and the lifetime and 12 months reproductive history of individual cows. The data sheets used are attached in Appendix 4 (a) and (b).

The data was entered into Microsoft Excel 2007 and Statistical Package for Social Sciences (SPSS) 18 and analyzed for descriptive statistics of the livestock inventory, herd structures and demographic parameters; distribution of the inventory among households; and herds entries and exits. Lorenz curves showing the equity of distribution of livestock were constructed as scatter plots from cumulative frequency data derived, as described in ILRI (1995), from frequency and percent of households holding different numbers of the livestock species.

Data for reproductive rates of cattle was collected from a sub-sample of 117 respondents, some of whom were different from the original ones, so long as they could recall reproductive histories of one or more of their cows. This group recalled histories of 421 cows which were considered reproductive because they had undergone at least one of the reproductive activities of birth whether live or still, abortion or was currently pregnant. The data was analysed for demographic parameters namely 'state variables', 'basic demographic rates', 'global or overall demographic indicators' and 'synthetic demographic rates'. The results are presented in charts and tables.

5.3 Results and discussions

5.3.1 Livestock inventory and herd structures

Livestock inventory is the number of livestock of different species, age and sex classes held by a producer at a given point in time while herd structure means the proportion in numbers of a single species formed by different age and sex classes (ILCA, 1990). Thus herd structure is a sub-set of livestock inventory. Households' livestock inventory and herd structure by species, age and sex categories for the study area are shown in Table 5.1.

The inter-species composition of different holdings is normally compared in terms of the relative total live weight (biomass, measured in units of tropical livestock units - TLU) of the different species, rather than in terms of their numbers, because relative biomass roughly parallels both relative output and relative pressure on feed supplies (Jahnke, 1982; ILCA, 1990). However, Table 5.1 is done in numbers as the interest of this discussion is in household means and proportions.

In proportions of total herd size goats came first (37.3%), followed by cattle (33.4%), sheep (17.8%), camels (10.5%) and lastly donkeys (1%). As seen in chapter 4, goats were the pillar of subsistence, first in herd size, in sales and in milk provision. Females formed the greater proportion of herds in all species.

Table 5.1: Households' livestock herd structures by species, age and sex in Garissa County, Kenya

	n	Min.	Max.	SD	Mean	% of total	% of categories
Adult Male Camels	42	1	22	4.5	4.5	20.2	Ratio of male to females
Adult Female Camels	55	1	50	12.8	11.7	52.5	1:3
Camel Male Calves	26	1	13	2.4	2.7	12.1	All calves 27.3% of
Camel Female Calves	34	1	16	3.1	3.4	15.2	camels
Total camels and % in herd					**22.3**	**10.5**	
Steers	5	1	6	2.0	2.8	3.9	Ratio of steers to other
Entire Males > 6 yrs	47	1	50	9.7	7.0	9.9	males 1:8;
Entire Males 3 - 6 yrs	51	1	30	7.5	7.5	10.6	Ratio of reproductive
Entire Males 1 - 3 yrs	49	1	70	13.2	8.2	11.5	males to reproductive
Cows > 6 yrs	83	1	180	31.3	16.5	23.2	females 1:2;
Cows 3 - 6 yrs	66	1	56	12.3	9.9	13.9	Reproductive females
Female Cattle 1 - 3 yrs	48	1	103	17	9.3	13.1	37.2% of cattle
Male Calves	47	1	46	7.3	4.5	6.3	All calves 13.8% of
Female Calves	46	1	69	10.4	5.3	7.5	cattle
Total Cattle and % in herd					**71**	**33.4**	
Ewes	102	1	236	34.9	21.2	55.9	All lambs 24.8% of
Rams	86	1	102	13.1	7.3	19.3	sheep; ratio of rams to
Lambs	95	1	126	15	9.4	24.8	ewes 1:3
Total Sheep and % in herd					**37.9**	**17.8**	
Does	137	1	350	60.0	50.1	63.1	
Bucks	125	1	128	20.3	13.7	17.3	All kids 19.6% of goats;
Kids	130	1	113	15.7	15.6	19.6	ratio of bucks to does 1:4
Total Goats and % in herd					**79.4**	**37.3**	
Donkeys and % in herd	**76**	**1**	**14**	**2.3**	**2.2**	**1**	
Total herd					**212.8**	**100%**	

Note: 'n' is the sub-sample size and differs between species and categories because such owning households are less than the sample size of 146. The numbers also reflect the frequency of ownership.

This bias, also discussed by Bailey *et al.* (1999) for other pastoral areas, ensures adequate provision of milk, an important source of food and income, and continued reproduction of replacement stock for rapid recovery after drought, disease or other disasters. The authors also observed that this orientation has important implications for strategies to increase market off-take rates.

The ratio of males to females was higher than would be expected for purposes of breeding alone. The age trend in male cattle (younger more in herd than older) also contrasted that in females where the older and therefore of proven performance formed the larger proportion. It may be that young males were the herd fraction that was accumulated at the risk minimization stage, to be sold later at the risk absorption stage, when efforts are made to sustain the most valuable animals while selling the less valuable (Rota and Sperandini, 2009).

The small steers to males ratio shows that castration is not a common practice in pastoral subsistence production. This is probably used as a breeding rather than a marketing tool since the greater number of entire males enhances the reproductive potential of the herd. The relatively high proportion of young stock in all species suggests a high birth rate or low pre-weaning mortality.

These results indicate that overall the herds were structured to provide for both immediate and future needs in terms of milk, sales and herd replacement as well as for rapid recovery after disasters.

5.3.2 Distribution of livestock among households in the study area

The role of livestock in livelihoods and the potential for commercialization is determined by household herd sizes and structures and distribution of ownership among households

(Negassa *et al.*, 2011). Herd sizes and structures are discussed in Section 5.3.1 above. This study also sought to determine the distribution of livestock species i.e. ownership patterns, among different geographical/administrative locations of the study area and among households.

The distribution of livestock in this study area is shown below in cross-tabulation, bar charts and Lorenz curves. A Lorenz curve is a graphical presentation to demonstrate the equity of distribution of a given variable such as income, asset ownership or wealth (ILCA, 1990; ILRI, 1995). The 45 degree line drawn from the zero intersection represents perfect equity where the percentage of each species held corresponds exactly to the percentage of households in the area e.g. 10% of the households hold 10% of the cattle and so on. This means that the more bowed the Lorenz curve is from the equity line, i.e. the bigger the area between the line and the curve, the more inequitable is the distribution. In case of complete inequality, with the largest holder holding all livestock, the Lorenz curve would run along the x-axis.

Table 5.2 shows the distribution of livestock species and herd sizes in the three study districts. The ownership of various categories of livestock was skewed as discussed in chapter 4, with most people being in the small herd category of 0-10, less in the category of up to 30 and very few medium and large herds. Thus, smallholders were predominant. It is worth noting that in camel ownership all the 47 respondents interviewed in Ijara District owned only 0 – 5 camels.

Table 5.2: Distribution of livestock species among three Districts of Garissa County, Kenya

Categories of species TLUs		Districts and proportions (%) of respondents with such categories of species TLUs			
		Balambala n = 48	**Garissa n = 51**	**Ijara n = 47**	**Grand Total n = 146**
Camels	0 – 5	23.3	15.1	32.2	70.5
	6 – 20	6.8	13.7	0	20.5
	21 – 40	0.7	4.1	0	4.8
	41 – 70	1.4	2.1	0	3.4
	>70	0.7	0	0	0.7
	Total	**32.9**	**35**	**32.2**	**100**
Cattle	0 – 10	28.8	28.8	6.2	63.7
	11 – 30	3.4	5.5	11.6	20.5
	31 – 50	0	0.7	4.1	4.8
	51 – 100	0	0	4.8	4.8
	101 – 300	0.7	0	4.8	5.5
	6 = >300	0	0	0.7	0.7
	Total	**32.9**	**34.9**	**32.2**	**100**
Sheep and goats	0 – 10	21.2	28.1	23.3	72.6
	11 – 30	8.9	6.2	5.5	20.5
	31 – 60	2.7	0.7	2.7	6.2
	4 = >60	0	0	0.7	0.7
	Total	**32.9**	**34.9**	**32.2**	**100**
Categories and averages of Total TLUs	0 – 10	5.0	6.0	3.9	5.2
	11 – 30	19.8	18.7	19.1	19.2
	31 – 50	41.5	38.4	38.4	39.2
	51 – 100	78.4	71.6	74.3	74.3
	101 – 300	175.4	115.0	163.6	161.5
	>300	0	0	445.3	445.3
	Total	**26.0**	**24.1**	**65.5**	**38.1**

TLU = Tropical Livestock Units where 1 Camel = 1 TLU, Cattle = 0.7 TLU, 1 Sheep or Goat = 0.1 TLU, Jahnke (1982).

Figures 5.1 – 5.2 show the distribution of livestock in households. Camels and cattle distributions are skewed to the left showing that most households owned fewer numbers of the two species. Their curves also show bigger bows and areas between the equality line and the curves meaning that camels and cattle were more unequally distributed than sheep and goats. Although sheep and goats had equal category numbers, their distributions were different with sheep approximating normal distribution and most households owning the bigger number of goats. It can also be seen that 58% of respondents had no camels at all while the percentage with no cattle, sheep and goats were 27%, 28% and only 2% respectively. At only 2% zero ownership and smallest Lorenz curve bow/area, goats appear to have been the equalizing asset among all livestock.

Mace and Houston (1989) observed that pastoralist herds are not wild populations or products of circumstance. Species ratios are thus determined by factors such as household short or long term subsistence needs (for sale, slaughter, milk and other uses); household wealth (from livestock and other income); species sensitivity to risk especially drought and mortalities; species differences in production, reproduction and growth rates; and different household expectations of claims (such as exchanges, dowry, donations etc). For example, respondents indicated that the level of tsetse fly infestation in Ijara District was too much for camels. However, probably as a compensatory mechanism, more respondents in Ijara owned the other species in the medium to large categories (31 and above) than in the other Districts meaning that there were more large holdings. Most respondents also owned cattle in the category of 11-30 rather than in the category of 0-10 as in other Districts. Thus, the average total TLUs was greater in Ijara than the other Districts.

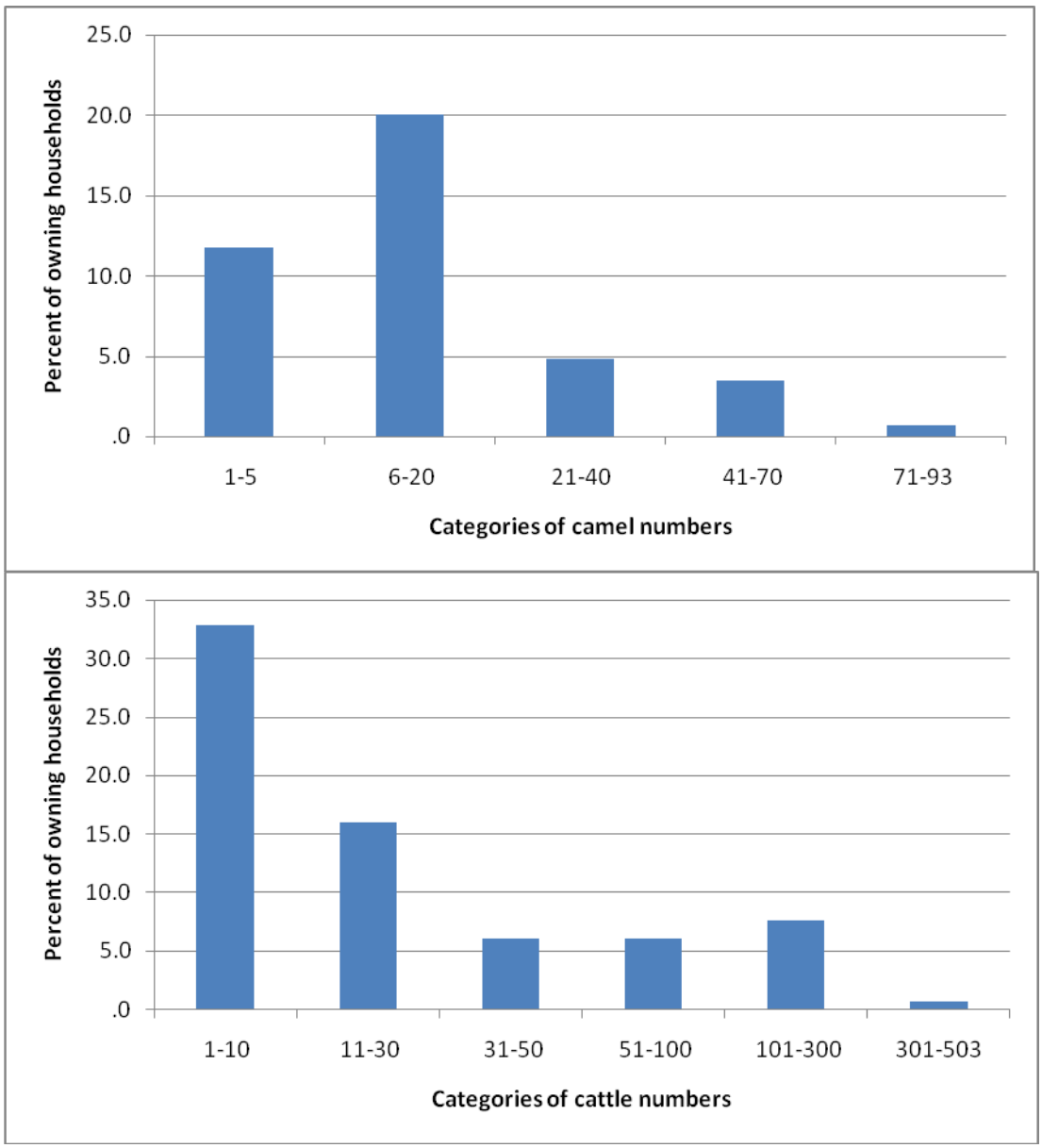

Figure 5.1(a): Distribution of camel and cattle herd sizes in Garissa County, Kenya

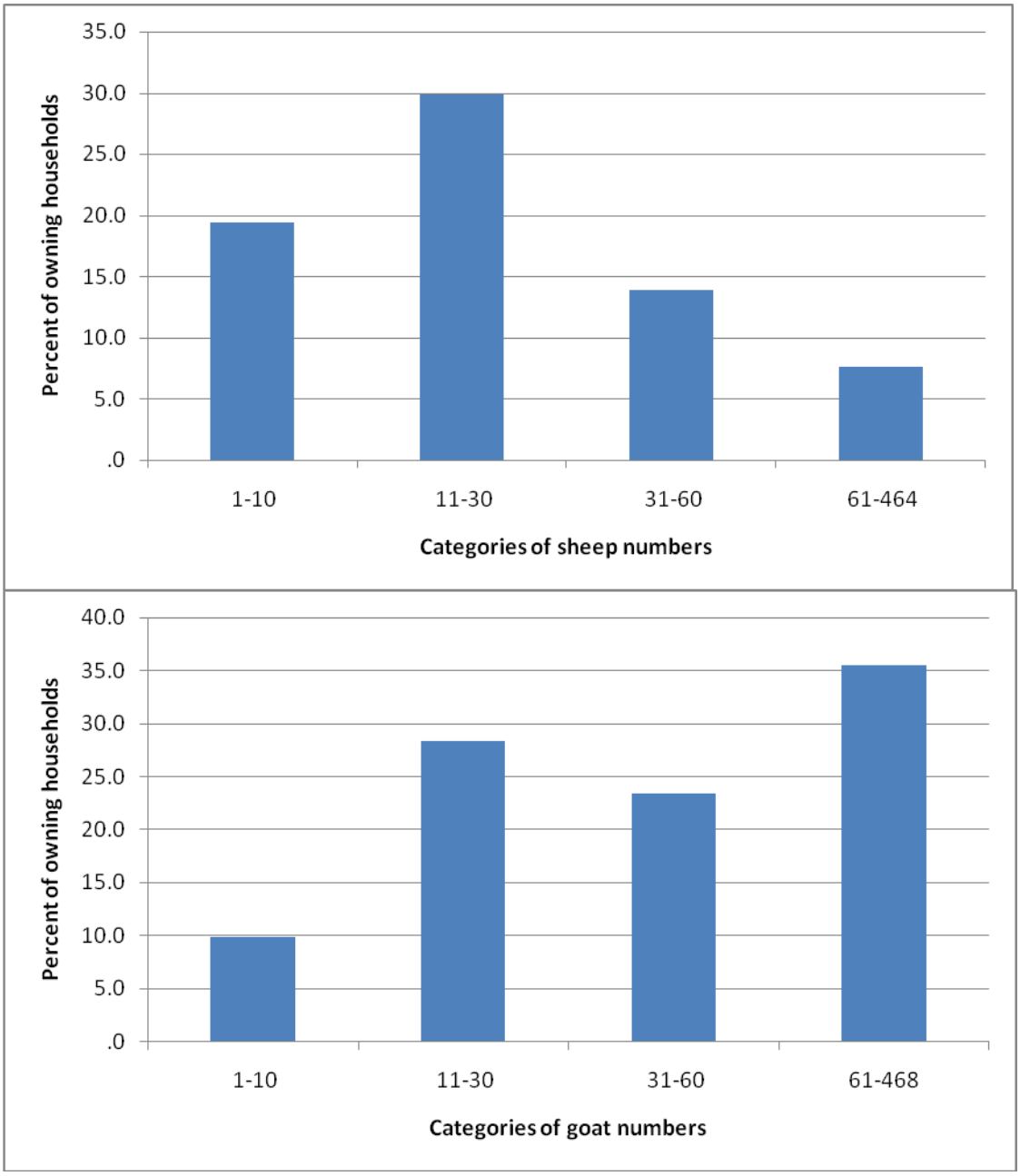

Figure 5.1(b): Distribution of sheep and goat herd sizes in Garissa County, Kenya

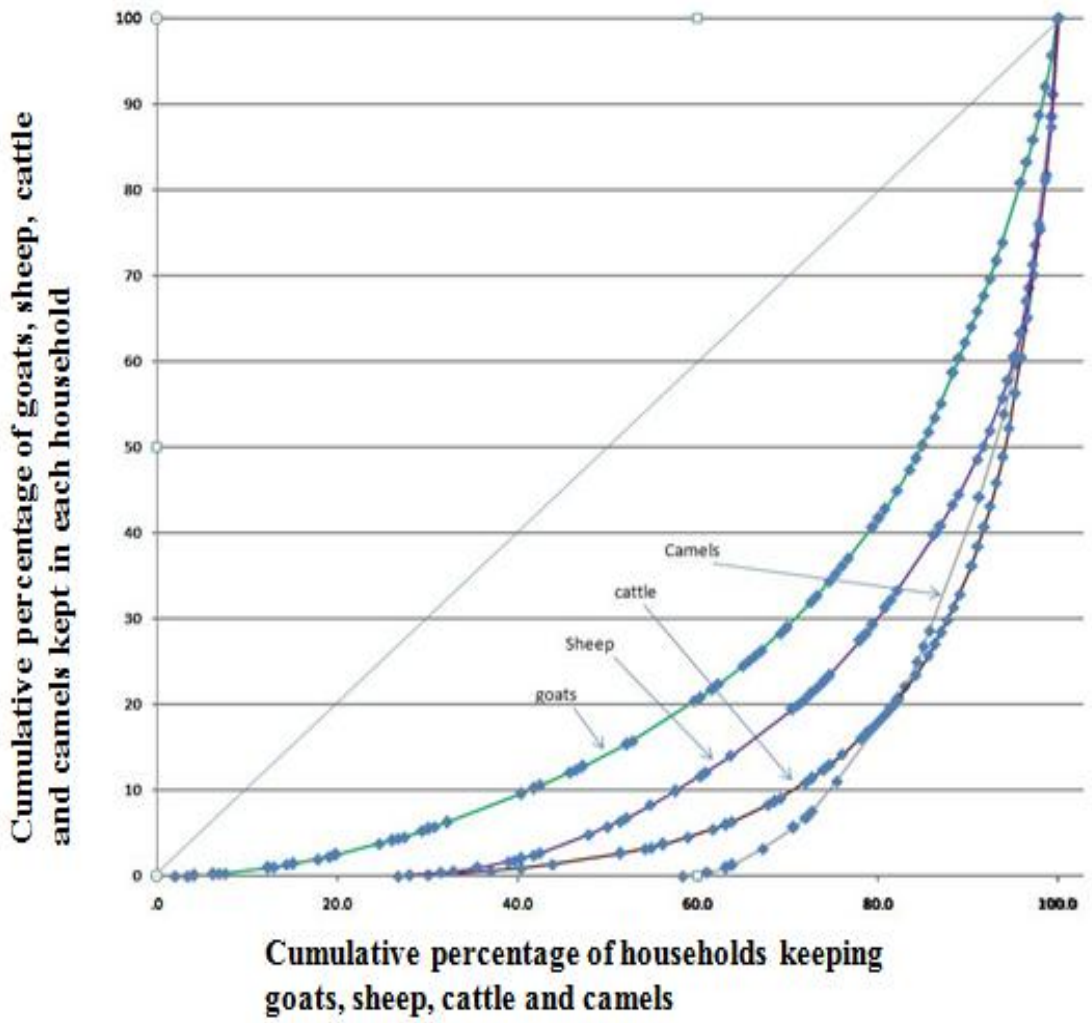

Figure 5.2: Lorenz curves of goat, sheep, cattle and camel holdings to households holding them in Garissa County, Kenya

5.3.3 Household livestock herd dynamics

Livestock herd dynamics are the changes in herd size due to the different inflows and outflows over time which indicates the stability of herd structures over that time (Negassa and Jabbar, 2007). Knowledge of livestock population dynamics is important to better understand functional attributes and development potential of pastoral production systems (Desta and Coppok, 2002). The reported herd dynamics in this study area are shown in Table 5.3.

Exits were more than entries in all species – an aggregate of 57.9% exits compared to 42.1% entries. Cattle had the highest turnover followed by goats, sheep, camels and then donkeys. In all species, sex and age categories, purchases accounted for the greater proportion of entries followed by births, then in-donations. However, in-donations came first in camel female adults and cattle females of 1-3 years age. Births came first in donkeys.

Mortalities accounted for the greater proportion of exits, followed by sales, out-donations, consumptions, and un-explained losses in that order. However, sales came first in camel male adults, cattle male >6 years age, cattle male calves, bucks and donkeys. In all the entry and exit events combined, purchases came first, followed by deaths, sales, births, out-donations, in-donations, consumption and lastly unexplained losses. This means that any interventions to improve births will reduce purchases for herd building and free money for other uses. Similarly sales can be increased by reducing mortalities.

Both entries and exits were higher for males than females in cattle and goats and the reverse for camels and sheep. Entries of cattle males were higher for 1-3 years age (purchases) followed by 3-6 years age (purchases), calf births then >6 years old (purchases).

Table 5.3: Mean annual number of household livestock entries and exits by species, sex and age in Garissa County, Kenya

			Entries				Exits						
Species	**Sex**	**Age**	Born	Bought	Gifted in	**Total**	Sold	Gifted out	Home consumption	Died	Lost	**Total**	End balance
Camels	**Males**	**Adults**		1	1	**2**	2.5	1	1	1.7	0	**6.2**	- 4.2
		Calves	1.8	0	0	**1.8**	1.8	1	1.3	2	0	**6.1**	- 4.3
	Females	**Adults**		2	3.7	**5.7**	1.9	1.3	1	3.2	1.5	**8.9**	- 3.2
		Calves	2.3	3	0	**5.3**	1	1.5	0	2.3	0	**4.8**	**0.5**
Cattle	**Steers**			0	0	**0**	1.7	0	0	0	0	**1.7**	- 1.7
	Males	**≥ 6yrs**		2.6	1	**3.6**	2.8	1.8	1	2.1	1	**8.7**	- 5.1
		3-6yrs		6.7	1	**7.7**	2.4	1.5	1.5	2.4	0	**7.8**	- 0.1
		1-3yrs		13.5	1	**14.5**	1.7	1.8	1	2.4	1	**7.9**	**6.6**
		Calves	4.4	0	0	**4.4**	6	0	0	1.9	0	**7.9**	- 3.5
	Females	**≥ 6yrs**		2	1.6	**3.6**	1.6	3.3	1	5.1	0	**11**	-7.4
		3-6yrs		10.6	1	**11.6**	2.6	1.5	0	3.7	1	**8.8**	**2.8**
		1-3yrs		0	1.3	**1.3**	1.4	1.5	0	2.8	0	**5.7**	- 4.4
		Calves	4.9	3	0	**7.9**	0	0	0	1.6	0	**1.6**	**6.3**
Sheep		**Rams**		3.2	1.7	**4.9**	4.1	1.4	2.2	4.1	1	**12.8**	- 7.9
		Ewes		3.7	3	**6.7**	3.4	1.9	1.8	4.3	3.3	**14.7**	- 8
		Lambs	7.1	1	0	**8.1**	0	1	1.5	4.3	0	**6.8**	1.3
Goats		**Bucks**		8.4	2.3	**10.7**	6.3	1.9	2.8	5.5	3.8	**20.3**	- 9.6
		Does		7.6	3	**10.6**	3.8	2.8	2.5	5.2	3.5	**17.8**	- 7.2
		Kids	10.1	0	0	**10.1**	1.3	2	1.8	4.2	0	**9.3**	**0.8**
Donkeys			2	1.4	1.9	**5.3**	1.8	0	N/A	1.4	1	**4.2**	**1.1**

Entries of cattle females were higher for 3-6 years age (purchases), followed by calf births, >6 years age (purchases), then 1-3 years age (donations). Exits of cattle males were higher for >6 years age (sales) followed by 1-3 years age (deaths), calves (sales) and then 3-6 years age (sales and deaths). Exits of cattle females were higher for >6 years age (deaths) followed by 3-6 years age (deaths), 1-3 years age (deaths), then calf deaths.

It is difficult to determine definite trends and rationale in the dynamics, but one can discern efforts at culling, restocking, retention of valuable categories of animals, natural events and sometimes action that seems irrational. For example, higher sales of >6 years old cattle males suggests culling; higher purchases of 1-3 years old males indicates accumulation for later selling as seen in section 4.3.1 above; higher purchases of 3-6 years old cows and lower sales of 3-6 years old cattle males indicates herd re-building with females at a prime age for reproduction and retention of bulls at a prime age for breeding. Higher exits of female cattle of all age categories due to deaths are natural events in the form of drought, diseases or other calamity. However, higher entries for males than females in cattle and goats would seem irrational in a system of subsistence livelihoods depending on cow and goat milk as an important food and cash source. The same goes for sales which are distributed among all age groups of all species including animals at their prime and valuable categories such as cattle females of 3-6years age and calves and kids. Such findings prompted Pavanello (2010) to report that, due to livelihood pressures, pastoralists were selling more animals than before and regardless of productivity, age or sex.

All the end balances were negative except for camel female calves, cattle males of 1-3 years age, cattle females of 3-6 years age, cattle female calves, lambs, kids and donkeys. This is because births were higher than exits for the young and as seen above 1-3 years old males and

3-6 years old cows had higher purchases due to accumulation for later selling and for restocking respectively. The negative end balances resulted from the net exits being larger than the net entries.

5.3.4 Livestock demographic parameters

Livestock demographic parameters are important indicators of herd performance which is driven by the biological characteristics of the animals and the owners' herd management practices (Lesnoff *et al*., 2011). Thus, demographic parameters can be defined as the state and rates of change of a population caused by natural animal events or related to the owners' decisions and management. Lesnoff *et al*. (2011) listed four types of demographic parameters namely, **"state variables"** which describe the state of the herd at a given time in terms of the size and structure; **"basic demographic rates"** which measure, over a given period, population changes caused by the natural performance of the herd and those related to the owners' decisions and management; **"synthetic demographic rates"** directly derived from the basic rates; and **"global or overall demographic indicators"** which summarize the herd dynamics and production over the year.

Tables 5.4 a) and b) show variables of reproductive cattle and of the herd respectively that describe their state at the time of the study and over the preceding 12 months. The variables are also used to calculate the overall demographic indicators by species and the annual demographic parameters of cattle in Tables 5.6 and 5.7 respectively.

Table 5.4 (a): Age and reproductive parameters of reproductive cattle in Garissa County, Kenya (n = 421)

	Minimum	Maximum	SD	Mean
Age in years	3	22	2.8	7.7
Number of births in lifetime	0	18	2.2	3.0
Number of live births in last 12 months	0	1	0.5	0.6
Number of stillbirths in last 12 months	0	1	0.3	0.1
Number of abortions in lifetime	0	4	0.6	0.3
Number of abortions in last 12 months	0	1	0.2	.04

Table 5.4 (b): Aggregate herd status and changes per species in Garissa County, Kenya

(These figures are also used in calculation of demographic rates, Table 5.6 below)

Variable /Species	**Camels**	**Cattle**	**Sheep**	**Goats**
Mean herd size, at date of survey	7.1	30.5	24.9	75.2
Mean entries	14.8	54.6	19.7	31.4
Intakes	10.7	45.3	12.6	21.3
Mean exits	26	61.1	34.3	47.4
Off-takes	15.3	36.1	17.3	27
Mean sales	7.2	20.2	7.5	11.4
Mean herd size, 12 months ago	18.3	31.5	39.5	91.2
Mean herd size over the year	12.7	31	32.2	83.2

- Herd size 12 months ago = size at date of survey - entries + exits; Intakes = purchases + in-donations; Off-takes = sold + out-donated + consumed. Assume mean herd size over the year = (herd size to-date + herd size 12 months ago)/2.
- Intakes are entries without births; off-takes are exits without mortalities and un-explained losses. Thus intakes and off-takes are deliberate management entry/exit events.

The minimum reproductive age of three years seen in Table 5.4 (a) is quite early and this can be explained by the fact that all male and female cattle were left to mix and mate freely during grazing. The maximum age of 22 years shows the longevity of some indigenous animals, some of which are kept for long because of their exceptional (re-)productivity histories, herd leadership qualities or other sentimental reason. However, the same longevity is not reflected in the overall population which shows a mean age of 7.7 years in reproductive animals. This means that longevity is the exception and a short life is the norm. This fact also offers part explanation for the need to maximize on the chances of early mating and conception as seen above and in fact could be the most compelling reason. Fortunately, cows conceive in large numbers after the rains, as during this study, and abortions are a rare occurrence.

The age at first parturition can be estimated to be four years from the minimum reproductive age of three years and the difference between the mean age and the mean lifetime live births, assuming there is a birth every year. This agrees with the reproductive parameters for African domestic livestock quoted in ILCA (1990) citing Wilson *et al.* (1985). The small mean number of births per reproductive cow's short lifetime partly explains the need of pastoralists to have large herds for current livelihood outcomes and future insurance.

There were higher aggregate exits than entries for all species which left a net negative balance in the herd inventory at the end of the 12 months. However, these results related specifically to the 12 months of June 2011 to July 2012 and although the period was rated average to much better than the past 5 years by 82% of the respondents as seen in Chapter 4, the year fell in the recovery stage of the 2009-2011 drought and no doubt had ill effects carried forward.

Table 5.5 shows the relationship between the age of the reproductive cows and various reproductive parameters. Most of the cows which had never given birth were in the age group 3-6 years and many of these were currently pregnant. Cows of 7-10 years age were the most active with the most lifetime live births, 12 months live births, 12 months stillbirths, lifetime abortions, 12 months abortions and current pregnancies. Overall, cows in ages 3-10 years were all good in reproductive performance with most pregnancies, most 12 months live births, least 12 months stillbirths and least lifetime and 12 months abortions. Animals of this age range would be good cows for pastoralists to retain and for outsiders such as ranchers to buy for breeding and worst for pastoralists to lose through trade or mortalities.

Reproductive activity in all parameters decreased after this age onwards and any animals older than 16 years were kept for other reasons. The very fact that animals were kept up to such old age is a worrying situation as it means that there was no practice of culling and animals were sold irrespective of age as seen in Section 5.3.3 above.

The high numbers of pregnancies which occurred after the rains almost make pastoralist cows seasonal breeders. These pregnancies would result at parturition to the population "boom" phase in the livestock cycles discussed by Scoones (1996) and Bailey *et al.* (1999).

It appears in fact that apart from the purchases done to rebuild herds, it is these waves of pregnancy that counteract the "busts" caused by disasters such as drought and diseases. Unfortunately the "busts" are likely to be longer lived due to the prevailing climate variability and other pressures on pastoralism and this is the cause of the worldwide concern on the conservation and utilization of local livestock breeds (FAO, 2007). Urgent interventions are therefore required to smoothen livestock cycles.

Table 5.5: Relationship between age of reproductive cows and reproductive parameters described in table 5.4 (a) above in Garissa County, Kenya

Count of cows with such reproductive parameters		Age categories (years) and % of total cows					Percent of total number of cows
		3-6	7-10	11-15	16-22	Grand Total	
		38.8 %	48.4 %	11 %	1.9 %	421	100 %
Number of births in lifetime	0	18	5			23	5.5
	1-4	144	157	17		318	75.5
	5-8	1	42	21	6	70	16.6
	9-18			8	2	10	2.4
Number of live births in last 12 months	0	69	83	20	6	178	42.3
	1	94	121	26	2	243	57.7
Number of stillbirths in last 12 months	0	155	191	39	7	392	93.1
	1	8	13	7	1	29	6.9
Number of abortions in lifetime	0	142	166	34	4	346	82.2
	1-2	21	34	10	3	68	16.1
	3-4		4	2	1	7	1.7
Number of abortions in last 12 months	0	156	194	46	7	403	95.7
	1	7	10		1	18	4.3
Current pregnancy status	Pregnant	101	127	28	3	259	61.5
	Not pregnant	62	77	18	5	162	38.5

This smoothing can be done by short term interventions to adequately mitigate against disasters as well as long term strategies to enhance resilience and decrease vulnerability. These include earl warning and early response to disasters; risk avoidance by for example fattening away from risky areas and feedlots; risk financing for example by livestock insurance; enhanced social protection measures; opportunities for diversification and investment in education. Such interventions are further discussed in the report on the Kenya Post-Disaster Needs Assessment 2008-2011 Drought (Government of Kenya, 2012) and include broadly Humanitarian Relief; appropriate Policy Development; Enhanced Emergency Preparedness and Mitigation; and Risk Financing.

Table 5.6 shows the overall demographic indicators which summarize the herd dynamics and production over the year. Cattle had the highest multiplication and growth rates followed by goats, sheep then camels in that order. The rates are less than 1 reflecting the decrease in all species' herd sizes over the 12 months. The negative growth rates indicate that the livestock populations would be annihilated with time if the trends were to continue and not be interrupted by year on year differences in population dynamics especially the upward, "boom" phases of the livestock cycles.

The annual production rates did not follow the same order as the above other rates because of the differences in off-takes and in-takes between the species which depend on management objectives and livelihood needs. The variation in mortality rates reflected the different species' sensitivity to risk such as drought and diseases.

Table 5.6: Overall livestock demographic indicators by species in Garissa County, Kenya

Variable /Species	Camels	Cattle	Sheep	Goats
Annual multiplication rate (Herd size at date of survey/herd size 12 months before)	0.39	0.97	0.63	0.82
Annual population growth rate (annual multiplication rate -1)*100	-61%	-3%	-37%	-18%
Annual production rate (P/N) P = (herd size at date of survey – herd size 12 months ago) + (number of off-takes over the year – number of intakes over the year) N = mean herd size over the year	-0.5	-0.3	-0.3	-0.1
Annual mortality rate (Probability or hazard rate for an animal to die a natural death = (number died in 12 months/herd size 12 months ago) * 100	50%	69%	32%	16%
Off-take rate (Probability or hazard rate for an animal to exit the herd as off-take = (off-take/herd size 12 months ago) * 100	83.6%	116.5%	43.8%	29.6
Commercial off-take rate (Sales/ herd size 12 months ago) * 100	39.3%	64.1%	18.9%	12.5%
Intake rate (Probability or hazard rate for an animal to enter the herd as an intake = (intake/herd size 12 months ago) * 100	58.5%	143.8%	31.9%	23.4%

Although goats were the most sold species as seen in Chapter 4, the overall off-take and commercial off-take rates appear the least because they also formed the greatest proportion of total livestock herd size and therefore the probability of an individual goat being 'off-taken' was smaller compared to the other species. As seen in Section 5.3.3 above, cattle had the most entries and exits followed by goats, sheep then camels, but the order was different with intakes and off-takes because the latter rates were minus the births and mortalities respectively which were different between the species.

It appears that contrary to the observation by Lesnoff *et al*. (2011), livestock demographic parameters are driven more by environmental factors – droughts, diseases and other disasters – than by the biological characteristics of the animals and the owners' herd management practices. This is likely to be the case because animal characteristics and owners' practices are themselves largely dictated by the environment.

Table 5.7 shows the annual reproductive parameters of cattle. The calving rate was lower than the ideal given that the gestation period of a cow is 280 + (-) 10 days which means that, in normal circumstances, a cow should calve at least once per year. However, the ideal is seldom attained given the many factors that influence fertility such as congenital defects, nutrition, breed, age, weight, disease/injury, environment, hormonal disturbance and bull infertility. The prolificacy and net prolificacy rates were below 1 for the same reasons. Fecundity and net fecundity rates were lower than the above rates because they are products of other rates which are themselves fractions. The lower than ideal rates observed in this study were offset by the low stillbirth and abortion rates. This together with the high percentage of females in the herd structures and the high pregnancy rates after the rains make this production system able to recover quickly after droughts. This depicts the resilience of the pastoral herds.

Table 5.7: Annual reproductive parameters of cattle in Garissa County, Kenya

Parameter	Calculated value
Annual reproduction rate per individual cow (same as parturition or calving rate) (Average number of births per breeding female per year)	0.6
Prolificacy rate (Mean number of offspring (born alive + stillborn) per parturition)	0.7
Net prolificacy rate (Average number of offspring born alive per parturition, calculated as: Prolificacy rate * (1 – Stillbirth rate))	0.6
Fecundity rate (Average number of offspring (born alive or stillborn) per reproductive female and year, calculated as: Parturition rate * Prolificacy rate)	0.42
Net fecundity rate (Average number of offspring born alive per reproductive female and year, calculated directly or by: Parturition rate * Net prolificacy rate)	0.36
Stillbirth rate (Probability that an offspring is stillborn = (stillbirths/total births))	0.1
Abortion rate (Probability or hazard rate for a female to have an abortion)	0.04

Note: Annual demographic parameters were done for cattle only, as a representative species, because cattle events are easier to remember, as they occur only once in a long while.

5.4 Conclusions

The following conclusions were made from the study.

i. Adult females of all species made up 51.4% of the herd, young females 13.1% and the rest were males and young stock. The high proportion of females capable of reproduction and milk production and the presence of replacement young females and young stock indicated the resilience of the herds.
ii. Livestock were unevenly distributed among households and geographical areas, although goats were more equitably distributed.
iii. The 12 months livestock dynamics exhibited higher exit proportions than entries resulting in herd and flock declines during the year.

5.5 Recommendation

It is recommended that the Government and development partners should undertake interventions to improve equity of livestock distribution such as risk financing and social protection; balance the herd dynamics in favor of entries by improvement of reproduction and reduction of mortalities; and support livelihoods diversification to reduce dependence on livestock.

CHAPTER 6

6.0 GARISSA LIVESTOCK MARKET STRUCTURE, CONDUCT AND PERFORMANCE, KENYA

Abstract

Pastoralist livestock trade plays a great role in local food security and poverty alleviation, but also has implications on indigenous animal genetics utilization; conservation; importation of 'exotic' genetics; and transmission of trans-boundary diseases. This study was done to analyze Garissa livestock market and the utilization and value addition of marketed livestock. Market physical and facilitating functions were observed and data collected using semi-structured interviews of market players and longitudinal records of sales and purchases. Incoming animal consignments were 71% local, 29% cross-border and 75% on foot. Local consignments accounted for 54%, 35% and 87% of all animals, cattle and camels respectively and all the small stock. Animals from Somalia were 46%, 65% and 14% of all animals, cattle and camels respectively. Over 85% of the purchased animals were trucked to long distance destinations for slaughter, fattening and breeding. The market concentration ratio was 24% and 10% for sales and purchases respectively. The market value of the animals that was passed on to the producers was 86% and the wholesale margin was 17% comprising of 8% marketing costs and 92% profit. The market lacked adequate facilities for livestock disease control, general hygiene, human and animal welfare. However, business was competitive and offered adequate product choice to buyers and fair returns to producers and sellers. Interventions are required to improve the market quality standards and operating procedures.

6.1 Introduction

The socio-economic contribution of Kenyan pastoralism includes livestock products, employment, socio-cultural values and animal genetic resources conservation (Hatfield and Davies, 2006; Davies, 2007). Aklilu *et al.* (2002) estimated the contribution of Kenya pastoral areas to the supply of the country's beef as 72% with 46% being internal and 26% cross-border.

Pastoralists sell livestock to earn income to meet needs other than those met by direct consumption or utilization of livestock and products such as other types of food, clothing, travelling, education, health care and capital for income diversification and other investment. In addition livestock marketing can be used to promote almost all the objectives of pastoral development such as increase or stabilization of output and incomes or environmental conservation (Sandford, 1983).

Little (1996) noted that livestock marketing patterns and incomes provide good indicators of the status of the pastoral sector and local food security. Regional cross-border livestock trade is a major and growing economic activity that contributes to local and regional food security, supply of meat to urban areas, government revenues and pastoralist poverty alleviation (COMESA, 2009). The COMESA (2009) report identified Garissa livestock market as the largest in eastern Africa and a key outlet to the Kenya-Somalia cross-border livestock trade.

This market has never been properly evaluated. Little and Dube (2011) noted that there is need for new research approaches and analyses of pastoral domestic and local livestock markets that are rapidly changing and that have received less research attention than regional cross-border and export markets. Traditional analyses of markets focused on household access

to markets only. USAID FEWS NET (2008) recommended deeper analyses of food markets to address market dynamics and performance. This study was conducted to assess the Garissa livestock market structure, conduct and performance to meet this objective.

6.2 Materials and methods

6.2.1 Data collection and analysis

The study area was described in Chapter 3. ILCA (1990) and ILRI (1995) defined agricultural markets as a physical or conceptual place where exchange takes place. Livestock marketing means sale, purchase or exchange of livestock products for cash or goods in kind and involves the movement of goods from the point of production through the place of exchange to the final consumer. For a marketing system to be operative and effective, it must provide exchange functions, physical functions and facilitating functions (ILRI, 1995).

The market was initially observed for its physical and facilitating functions and these were recorded according to a semi-structured guidance sheet to include market physical facilities; management structures; market players, their numbers, roles and challenges; fees and charges; costs and incomes; and conduct of business. The physical and organizational infrastructure of the market was assessed using the World Bank Tool for Evaluation of Livestock Markets (The World Bank, 2009) and scored according to the different levels of advancement. Appendices 3 and 4 show the guidance sheet and the assessment using the World Bank Tool respectively.

Livestock traders and other players in the market were sampled purposively according to their roles and on the basis of their willingness to interrupt their activities and be interviewed. Longitudinal data was then recorded from samples of sellers and buyers on every main market

day i.e. once per week on Wednesday and sometimes on the next day for 20 market days from 18th July to 3rd October 2012. The data collection sheets are shown in Appendix 5 (a) and (b).

Market performance data collected from sellers included origin of livestock; means of livestock transport to the market; transport costs; personal subsistence costs; details of route and market taxes and fees; number of animals brought to the market; number of animals left over unsold at the end of the market day; and details of the sold animals i.e. number, purchase price at origin, unit selling price and total sales all disaggregated into animal species, sex and age categories. One hundred and two (102) data sheets were completed for 73 sellers in 20 market days.

Market performance data collected from buyers included destination of bought livestock; means of transport; transport costs; personal subsistence costs; details of market taxes and fees; number of animals bought, purchase price and purpose of purchase whether slaughter, fattening, breeding or draught power all disaggregated into animal species, sex and age categories. One hundred and seventy (170) data sheets were completed for 74 buyers in 17 market days.

The competitiveness of the market was illustrated by the 'market concentration', calculated as the percentage of total trade accounted for by a defined top number of sellers/buyers. The results of the physical and functional descriptions are reproduced in narrative while the performance data was entered into Microsoft Excel 2007 and Statistical Package for Social Sciences (SPSS) 18 and analyzed for descriptive statistics.

6.3 Results and discussions

6.3.1. Physical description of the market

The market covered an area of about 1.21 hectares located 2.5 km from the town centre along the Wajir road. The market did not provide animal quarantine areas, treatment or emergency slaughter facilities. The only physical structures for animals were eight enclosures and crushes, two watering troughs and three loading ramps. Feed was sold in hand carts and delivered to animals on the ground. Physical facilities for people included a shed for Government and Council officers, a resting shed for traders, one disused auction platform and toilets under construction. CBPP testing was done on the verandah of a shop outside the market. There were no facilities for waste disposal and manure, carcasses and polythene papers were scattered around the market. A sketch of the market layout is shown in Figure 6.1 while Plates 6.1 a) and b) show photographs of various parts of the market. An assessment of the market using the World Bank Tool showed an overall score of 15 out of 48, that is, 31%. Major improvement interventions are therefore required especially on staff training and regular independent market inspections.

6.3.2 Management structures

The institution in overall charge of the market was Garissa Municipal Council. Other institutions and were Garissa County Council which was the overall host; the Veterinary Department which did disease testing and issuing of movement permits; the Livestock Production Department which collected data on livestock sales and prices; the Kenya Police and Administration Police for security; the Kenya Livestock Marketing Council (KLMC) which supported market infrastructure; and the District Livestock Marketing Council (DLMC) which also collected marketing information data.

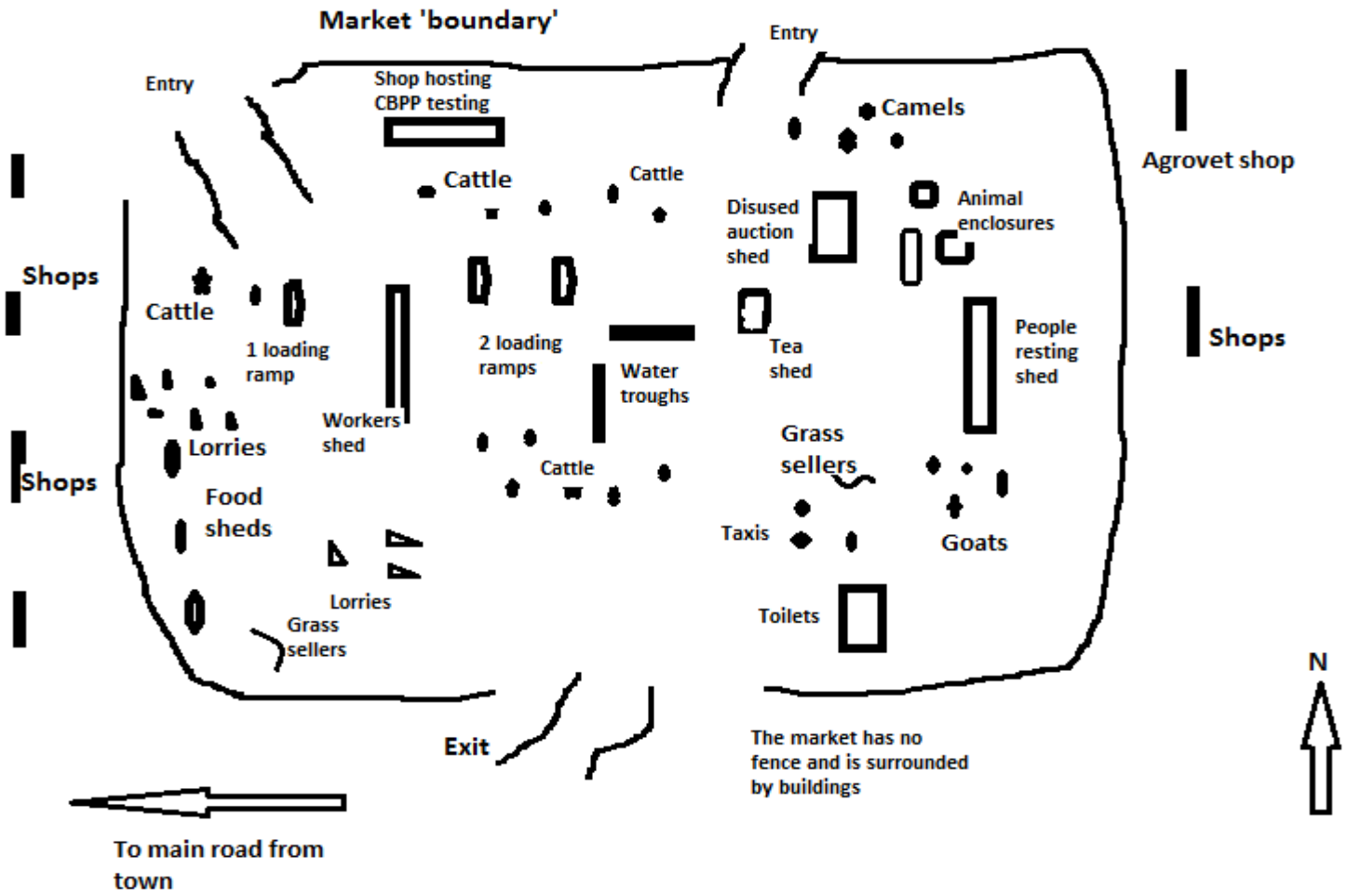

Figure 6.1: A sketch of the livestock market in Garissa County, Kenya in July 2012

Entrance into the market with no specific gate.

Shed for Government and Council officers.

Cattle and woman sharing water trough.

Improperly disposed goat carcass.

Improper waste disposal.

Marketing information board with no information.

Plate 6.1 a): Photographs showing different parts of the livestock market in Garissa County, Kenya

 Unsafe cattle loading.	 Food "kiosks" surrounding the market with no separation.	 Picture from a follow-up visit showing new constructions including toilets on the right.
 Picture from a follow-up visit showing new metal-sided loading ramp under construction and feeds on sale.	 Picture from a follow-up visit showing new water trough and wall under construction separating food "kiosks" from market.	 Picture from a follow-up visit showing new sheds under construction.

Plate 6.1 b): More photographs showing other parts of the market and new structures in Garissa County, Kenya

Some institutions such as the Departments of Veterinary Services and Livestock Production; and KLMC and DLMC were related. Veterinary Services and Livestock Production are Government Departments in the same Ministry and DLMC is the local representative of KLMC. However, in terms of market functions there was no direct hierarchical relationship between the institutions, but they were coordinated and ad hoc meetings were held to solve any problems.

6.3.3 Conduct and flow of business and challenges facing the various players

Table 6.1 shows a breakdown of the main market players, their estimated numbers per market day and the services they charged or paid for. Garissa livestock market is a primary market (animals are brought here straight from the producer), secondary (from other smaller markets or to other markets) and also terminal market (to their final destinations: slaughter, breeding or fattening or moved back home). The market was held on Wednesdays and activities started before 7 a.m. and ended between midday and 4 p.m. depending on the volume of business.

The livestock sellers were producers selling their own animals and traders who had brought animals from the hinterland. The sellers were of Somali ethnic community and were therefore, by their clan affiliations and kinship (Mahmoud 2008, Pavanello 2010), able to manage the risk of insecurity and source animals from far and wide within Garissa and neighbouring counties and from Somalia and Ethiopia.

The livestock brokers were from within the County and mostly of Somali ethnicity. The total number of brokers was more than 20 but all could not be counted since their market attendance varied from market day to market day.

Table 6.1: Livestock market players, their estimated numbers per market day and their roles and fees/costs (KShs = Kenya Shillings) in Garissa County, Kenya

S/No	Type of player	Estimated numbers	Roles	Fees/costs
1.	Garissa County and Municipal Councils (GCC & GMC)	10 officers	Co-hosts of the market	GCC: Charge export fees KShs 100 per cow
				GMC: Charge auction fees KShs 160 per cow (although no auction done); and loading fees 4,000.
2.	Livestock sellers	Vary	Bring animals for sale	Sellers may pay brokers if they engage them, but generally they do not pay any charges apart from their own subsistence.
3.	Livestock brokers	20 (but vary)	Connect seller and buyer	Charge KShs 200 per cow/camel/donkey; KShs 50-100 per goat. This money is paid by the person(s) who engages the broker.
4.	Livestock buyers	30 (but vary)	Come to buy animals. Incur most of the market costs	Pay GCC and GMC fees of KShs 130 and 160 per cow respectively; broker 200 per cow; CBPP test if required 50 per cow; enclosure minder 200 - 500; animal ID 200; grass if required; loaders 400 per truck; loading fee 3-4,000; veterinary movement permit 100; transport broker 500 and transporter depending on destination and number of animals.
5.	Enclosure minders	8	Guard animals collected in enclosures awaiting transportation	Charge KShs 200 - 500 per owner
6.	Iron brander	2	Brand animals for owners requiring their animals to be identified	Charge KShs 20 - 50 per owner
7.	Paint brander	8	Paint numbers on animals for owners requiring their animals to be identified	Charge KShs 100 - 200 per owner
8.	Grass vendors	Few	Sell grass/maize stalks transported from riverside farms to owners needing to feed their animals	Charge KShs 100 per small bundle
9.	Veterinary officers	5-6	Do CBPP test on animals going for fattening and breeding and issue livestock movement permits	Charges: KShs 50 per cow for CBPP testing and KShs 100 per consignment of livestock movement.
10.	Transport brokers	10	Connect buyers with transporters	Charge KShs 500 per livestock owner and 1000 per lorry owner
11.	Transporters	100	Provide transport for livestock on their return journeys having come to Garissa on other business	Charge KShs 40,000 to Nairobi, 23-30,000 to Mombasa and 15, 000 to Mwingi. Transporters also pay for sand and at the gate.
12.	Loaders	10	Load livestock onto lorries	Charge KShs 400 per 10 wheeler lorry (capacity 30 cattle), 800 per trailer lorry (30-38 cattle) and 1000 for semi-trailer lorry (40-45 cattle).
13	Police	10	Provide security in and around the market	They are paid KShs 1000 each by the GCC/GMC
14.	Others are the market gate-keeper who charges KShs 400 per loaded lorry passing through and sand harvesters who collect sand away from the market and sell it to transporters for KShs 800 per lorry (sand is put on the lorry floors to prevent animals slipping).			

The livestock buyers were of mixed ethnic origins. The involvement of other ethnic groups at Garissa market indicated that risks faced by traders above had been considerably reduced at this level. The trust considerations and mode of trade and payment were also different in the market. Somali sellers, buyers and brokers just kept a record of the day's business transactions and then met as a group later in the evening in town to settle accounts. Traders of Kikuyu and Kamba origin paid in cash at the market and mostly loaded their animals onto trucks and departed immediately.

The ethnic factor from this level closely corresponds with the destinations, purposes and transport of animals bought and this may point to vertical linkages or partnerships in the destinations as discussed by Little (2006). A small extent of gender inclusion among livestock brokers, livestock buyers, grass vendors, crush minders and numbering boys was observed. Brokers and buyers included men and a few women; grass vendors women and youth while crush minders and numbering boys were young men or boys.

Livestock brokers were not registered, they had no association, the business did not require any licensing and there were no entry conditions or barriers. Although they had no association or cooperative, the brokers sometimes worked in groups probably to capture as many clients as possible. The brokers mostly connected sellers and buyers for a commission, but sometimes they bought and sold. The livestock buyers were also not registered and they claimed to get their annual livestock traders' licenses from their home counties. This is something that needs follow-up by the County Veterinary department as licensing of livestock traders is a requirement by law due to security reasons. The buyers also sometimes worked in

groups to share costs and transact business faster. The loaders worked in a group with most of them doing the manual work and one doing the recording.

Discussions with key informants indicated that animals from Kenya and Ethiopia were of the Aadey (Boran) breed while those from Somalia were either the Somali Zebu (Shawar), with brown and white patches or the Sahiwal (Gadud). Cattle were sold on body condition score, but generally the Aadey were in greater demand as they were said to have better weight and fattening gains. Steers were not common in the market as they reportedly required more time for fattening. Cattle prices were suggested by brokers pegged on the current dollar rates, by sellers based on the purchase price or the wishes of the producer if selling directly. The other service providers set their charges according to their institutional regulations or the nature of their services in the case of the private entrepreneurs – for example loaders had set their charges quite high because sometimes they were injured by animals and there was no insurance.

The market was a bee-hive of activity during market days attracting the many primary players and other secondary actors such as food vendors, taxis and other public service vehicles. Activities were lively and everybody seemed happy. From personal observation livestock market players prefer such 'informal' settings as more formal management and physical structures almost always imply rigid bureaucracy and increased taxation. A good example is auction physical structures and mode of selling animals which would imply removal of brokers, less freedom of seller/buyer interaction and payment of fees for the auctioneer. This explains why the one auction platform in the market was no longer used.

However, this free-for-all situation is dangerous in terms of business ethics, security, occupational health and safety and animal welfare. Since there was no free flow of

information and seller/buyer - broker negotiation was private, there may have been collusion on prices or commissions. The market was also different from markets in Australia which are guided by the Australian Code of Practice for the Selling of Livestock (Saleyard Operators Australia, 2007). The Australian code provides guidelines to sale yard operators to achieve the required standards for health, safety and welfare for the sale of all classes of livestock by auction. It has details for market site and service requirements; structural requirements; operational requirements; operators' responsibilities; traders' responsibilities; and procedures in case of disease outbreaks.

The structural challenges cited by market players were inadequacy of toilets, inadequate and dirty watering troughs and the need to plant trees around the boundary of the market to serve as wind breaks and reduce the dust. The functional challenges at the market earlier cited by producers (chapter 4) included high council fees, high broker charges, fluctuating and low prices especially during drought; lack of feed or cost of feeding during the market day and problem of carry-over of unsold animals and cost of returning forcing them to sell at lower prices. It appears that costs incurred mainly by buyers such as council and broker charges were passed on to producers.

6.3.4 Origins and transport of livestock brought to the market

Tables 6.2 (a) and (b) illustrate the types and proportions of marketed animals, their origins and means of transport. According to the veterinary movement permits the animal movements were 71.2% local and 28.8% cross-border. The local movements accounted for 54.4% of all animals, 34.7% of cattle, 86.5% of camels and all the goats and sheep.

Table 6.2 (a): Types of animals brought to the market, their origins and means of transport in Garissa County, Kenya

		Means of transport			
Category of animals	**Origins**	**Truck**	**Trek**	**Total**	**%**
1. All cattle	Local		1249	1249	34.7
	Somalia		2348	2348	65.3
Adult males	Local		533	533	41.9
	Somalia		738	738	58.1
Immature males	Local		408	408	49
	Somalia		424	424	51
Male calves	Somalia		75	75	100
Adult females	Local		160	160	15
	Somalia		906	906	85
Immature females	Local		148	148	41.9
	Somalia		205	205	58.1
2. Camels	Local	22	202	224	86.5
	Somalia	35	0	35	13.5
3. Goats	Local	1029	71	1100	100
4. Sheep	Local	246	26	272	100
5. All animals	Local	1297	1548	2845	54.4
	Somalia	35	2348	2383	45.6
Total		**1332**	**3896**	**5228**	**100**
	%	25.5	74.5	100	

Table 6.2 (b): Categories and proportions of animals brought to the market in Garissa County, Kenya

Category of animals	Number	Proportions	
		% of species	% of all animals
1. All cattle	3597	100	68.8
Adult males	1271	35.3	24.3
Immature males	832	23.1	15.9
Male calves	75	2.1	1.4
Adult females	1066	29.6	20.4
Immature females	353	9.8	6.8
2. Camels	259	100	4.9
3. Goats	1100	100	21
4. Sheep	272	100	5.2
5. All animals	5228		100

Most of the local animals originated from within Garissa County especially Balambala, Fafi and Ijara sub-counties in that order and from the neighbouring Counties especially Tana River. Animals from Somalia originated mostly from Baidoa, Dinsor and Dobley which according to Little (2006) are approximately 550 km, 28 days walking; 490 km, 23 days; and 160 km, 8 days; respectively from Garissa. Cross-border trade from Somalia contributed 45.6% of all animals, 65.3% of cattle and 13.5% of camels.

The results confirm the estimates of Little (2006) that 65 – 68% of cattle sold at Garissa were from Somalia, 27 – 30% from Garissa District and the rest from Mandera and Wajir Districts. Since Somalia/Ethiopia routes and Garissa livestock market are the largest in East Africa, these findings also suggest that the situation has changed since Aklilu *et al.* (2002) put the proportions of Kenya's beef supply at 46% internal and 26% cross-border.

Cattle constituted the largest proportion of animals brought to the market followed by goats, sheep then camels. This was a different situation from the producer level where goats were the most sold species as seen in Chapter 4. Among cattle, adult males were brought to the market more followed by adult females, immature males, immature females and lastly male calves. No steers or young female cattle were brought to the market during the study period. The proportion of goats brought to the market was greater than adult female cattle, immature males and immature females.

The higher demand of cattle necessitated the sourcing of over half of all cattle from Somalia as seen above. This indicates a need for intervention on local production particularly considering the high costs and risks of cross-border trade and the uncertain future of the Somalia route which may change once the country solves its governance problems. Little

(2006) argued that since the Horn of Africa region is so politically volatile, the direction and scale of cross-border trade is subject to rapid changes.

According to Little and McPeak (2006), citing Tambi and Maina (2003), increased consumer demand can be met mainly by increasing herd size, higher off-take rates or increasing productivity of animals. All the young male cattle marketed in the sample were sourced from Somalia and this, as seen in Chapter 5, could have been because the local age group was being with-held and accumulated by producers for later selling. This indicates a direct link between producer herd dynamics and the proportions of marketed livestock and implies that the scenario will change at a future date in a manner which may be cyclic or otherwise. Cattle from Somalia predominated in all categories including adult females, immature females and male calves. This suggests that there were more distress sales from Somalia than from Kenya. The small proportion of camels from Somalia despite the known fact that the Country has more camels than Kenya suggests an alternative route possibly due to price or demand differentials.

All cattle, most of the local camels, and some goats and sheep were trekked to the market. All cross-border camels and most sheep and goats were brought in by truck. In a way this reflected infrastructure state and the ease of walking the different animals over the distances. This probably explains why all goats and sheep were procured locally. Consequently, the level of trade of all species may change if transport infrastructure is improved among the Horn of Africa countries.

6.3.5 Destinations, transport and purposes of livestock taken from the market

Table 6.3 shows the destinations and purposes of purchased livestock. The purchased animals were transported to various destinations by trek or truck. The animals trekked were 11.9% of the total and were taken to the nearest distance namely Garissa slaughterhouse which took 8.6% of the animals; and Madogo, the township across the Tana river from Garissa, other areas of Tana River County and Fafi District within Garissa County which together took 5.9% of the animals. Most of the animals were moved by truck (88.1%) to long distance destinations namely Mwingi/Nguni/Kithyoko townships along the main road from Garissa to Nairobi (40.9% of the animals); Njiru slaughterhouse in Nairobi (23.7%); Thika/Nyahururu/Githunguri (10.8%); Masinga/Machakos/Mbooni/Emali (7.5%); Mombasa/Mariakani (1.1%) and Kenya Meat Commission, Athi River (1.1%). The trucks were not special for livestock transport but carried livestock on their return journeys to Mombasa or Nairobi having come to Garissa, Wajir or Mandera on other business.

Mwingi, Nguni and Kithyoko were transit centers for other terminal destinations including Nairobi. Thika, Nyahururu and Githunguri received significant numbers. The Masinga, Machakos, Mbooni and Emali cluster were consumption or transit centers. Emali is one of the largest livestock markets in the Country (Radeny *et al.*, 2006). Its purpose in receiving animals from Garissa, while placed in a pastoralist livestock production area, Kajiado County, is interesting. It appears moving animals to Nairobi via Emali added value to them, as it is further from Garissa than Nairobi by road. This shows that sometimes traders move animals past obvious terminal and consumption centers in search of price differentials or other marketing advantages.

Table 6.3: Proportions of animals bought from the market, their destinations and purposes in Garissa County, Kenya

Livestock categories	Purposes	Destinations and number of livestock bought									
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Grand Total**	**% of category**
Adult males	Slaughter	186	946		203		30	25	30	1,420	76.6
	Fattening	331			42		60			433	23.4
	Breeding	1								1	0.05
Immature males	Slaughter	115	124		121			70	20	450	26.8
	Fattening	1,067					163			1,230	73.2
Young males	Fattening	314			30		50			394	92.5
	Breeding	32								32	7.5
Adult females	Slaughter	20	374		112				28	534	84.1
	Fattening	49					48			97	15.2
	Breeding	4								4	0.6
Immature females	Slaughter		152		34					186	37.2
	Fattening	230			30		54			314	62.8
Young females	Fattening	20								20	100
Camels	Slaughter			18						18	85.7
	Fattening					3				3	14.3
Goats	Slaughter			70						70	41.9
	Fattening					79				79	47.3
	Breeding					18				18	10.8
Sheep	Slaughter			40						40	47
	Fattening					36				36	42.4
	Breeding					9				9	10.6

Note: Destination codes: 1 = Mwingi, Nguni and Kithyoko; 2 = Njiru; 3 = Garissa slaughterhouse; 4 = Thika, Nyahururu and Githunguri; 5 = TanaRiver, Madogo and Fafi; 6 = Machakos, Masinga, Mbooni and Emali; 7 = Mombasa and Mariakani; 8 = Kenya Meat Commission.

Animals intended for slaughter comprised of most of the adult males (76.6%), adult females (84.1%), camels (85.7%) and sheep (47%) and no young males and young females. Njiru, Garissa slaughterhouse, Mombasa/Mariakani and Kenya Meat Commission only took animals for slaughter because they are slaughter places. Animals intended for fattening comprised of most immature males, young males, immature females, young females and goats. Fattening also was the only purpose that took all categories of animals and the only in young females. Breeding took the least of all animal categories and none of immature males, immature females, young females and camels. Only the Ukambani areas Mwingi, Nguni and Kithyoko took cattle for breeding. Figure 6.2 shows a map of Kenya with livestock routes including those to and from Garissa.

Tana River, Madogo and Fafi only took camels, goats and sheep for fattening and breeding. In general, pastoralists are very loyal to their livestock breeds and anecdotal evidence from focus group discussions indicates that the Somalia cattle breeds were not favoured by local producers. This may be an opportunity lost or not yet taken to tap into the good qualities of the Somalia genetics especially the Sahiwals which are better in milk production than the local breeds. Otherwise the distribution of the animal categories among the purposes seems quite logical.

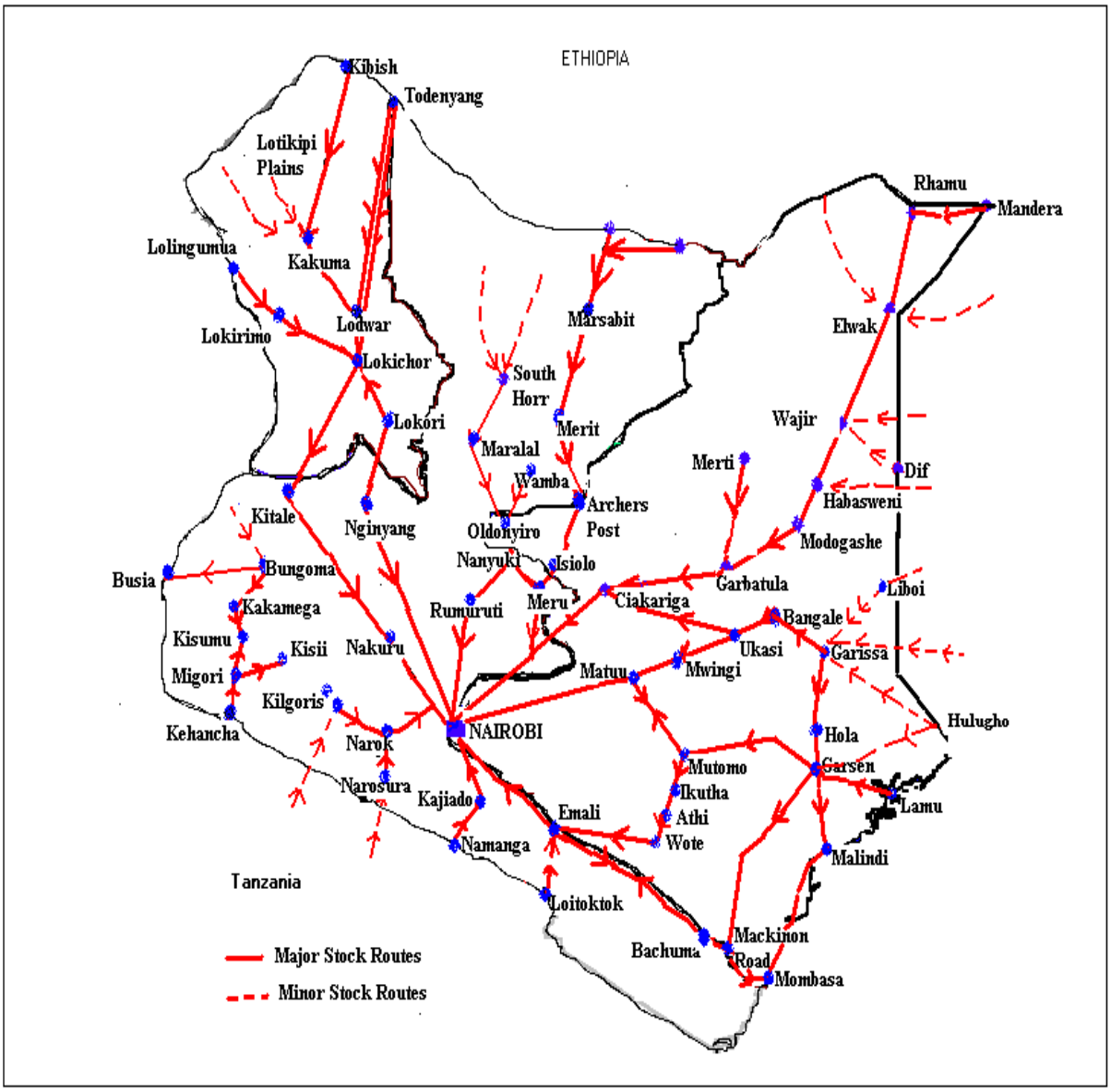

Figure 6.2: Map of Kenya showing livestock routes. Source: Muthee A. M. (2006)

6.3.6 Livestock sales and purchases and market competitiveness

Tables 6.4 (a) and (b) show the descriptive statistics and frequencies of livestock sales and purchases. The different numbers of reporting respondents (N) among the species, sex and age categories is a reflection of the varying sizes of lots and frequency of sale and purchases of the categories. A 'lot' means all the number of animals traded at once in one particular time. The mean sales per category of animals were not very large and the maximum number of animals sold per lot was 200 for adult female cattle. The mean purchases and maximum bought per lot were even smaller. Thus there was high frequency of trade of small numbers of all species by a large number of sellers and buyers. None of the 73 sellers had more than five lots in the 20 market days and the maximum lots for an individual among the 74 buyers in 17 days was 12.

The competitiveness of the market was calculated by the ratio of total trade accounted for by the seven top sellers/buyers who traded a mean of 100-200 animals per lot. The calculation is shown in the box below.

		Sales	Purchases
Animals traded by top 7 'firms' (sellers/buyers)		934	544
Total animals traded in the study sample		3891	5388
7-firm concentration ratio	=	934/3891	544/5388
	=	24%	10.1%

These low concentration ratios imply low monopoly/oligopoly or monopsony power and therefore low opportunity to collude as cartels on pricing or other market policies.

Table 6.4 (a): Descriptive statistics of categories of livestock sold and purchased per lot during the sample market days in Garissa County, Kenya

	Sales						Purchases					
	N	Min.	Max.	Mean	Totals	%	N	Min.	Max.	Mean	Totals	%
Adult male cattle	27	8	70	34.7	938	24.1	75	1	50	24.7	1854	34.4
Immature male cattle	29	5	90	20.1	584	15	82	4	70	20.5	1680	31.2
Young male cattle	5	5	20	14.6	73	1.9	25	4	32	17.0	426	7.9
Adult female cattle	22	1	200	43.5	957	24.6	32	4	90	19.8	635	11.8
Immature female cattle	13	2	74	24.3	316	8.1	27	2	60	18.5	500	9.3
Young female cattle	111	0	0	0	0	0	1	20	20	20.0	20	0.37
Camels	25	1	20	4.4	111	2.9	17	1	3	1.2	21	0.38
Goats	30	8	80	24.6	738	19	10	7	40	16.7	167	3.1
Sheep	19	5	20	9.2	174	4.5	9	1	20	9.4	85	1.6
Total animals	110	1	200	35.8	3891	100	185	1	110	29.1	5388	100

Table 6.4 (b): Frequency (%) of trade in different categories of livestock during the sample market days (n=111) in Garissa County, Kenya

Categories of numbers	Adult male cattle	Immature male cattle	Young male cattle	Adult female cattle	Immature female cattle	Young female cattle	Camels	Goats	Sheep	Total animals
0 – 40	96	99	100	96.5	98.6	100	100	98.2	100	81.2
41 – 80	4	0.7		1.5	1.5			3.6		13
81 – 120		0.9		1.2						4.4
121 – 160				0.9						1.8
161 – 200				0.9						0.9
Totals	100	100	100	100	100	100	100	100	100	100

Note: In table 5.4 b) sales and purchases have been averaged to one figure for traded animals. A 'lot' means all the number of animals traded at once in one particular time.

The predominant ‘small-seller’ situation also means that most of the sellers were probably producers with the exception of the larger sellers, repeat sellers and those bringing animals from Somalia and that there were no ‘cooperatives’ among sellers. Cooperatives have the potential to improve marketing efficiency by reducing costs (ILRI, 1995).

6.3.5 Marketing costs and benefits

Tables 6.5 (a) – (c) show the mean costs, sales and margins per lot for sellers from local and Somalia by truck and trek and summary of all sellers. Column (a), Number in, means the number of animals brought to the market. Column (b), Unit purchase price, was the price per unit of the animal category at the producer level. Column (c), Total actual purchases, represented the value of animals at the farm gate (the value given to the producers) – this value is a mean of the various categories with different numbers of respondents and is not derived directly from multiplying (a) * (b).

Column (d) was the number of animals sold on the first day. Column (e) was the unit price at which the animals were sold at the market. Column (f), Total actual sales, was the value of animals sold on the first day – the value is a mean of the various categories with different numbers of respondents and is not derived directly from multiplying (d) * (e).

Column (g), Total ‘if’ sales are total sales if all the numbers brought in had been sold – this number is also not derived directly from multiplying (a) * (e). It is the assumed market value of all the animals brought in. Column (h), Margin ‘if’, is the assumed margin if all the numbers brought in had been sold. Margins are calculated by column (g) minus column (c) and % margin as 100((g – c)/c). Columns (j), (k) and (l) are calculations of the numbers and percentage of animals sold and left over.

Table 6.5 (a): Mean costs, sales and margins (KShs) per lot for local livestock sellers by truck and trek in Garissa County, Kenya

Type of animal	a) No. in	b) Unit purchase price	c) Total actual purchases	d) No. sold day 1	e) Unit sale price	f) Total actual sales	g) Total 'if' sales	h) Margin 'if'	i) % margin	j) % sold	k) No. left over	l) % left over
Sellers, local, truck												
Camels	35	70,000	2,450,000	10	76,000	760,000	2,660,000	210,000	8.6	28.6	25	71.4
Goats	40	4,880	202,920	27	5,700	157,719	230,392	27,472	3.5	67.5	13	32.5
Sheep	15	3,843	56,206	10	4,441	43,088	64,047	7,841	13.9	66.7	5	33
Sellers, local, trek												
Adult male cattle	48	24,045	1,182,545	36	27,864	986,500	1,367,045	184,500	15.6	75	12	25
Imm. males	29	24,079	731,629	20	26,643	532,250	791,929	60,300	8.2	68.9	9	31
Adult females	31	23,700	768,500	31	26,300	816,100	821,900	53,400	6.9	100	0	0
Imm. females	25	24,333	648,333	22	26,167	634,833	694,667	46,334	7.1	88	3	12
Camels	8	42,308	446,654	3	48,980	184,680	922,022	475,368	106.4	37.5	5	62.5
Goats	18	4650	83,950	10	6,100	59,750	108,250	24,300	28.9	55.6	8	44.4
Sheep	9	4,067	34,867	6	4,800	28,000	41,267	6,400	18.4	66.7	3	33.3

Table 6.5 (b): Mean costs, sales and margins (KShs) per lot for livestock sellers from Somalia by trek in Garissa County, Kenya

Type of animal	a) No. in	b) Unit purchase price	c) Total actual purchases	d) No. sold day 1	e) Unit sale price	f) Total actual sales	g) Total 'if' sales	h) Margin 'if'	i) % margin	j) % sold	k) No. left over	l) % left over
Sellers, Somalia, trek												
Adult male cattle	43	22,705	1,005,294	34	28,029	977,441	1,238,324	233,030	23.2	79.1	9	20.9
Imm. males	28	20,567	611,933	20	24,133	507,267	707,400	95,467	15.6	71.4	8	28.6
Young males	15	14,100	212,000	14	17,400	260,400	268,000	56,000	26.4	93.3	1	6.7
Adult females	61	22,440	1,339,113	53	25,947	1,300,967	1,538,700	199,587	14.9	86.9	8	13
Imm. females	29	21,714	640,214	26	24,429	650,571	732,143	91,929	14.4	89.7	3	10.3

Notes:

- The unit purchase and sale prices multiplied by the numbers brought and sold do not add up exactly to the total purchases and sales respectively because these are separate means with different numbers of respondents and not figures derived from each other.
- The mean numbers of sold plus left over do not add up exactly to numbers brought in because the numbers of respondents are different.
- Total 'if' sales and margin 'if' are the assumed total sales and margin if all the numbers brought in had been sold.
- Margins are calculated by column (g – c) and % margin as 100((g – c)/c) and consist of marketing costs plus normal profit.
- KShs (Kenya Shillings) 87 = 1 US Dollar in August 2012.
- Imm. = immature

Table 6.5 (c): Aggregate costs, sales and margins (KShs) per lot for all livestock sellers in Garissa County, Kenya

Type of seller	Transport costs	Food and accommodation	Route and market taxes	Total actual purchases	Total costs	Total actual sales	Total 'if' sales	Margin 'if'	Margin (%)
Local, truck	9,720	2,048	12,443	2,709,126	2,733,337	960,807	2,954,439	245,313	9.1
Local, trek	9,435	2,221	8,718	3,896,478	3,916,852	3,242,113	4,747,080	850,602	21.8
Somalia, trek	44,863	7,867	38, 197	3,808,554	3,899,481	3,696,646	4,484,567	676,013)	17.7
All combined	64,018	12,136	59,358	10,414,158	10,549,670	7,899,566	12,186,086	1,771,928	17

In Table 6.5 (c) Transport costs, Food and accomodation and Route and market taxes constitute the marketing costs. These plus the Total actual purchases make up the Total costs. This was the trader's investment from which he hoped to make a profit.

Total 'if' sales, the assumed market value of all the animals brought in, was the sum of the Total actual purchases plus marketing costs plus profit. Total actual purchases of all sellers combined (Table 6.5 c, last row) were 85.5% of Total 'if' sales as shown in the calculation in the box.

Percentage of market value of the animals passed on to producers
= 100 (Total actual purchases/Total 'if' sales)
= 100(10,414,158/12,186,086) = 85.45%

This was the percentage of the market value of the animals that was passed on to the producers. This entitlement is a fair value in this first stage of the marketing chain and the theoretical percentage due to the producers will continue decreasing along the chain as other players join in, invest and expect returns. Thus marketing costs plus profit account for the difference, i.e. 14.5%, of the animals' market value.

The added marketing costs for all sellers combined were 1.3% of the farm gate value (total actual purchases) and this percentage represented the value added to the animals in this segment of the value chain from the farm gate to this market. The value addition comprised of the services that were provided to enable the animals reach the market and included assembling, handling and transport. The calculation is shown in the box below.

Marketing costs	= 64,018+12,136+59358 = 135,512
Value added	= 100(135,512/10,414,158) = 1.3%

For all sellers in total, transport accounted for the largest proportion (47.2%) of the marketing costs followed by route and market taxes (43.8%) then food and accommodation (8.9%). Market taxes are discussed in Table 6.1 above. Route expenses mentioned were payment for pasture and water which for the Somalia route were KShs 5,000 - 16,000 for pasture and KShs 4,000 - 12,000 for watering, depending on the livestock numbers, at Dobley, Liboi, Ifo and Saretho points. Following the definition of transaction costs as costs associated with market exchange, including costs of searching for options, negotiating contracts and enforcing agreements, but excluding physical marketing costs such as for transport and storage (Shiimi *et al.* 2010), it can be said that food and accommodation; and route and market taxes were the overt transaction costs for this case. Thus, the combined transaction costs accounted for a larger proportion (52.7%) of the marketing costs than transport (47.2%). The calculations are shown in the box below.

Marketing costs	= 64,018+12,136+59358 = 135,512
Transport	= 100(64,018/135,512) = 47.2%
Route and market taxes	= 100(59,358/135,512) = 43.8%
Food and accommodation	= 100(12,136/135,512) = 8.9%
Transaction costs	= 100((12,136+59,358)/ 135,512) = 52.7%
Marketing costs	= 100(135,512/1,771,928) = 7.6% of margin
Profit	= the remainder i.e. 92.4% (1,771,928)) = 1, 637, 261

The marketing margin, which in this case can be termed as the wholesale margin, is the difference between the farm gate price and the price received at the market. For purposes of this analysis the market price is named "total 'if' sales" as it is calculated from the assumption that all animals are sold on the first day, there are no leftovers and no holding costs. Indeed, the marketing costs inquired from the respondents and considered here were the really obvious ones without considering any hidden or opportunity costs.

In aggregate all sellers realized a margin of 17% of which 7.6% was the marketing costs and 92.4% profit. ILRI (1995) gave an example of margins of more than 15% as being considered unacceptable, but at the same time noted that although there are not many cases of excess profits in African agricultural markets, margins of more than 10% may be required in many markets to compensate for risk factors. In this marketing system due to long distances over insecure areas with poor or no marketing infrastructure such risks include animal deaths, weight loss, thefts, predation, strays, storage charges for leftovers and general uncertainty. Despite these margins the market was competitive as seen from the low concentration ratios above. The marketing costs of sellers getting animals from Somalia were much larger than their local counterparts, but the unit purchase prices were lower and although their margins were on aggregate slightly lower, possibly caused by the lack of camels, they were higher in other categories and thus the attractiveness of the route.

Leftovers which accounted for large and varying proportions of the various categories of livestock resulted in the actual day sales being lower than total purchases by a difference that was 24% of the total purchases and which therefore represented the opportunity cost if for any reason these animals were not sold at all. The leftovers may accumulate and result in 'hold ups' (accumulation and lack of return options) which are among factors discussed by Bailey

et al. (1999) that make markets one-way destinations and place producers in a weaker bargaining position. The authors noted that pastoralists' recognition and fear of these problems lowers marketing volumes and affects the rest of the value chain. Low producer market interaction and loss of market competitiveness and efficiency can also result from high transaction costs (Williams *et al.* 2003).

6.4 Conclusions

The following conclusions were made from the study.

i. The market had enclosures, crushes, watering troughs and loading ramps for animals and sheds, a disused auction platform and toilets under construction for people. It lacked feeding troughs, quarantine area, treatment and emergency slaughter facilities for animals and facilities for waste disposal.

ii. There were no standard operating procedures for sellers, buyers and service providers and this caused an apparent lack of barriers to entry.

iii. Price negotiation was confidential, there was no free-flow of information and brokers could collude, but the market appeared competitive with a fair return to producers and sellers and adequate product choice to buyers.

6.5 Recommendation

Major improvement interventions are required to upgrade the market to acceptable standards in both physical and organizational infrastructure. The Government should publish minimum standards to be met in establishing livestock markets that when enforced will provide human and animal amenities and ensure openness in trading.

CHAPTER 7

7.0 GENERAL DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

7.1 General discussion

Households' main source of income and production objective was subsistence livestock. Almost all future plans involved livestock such as increasing herd size, mixing with business or crops and commercialization. Few respondents had ever taken a bank loan for purposes of improving their livestock. Five of the seven banks operating in Garissa were offering interest free loans with two of them being wholly Islamic while the others offered Islamic Law compliant accounts. The credit pattern is one indicator of resilience/vulnerability though many pastoralist families often borrowed from neighbours (GoK, 2010).

The participation of mostly family labour allows for preservation of pastoral tradition and indigenous knowledge. This is an important aspect of sustainability of pastoral systems (Ayantunde *et al.* 2011). However, in the wider country and global context, the resulting low education standards, constrained livelihoods in this area and should be of major concern (Rakotoarisoa *et al.*, 2008). The situation of high traditional skills and low formal education is a no-win situation. Already the percentage of dependants with formal or self employment was very low and in future the backfire on the system will be greater in terms of lack of or reduced opportunities for diversification, including remittances, and therefore increased vulnerability.

Veterinary services are a global public good not only because of their pivotal role in animal health, welfare and productivity but also due to their important role in public health and food safety and sanitary standards for livestock marketing. In pastoral areas, this importance is further emphasized by the greater dependence of livelihoods on livestock and therefore the services play a big role in safeguarding assets, facilitating marketing and reducing

vulnerability. Though receiving animal health services from mixed sources may be a coping strategy to the erratic nature of animal health services, it is also of concern to animal welfare and food safety with regard to pathogen resistance and drug residues. Casey (1993) noted that consumers rely on the integrity of producers, processors and distributors to deliver a wholesome product free of pathogens or chemicals and this is especially so for meat, a product whose quality is highly variable and dependent on many factors along the long value chain.

Areas of dry season pasture to which pastoralists migrated in times of drought were only a mean distance of 2.6 days walking. In this era of climate change and population pressure this was probably due to reserves becoming scarcer. Most settlements in this County are near the river Tana and probably such pasture reserves survive along the river. However, most of the land along the river is covered by *Prosopis juliflora*, an invasive plant species that suppresses growth of other plants. This loss of rangeland grazing resources has been identified by FAO (2007) as one of the threats to pastoralism. The distance travelled to water and pasture, the amount consumed and the frequency of consumption can influence animal production performance (ILCA, 1990).

Livestock species support livelihoods in different ways and their nutrient resource requirements also differs and this determines their association with households. Goats were the most milked and sold animals, and can utilize grass, shrubs, larger forage trees and seed pods from such trees as *Acacia tortillis* which is common in the area, hence likely to survive for longer within or near the settlements. Camels also provide milk and transport and depend on browse from shrubs and trees that are resilient to drying and survive degradation better than grass. There were more cattle which are dependent on grazing which had to be searched

for over a wider range. Over such distances, the mobile phone was useful in keeping the owners in contact with herders of their animals. The revolution in information and communication technologies (ICTs) is radically opening up access to external knowledge among even the poorest and the rate of growth of mobile phone technology is particularly striking (Pretty *et al.* 2011).

Apart from drought, the list of constraints though not ranked, was a narrative of the livelihood pressures affecting this study area. Fluctuating rainfall and drought are intrinsic to Arid and Semi-arid areas and should be a critical issue in development initiatives because of their impacts on livelihoods (Barton *et al.*, 2001). The high mortality rates during droughts result in long recovery periods necessitating continued assistance post-disaster (Livestock Emergency Guidelines and Standards Project, 2009; Pavanello, 2009).

The huge losses that occurred in the last drought despite the use of coping strategies call for a higher level of Government/NGO intervention than the 1.4% livestock off-take /slaughter shown in the results. Morton (2006) discussed the meaning of coping strategies and noted that depending on the extent of disasters, households may in fact not cope but become permanently destitute and just survive. Ndikumana *et al.* (2000) noted that pastoralist responses to crises have become increasingly ineffective with growing populations and encroachment on rangelands and the increased frequency, severity and geographical scale of droughts. The authors further recommended the need to develop new responses especially those that can be instituted with the assistance of governments and development partners. The Government of Kenya (Republic of Kenya, 2011) has formulated a strategy to end drought emergencies in the country that has five interconnected elements, namely, peace and human security; sustainable livelihoods in a context of climate change; building human capital;

development of climate-proof infrastructure and quality humanitarian relief when required. The challenge as voiced by REGLAP (2011) is for the Government to provide leadership for the private sector and development partners in its implementation.

Migration, though used as a coping strategy, was also listed as a constraint for the reason that it exposes herders and livestock to different and new challenges such as diseases and conflicts. Kaimba *et al.* (2011) discussed migration as both a cause and effect of conflicts such as cattle rustling among pastoralist communities and between them and crop growing communities. Nkedianye *et al.* (2011) also observed that pastoral mobility may lead to greater sensitivity to drought and mortalities especially in fragmented areas where more market-oriented but less drought-resistant livestock breeds are resident. It appears that mobility is a necessary evil or an evil necessity done only under duress. Sedentarization, therefore, will probably be the lifestyle of the future for the pastoralists as shown by the patterns of movement and periods of stay in the same villages.

Goats were found to be the main pillar of subsistence; first in herd size, first among milk animals and in numbers sold. Goats were also the most equitably distributed, had the second highest annual multiplication and growth rates and the lowest annual mortality rates. Mace and Houston (1989) observed that pastoralist herds are not wild populations or products of circumstance. Species ratios are therefore determined by factors such as household short or long term subsistence needs; household wealth; species sensitivity to risk especially drought and mortalities; species differences in production, reproduction and growth rates; and different household expectations of claims.

The results of the relationships between household characteristics and livestock inventory show different directions and significance. Prevailing challenges and constraints in an area coupled with market and subsistence demands influence households' characteristics and how they interact with resources at their disposal to meet livelihood objectives. Thus 'vulnerability context', 'livelihood assets' 'policies, institutions and processes', 'livelihood strategies' and 'livelihood outcomes' are components which form the "Sustainable Livelihoods Framework". These components relate to each other in a variety of ways which are highly dynamic, non-linear and imply a certain level of influence but not direct causality (DFID, 1999).

The obscure relationships between household characteristics, livestock inventory and market interaction may also be an indication of the equally blurred dynamics between subsistence and commercialization. The classifications merely indicate "orientation" and not rigid conformation (Jaleta *et al.*, 2009) and there is no common standard for measuring the degree of household commercialization. The sum of consumption and income effects of market shocks (risks) and the scale can easily be tilted by favourable policies and institutional arrangements.

Livestock inventory and herd structure information can indicate the owners' management objectives, constraints and availability of (and pressure on) resources in the production system as well as provide the basis of calculating or forecasting herd productivity (ILCA, 1990). In addition, inter-species composition can be used in system description/ diagnostics as it may indicate whether or not competition for feed resources is likely to exist and also it is this mixing (diversification) that is used by pastoralists as a coping strategy to ensure security in case of epidemic disease or drought (Sissokho, 1998; Rota and Sperandini, 2009).

The findings suggest that males were the less valuable herd fraction accumulated for selling during periods when efforts are made to sustain the most valuable animals. This notion is further given credence by the fact that, in cattle, it was the age category of 1-3 years which formed the greater proportion of the males showing that this was a current accumulation. The study year 2012 also fell under the reconstruction and recovery stage of the 2009-2011 drought cycle management according to the model presented by Pavanello (2009).

There was a small steers to males ratio suggesting that castration was not a common practice and was probably used as a breeding rather than a marketing tool. Non castrated bull calves are more efficient in feed utilization, have higher growth rates and deposit more lean tissue. Later castration results in attainment of a layer of fat which is considered as good finishing and avoids dark cutting meat. Young stock also formed a relatively high proportion of herds of all species and thus a firm foundation for future herd viability.

The situation of mortalities being greater than births and purchases being greater than sales is not good for herd re-building/maintenance and livelihood outcomes. Also the bigger role of purchases than births in building herds does not augur well for the households which are less endowed with cash income sources. These purchases might have been occasioned by the recent drought and the need to re-build the herds.

The findings of inequitable livestock distribution contradict, but build on Pica-Ciamara *et al.* (2011) who, using total TLUs rather than separate species, concluded that livestock are fairly equally distributed among the livestock keeping populations of sub-Saharan Africa. Negassa *et al.* (2011) found that also in Ethiopia the livestock population is not evenly distributed among the geographical or societal landscape.

Livestock distribution cannot be a random process but is likely determined by several factors. These include culture, religion, environment, production system, subsistence and commercial objectives, consumption tastes, availability of markets, availability of breeding stock, household wealth, innovation and technology. Herd dynamics also affect and are affected by several factors including interactions of animals with the environment (including the eco-system and climate variability), household or owner socio-economic needs and animal physiological functions. This is because livestock herds are both biological and socio-economic units though the animals are also individual entities (Konandreas and Anderson, 1982).

Implications of herd distribution include distribution of accruing livelihoods outcomes or vulnerabilities and information for targeting interventions such as extension, disease control, productivity improvement and research studies (e.g. epidemiology, animal movement). In addition, because in pastoral societies livestock and especially cattle are valued as stores of wealth, distribution of livestock is equivalent to distribution of wealth and will have a bearing on social capital as well. DFID (1999) noted that a single physical asset can generate multiple benefits so that livestock may generate social capital (prestige and connectedness to the community) while at the same time being used as productive physical capital (e.g. for traction or transport) and remaining, in itself, as natural capital. Households with zero ownership of the various species are the poorest of the poor and are the fraction of society which needs most livelihoods interventions and social protection. Equity of livestock distribution should be considered when planning livelihoods interventions such as re-stocking and other social protection measures.

Equity objectives are among the five broad groups of government policy objectives including independence objectives, economic efficiency, resource conservation and stability. In agriculture and livestock, improving equity of income and assets is considered essential to policy formulation in many African countries (ILRI, 1995). The authors also identified Lorenz curves of livestock holdings of selected species sourced from special surveys as one of the ways of monitoring and evaluating the equity objective in the livestock sector.

Delgado *et al.* (1999), Upton (2000) and The World Bank (2008) discussed the implications of the increasing human population growth on the livestock revolution and the need to increase productivity. Development intervention opportunities and the need to increase productivity require livestock management plans as done in Dadaab refugee camp complex in this study County (Government of Kenya, 2011). Such plans need livestock herd structures and dynamics as some of the information inputs. Information on herd structures, performance parameters (such as calving rates) and off-take rates can also be used in herd projection models to show changes in off-take rate, herd size and herd composition over a number of years and thus predict the response of producers to market signals over that time (ILRI,1995).

Cattle reproductive parameters were lower than ideal and especially compared to dairy cows in intensive systems because extensive systems are natural and have little or no human technology interventions to improve fertility. However, natural systems have less infective agents and other factors likely to cause abortions and stillbirths which are therefore reasonably low.

The practice of leaving heifers/cows and bulls to graze together might appear as a lack of planning in breeding, but may be a management strategy to maximize mating and conceptions

and ensure future availability of replacement stock in an extensive situation where it is quite difficult to isolate individual animals on estrus. This strategy was done at the risk of inbreeding as seen in Chapter 3 that most producers sourced breeding stock from their own herds.

The results showed low abortion rates and high pregnancies due to natural synchronization by rains. However, planned breeding interventions such as selection to choose the best breeding animals, improved sire camps, surveillance for breeding diseases, estrus induction and synchronization, artificial insemination and embryo transfer can further assist reproduction and multiplication in pastoralist animals. This can be done on a case by case basis especially where minerals can be availed and feed supplementation done on range or feedlot animals from pasture sourced from outside or grown along river banks. Such intervention was done successfully in 2003 - 2004 where one pastoralist in Mandera (Bella farm), selected and 'zero-grazed' thirty of his animals, synchronized their estrus and artificially inseminated them to produce 40 Sahiwal cross calves (Personal observation). However, in order not to lose the good traits of indigenous animal genetics (Fadiga 2013), any crossbreeding should be done with improved but locally adaptable breeds such as Sahiwal cattle, Boran cattle, Galla goats and Dorper sheep.

The number and size of firms in the market and the conditions of entry into the market together with the degree of product differentiation determine the structure of the market. This market had many players with no apparent barriers to entry. Structure, Conduct and Performance analysis is based on the hypothesis that markets structure influences conduct which in turn influences performance. It has been shown that the structure of this market is competitive and the performance is reasonable. Though the social composition of the market

players was distinctive in that all sellers were of Somali ethnic group and buyers were Somali, Kamba and a few Kikuyu, ethnicity did not appear to play a part in the market conduct in terms of collusion, but it did affect the mode of payment as discussed earlier.

ILRI (1995) pointed out that large numbers of market players could indicate a lack of capital and risk avoidance and traders tend to deal in small quantities at a time as seen in this market. The authors added that the presence of many small traders can be seen as an effective adaptation of the market to inadequate external and public services such as capital and insurance. In this particular market, the small sales and purchases could also have been because of smallholder subsistence sales and slow absorption by downstream terminal markets and slaughterhouses that do not have storage space. In addition the above authors discussed that development of markets also depends on the equilibrium between demand and supply and that traditions of ownership of large numbers of livestock and reluctance to transfer their property rights by trading their assets can put societies in a poverty trap where subsistence activities dominate.

ILRI (1995) also indicated that market structure includes the nature of price information transfer whether institutional arrangements or facilities such as weighing scales, grading systems or an auction system. In this market there was a disused auction platform and information board. This study suggests that traders prefer the informality in personal price negotiation than auctioning. This method allows them to use their trust based networks of either clan affiliations and kinship or known associates of different ethnicity. As found in this study, buyers sometimes worked in groups to share costs and transact business faster. Thus, such trust networks, even downstream towards terminal/consumption centers and slaughterhouses, are forms of horizontal or vertical integration that do not contemplate

collusion, but reduction of transaction costs as discussed in Myers *et al.* (2010). However, Green *et al.* (2006) found that in northern Kenya markets where price finding was by negotiation between buyer and seller (dyadic sales) prices were significantly lower than in auction markets. The authors thus suggested that livestock producer prices would be improved on average by more widespread use of auction sales methods.

The higher demand of cattle necessitated the sourcing of over half of all cattle from Somalia. According to Little (1996, 2007) and Aklilu *et al.* (2002) origins and directions of marketed livestock within and across borders depend on livestock populations in the places of origins; price differentials; opportunities of demand; governance and security; marketing infrastructure and legal and policy environments.

Cross-border does not necessarily but often means informal because of the difficulty of tracing, monitoring, recording and regulating movements across long borders in vast and dry lands with low population densities and Government presence. The species, origins/destinations, purposes and means of livestock movements in turn have implications on security/conflict, pressure on resources, disease transmission along routes and across borders and spread and conservation of genetic diversity.

Although there is need for intervention on local production to meet increased consumer demand, Sandford (2011) asserted that the livestock population in the Horn of Africa is already too large for the natural environment to support it sustainably. This assertion must not be confused to mean that the livestock population is absolutely large but rather in relation to the holding capacity of the resources. Thus, of the three ways discussed by Little and McPeak (2006), citing Tambi and Maina (2003), to meet increased consumer demand i.e. increasing

herd size, improving off-take rates or increasing productivity of animals, it seems that the last two are the best options. However, improving productivity is more tenable than increasing off-takes since off-takes are already high compared to the relatively small household herd sizes. In a review of the livestock sector in the horn of Africa, Knips (2004) concluded that the regions' ability to meet increased demand will depend on livestock keepers' ability to increase productivity and improved linkages of smallholders to markets. Henriksen and Rota (2014) also observed that new and improved methods and technologies are available to reduce the risk of livestock production and increase income from the livestock enterprise, but producers need to be convinced of their economic advantages and assured of entrance into the value chain.

Options of increasing productivity and production without increasing the numbers lie in improving the genetic potential, actualizing that potential by improving feeding and access to animal health services and adding value to products and byproducts. In addition to breeding interventions discussed above, there are real opportunities for utilization of livestock from Garissa for fattening in feedlots or pasture within the county and even in neighbouring and distant counties. Within the county and in neighbouring counties with riverine areas, that is Tana River and Mandera, Government and NGO projects have started to train pastoralists to grow and store such fodder as Sudan grass (*Sorghum bicolar*) and Rhodes grass (*Chloris gayana*) in form of hay. These, together with farm crop residues, such as maize stover and banana stems in all counties and rice husks in Tana River County, can be used for feed-lotting to add value to slaughter animals or care for the milking herds and young stock. This integration can enable pastoralists keep their animals as well as diversify livelihoods for increased household incomes and safeguard vulnerable indigenous genetics. Mahmoud (2006)

discussed the case of pastoralist traders purchasing and transporting animals from North-Eastern Kenya to Coast Province ranches for fattening as a value addition tactic and risk reduction mechanism in response to marketing constraints. Muigai (2011) also identified fattening feedlots as one of ten niche products and business opportunities for livestock value addition in the same value chain. Other opportunities identified include packaging of dried meat; processing of African offal sausages; cottage leather industries; processing of camel milk; making of handicrafts from bones and hones; and export of meat and live animals to niche markets.

Opportunities also exist for stratified livestock production, a form of niche marketing for live animals that allocates to different geographical areas and different organizations, special market functions according to their comparative advantage (Sandford, 1983). This means that this area, having a comparative advantage of good indigenous cattle genetics with reasonable reproductive parameters, but threatened by droughts and other disasters, can be used for early production of young and immature animals which can then be purchased and transported to other areas for growth and fattening. Pastoralists would avoid the risks and at the same time earn income to further invest in their part of this system and also for their other livelihood needs and diversification options. The rearing areas will also serve as sources of animals for restocking in cases of disasters in the 'production areas'.

The findings on market concentration show that the situation has changed since 1998. USAID, FEWS NET (2007) indicated that generally, markets were highly concentrated in the Greater Horn of Africa. Garissa and Mandera were given as examples where 50 percent of traders sold less than 200 cattle per year, 35 percent sold less than 100 cattle and 13 percent had annual sales in excess of 1,200 animals. Markets therefore are constantly evolving with

economic growth and changing demands and abilities including supply, capital, market reach, facilities and risk. The marketing costs and benefits results address the concerns and recommendations for research by Little (2006) on the lack of data on herders' benefits and costs from cross-border trade.

Holtzman and Kulibaba (1994) recommended that for competitiveness, efficiency and flexibility to price and supply instability in livestock markets, interventions must provide positive externalities that promote private sector enterprise. These include consistent policies and regulations; suitable service charges; market information systems; stock route facilities such as good roads and water points; appropriate market place facilities and export facilities such as holding grounds and quarantine stations. Gue (1998) reported The World Bank guidelines for livestock marketing and processing which include recommendations and good practices in marketing of live animals, livestock and meat transport, slaughterhouses and roles of public and private sectors. IGAD member countries also have developed training kits to 'support capacity building to promote formal marketing and trade of livestock and livestock products from the Horn of Africa' which are being domesticated by Kenya (Personal observation, 2012) with technical support from FAO and other partners.

7.2 Conclusions

The following conclusions were made.

i. A high proportion of human population owned few livestock mostly in small household herds that were insufficient to sustain livelihoods and allow for high potential off-takes. However, herds were structured to provide milk and had reasonable reproduction rates indicating resilience of the herds.

ii. Livestock dynamics were of indefinite but declining trends of populations. The distribution of livestock among households and geographical areas was uneven although goats were more equitably distributed and core to livelihood support in terms of sales and milk production.

iii. Garissa livestock market had inadequate facilities for livestock disease control, human and animal welfare and general hygiene. There were no standard operating procedures for market players, but the market was competitive offering a fair return to producers and sellers and adequate product choice to buyers.

7.3 Recommendations

The study recommended that there is need for interventions to enhance livestock productivity and diversify livelihoods activities. Regular surveys are also needed on pastoralist livestock dynamics to keep track of this important resource. Livestock markets operators need to formulate and enforce standards and procedures to provide for human and animal welfare and openness in trading.

7.4 Recommendations for further research

Further work is needed to collect and analyse long time data to predict future herd changes given the livestock cycles and climate variability.

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APPENDICES

APPENDIX 1: PASTORALISTS' HERD STRUCTURES AND DYNAMICS

QUESTIONNAIRE

1. General information

Name of the enumerator ----------

Date of interview ----------

District ---------- Division ---------- Location ----------
Sub Location ---------- Village ----------

2. Respondent information

Name of respondent ----------

Respondent gender: 1= Male [ ], 2 = Female [ ]

Is respondent head of household? 1 = Yes [ ], 2 = No [ ]

If no, relationship to household head : 2 = Spouse [ ], 3 = Son/daughter [ ], 4 = Parent [ ], 5 = Son/daughter in-law [ ], 6 = Grandchild [ ], 7 = Other relative [ ], 8 = Hired worker [ ], 9 = Other (Specify) _____

3. Household (HH) Composition

Please indicate the following details for all persons usually resident in this home. See codes.

S/no. (start with HH Head)	Relation to HH Head (code)	Sex 1 = M 2 = F	Age (years)	Marital Status 1=S 2=M	Education Level (code)	Main occupation (source of income) (code)	**Education level:** 1=None 2= Primary 3= Secondary 4=Tertiary 5=University **Main occupation:** 1=None 2=Livestock 3=Crop farming 4=Employed (Specify) 4=Self, off-livestock/farm (Specify) 9=Other (Specify)
1.							
2.							
3.							
4.							
5.							
6.							
7.							

4. Production Objectives, Circumstances/Status and Strategies

4.1 Pastoralist objectives and aspirations

a) Please mention, in order of importance, 6 values/services you get from your livestock:

i) ---------- ii) ----------

iii) ---------- iv) ----------

v) ---------- vi) ----------

b) Would you say you are a subsistence livestock owner [ ], or commercial [ ]?

c) What future plans do you have for your livestock keeping?

4.2 Management and labour issues

a) Do you have your animals all in one herd [ ], or separated [ ]?

b) If separated, into how many herds [ ], are they mixed species [ ], or separate [ ]?

c) Do you have a separate milking herd for family milk? Yes [ ], No [ ]

d) How much is the production [ ], how much do you consume [ ], sell [ ]?

e) Who looks after your animals, yourself [ ], employed labour [ ], or other [ ] ---?

f) Do you have any problems getting labour? Yes [ ], specify ----------; No [ ]

g) How often do you see ***all*** your animals? [ ] months

h) How often do you get reports of your animals? [ ] months

i) Who makes everyday decisions such as where to go looking for pastures or breeding? Yourself [ ], employee [ ], or other [ ] ----------?

4.3 Constraints in production

a) Please mention, in order of importance, 6 normal constraints you face in your livestock production:

4.4 Access to services

a) How would you rate your access to:
Animal health services? Poor [ ], fair [ ], good [ ], very good [ ]

Financial (loan) services? Poor [ ], fair [ ], good [ ], very good [ ], N/A [ ]

b) Have you ever taken a bank loan for your livestock activities, Yes [ ], No [ ]

4.5 Access to resources

a) Nearest watering point ----------, how far? [ ] km, walking [ ] hrs.

b) Nearest dry season pasture area ----------, how far? [ ] km, walking [ ] hrs.

c) When did it last rain? ---------- (month and year)

c) Compare weather and livestock conditions of last 12 months with previous 5 years: Average [ ], slightly better [ ], much better [ ], slightly worse [ ], much worse [

4.6 Strategies and tactics – mobility

a) When did you come to this village? ----------

b) How often do you move in search of pasture and water? ---------- (months, years)

c) Do you move only part of your livestock [ ], all the herds [ ], whole family [ ]?

d) Last move, when ----------, to where ----------, how far? [ ] km, walking [ ] hrs.

APPENDIX 2 (A): 12 MONTHS LIVESTOCK INVENTORY, TRANSACTIONS AND CHANGES

Please indicate the following details about the Household Livestock Herd(s) **Today** and **in the Last 12 months**

		Numbers of entries during the year				**Numbers of exits during the year**						
Species and category	Number today	Avg. value	Bought	Donated in	Born	Sold	Main reason for sales	Donated out	Consumed	Died	Main cause of deaths	Stolen
All Camels												
Adult males												
Adult females												
Male Calves												
Female Calves												
All Cattle												
Steers												
Entire adult males (≥ 6yrs age)												
Entire adult males (3-6yrs age)												
Immature males (1-3 yrs age)												
Adult cows (≥ 6yrs age)												
Adult cows (3-6yrs age)												

		Numbers of entries during the year				Numbers of exits during the year						
Species and category	Number today	Avg. value	Bought	Donated in	Born	Sold	Main reason for sales	Donated out	Consumed	Died	Main cause of deaths	Stolen
Immature females (1-3 yrs age)												
Male Calves (≤ 1yr age)												
Female Calves (≤ 1yr age)												
All Sheep												
Ewes												
Rams												
Lambs												
All Goats												
Does												
Bucks												
Kids												
All Donkeys												
Others (specify)												

APPENDIX 2 (B): LIFETIME AND 12 MONTHS INDIVIDUAL ADULT COWS' REPRODUCTIVE DATA

Please indicate the following details about **each cow** in the herd **in lifetime & the last 12 months**

Animal Identity	**Age**	**Number of births in lifetime**	**Number of Live Births in last 12 months**	**Sex of offspring 1 = M 2 = F**	**Number of stillbirths in last 12 months**	**Number of abortions in lifetime**	**Number of abortions in last 12 months**

APPENDIX 3: GARISSA LIVESTOCK MARKET STRUCTURE AND CONDUCT SURVEY GUIDING NOTES

5.1 Physical description of market

- Qualitative description of the environment, location and facilities with regard to considerations for disease control, human and animal welfare, general hygiene and ease of operations.
- Market user views of perceived gaps and needs.

5.2 Management structures

- Qualitative description of the Government and market-user institutional arrangements.

5.3 Description of market players, their numbers and roles

- Qualitative and quantitative description of the number of sellers and buyers participating in the market to indicate the degree of concentration and influence on pricing.
- Qualitative and quantitative description of other service providers such as transporters, government officers, middle-men and others affecting the conduct of the market.

5.4 Description of fees and charges

- Qualitative and quantitative description of the fees and charges by the different charging players on their customers for various services.

5.5 Description of costs and incomes – of the sellers, buyers and transporters

5.6 Description of the conduct of business – core and support i.e. buying and selling of livestock, transport, brokerage, veterinary procedures, etc.

APPENDIX 4 (A): AN ASSESSMENT OF THE LIVESTOCK MARKET IN GARISSA COUNTY, KENYA, USING THE WORLD BANK TOOL FOR EVALUATION OF LIVESTOCK MARKETS – LOCATION, ROAD SYSTEM AND UNLOADING FACILITIES

Section 1 - Physical Infrastructure					
S/No.	**Feature**	**Levels of advancement**		**Indicators**	**Remarks/ Assessed Score**
		Marking Score	**Description**		
1.	**Location, road system**	**A well-located market should have easy access for vehicles and walked livestock with roads that are tarmacked to avoid dust, mud and other health problems and traffic congestion.**			
		0	Informal market with no control of livestock	Observation, inspection, map, satellite photograph.	The market had no perimeter fencing, tarmacked road or good facilities, but there was fair control of livestock and adequate access. **2**
		1	Formal market but with no perimeter fencing		
		2	Formal market site with untarmacked road		
		3	Adequate access with tarmacked road		
		4	Good facilities for livestock, human and vehicles		
2.	**Unloading facilities**	**Facilities for unloading livestock should be safe for livestock and their handlers; they should be kept clean and be well sited and able to handle all traffic even at busy times**			
		0	No facilities for loading and unloading livestock vehicles – manual only	Observation, ramp design, maintenance status, ramp numbers and Livestock data	The market had ramps, but they were not well designed and adequate in number. **2**
		1	Ramps unsuitable for purpose		
		2	Ramps badly designed or maintained		
		3	Good ramps but inadequate numbers		
		4	Ramps adequate in number and design, well sited and safe		

APPENDIX 4 (B): AN ASSESSMENT OF THE LIVESTOCK MARKET IN GARISSA COUNTY, KENYA, USING THE WORLD BANK TOOL FOR EVALUATION OF LIVESTOCK MARKETS – LIVESTOCK HOLDING AND INSPECTION

Section 1 - Physical Infrastructure, continued.					
S/No.	**Feature**	**Levels of advancement**		**Indicators**	**Remarks/ Assessed Score**
		Marking Score	**Description**		
1.	**Livestock Holding and Inspection**	**Market staff should be able to hold and inspect groups and individual animals to inspect their identification and health status when they arrive. Facilities should exist to hold suspect animals in isolation.**			
		0	No facilities to restrain animals for inspection on arrival	Observation, pen design, raceway, examination crush, isolation pens	The market had enclosures and crushes, but they were not adequate and most animals were outside enclosures. **1**
		1	Facilities to restrain groups of animals in a pen or yard but not individual animals		
		2	Adequate facilities to restrain all animals for inspection at peak arrival times		
		3	Adequate facilities to restrain individual animals safely		
		4	Facilities to hold animals in isolation		
2.	**Livestock Holding system**	**Livestock in a market should be held separately for disease control purposes.**			
		0	No system to restrain animal in separate locations	Pens, rails or tying points, observation	Animals of different species and sources were separated, but not by physical structures. **2**
		1	Little separation of stock and frequent mixing.		
		2	Sub-division of livestock is not complete		
		3	Separate pens or rails for livestock in individuals or groups from the same source		
		4	Well-designed pens and raceways that allow safe movement of animals and people		

APPENDIX 4 (C): AN ASSESSMENT OF THE LIVESTOCK MARKET IN GARISSA COUNTY, KENYA, USING THE WORLD BANK TOOL FOR EVALUATION OF LIVESTOCK MARKETS – WEATHER PROTECTION, WATER AND FEED

Section 1 - Physical Infrastructure, continued.					
S/No.	**Feature**	**Levels of advancement**		**Indicators**	**Remarks/ Assessed Score**
		Marking Score	**Description**		
1.	**Weather Protection**	**Livestock should be protected from excessive prevailing weather – e.g. hot sun or, cold winds or rain**			
		0	No protection for livestock from prevailing weather extremes	Observation, shades, walls, buildings, weather data, maintenance data	All animals in the market were kept outside under the sun, but new sheds under construction were seen in a later visit. **1**
		1	Partial protection from prevailing weather but not for all animals		
		2	Protection from weather part of year but unsuitable year-round		
		3	All animals have some suitable protection but not well-maintained		
		4	Well-designed and maintained shelter suitable for prevailing weather		
2.	**Water and Feed**	**Depending on the length of stay in a market and the prevailing weather, livestock should be provided with water and/or food**			
		0	No facilities for provision of water or food	Observation, water troughs, individual bowls or nipples, nets or feed troughs	The market had water troughs that were inadequate in number and maintenance. There were no feed troughs**.** **1**
		1	Facilities available but inadequately maintained for effective use		
		2	Drinking facilities available but no permanent access by all stock		
		3	Communal drinking facilities with permanent access by all stock		
		4	Separate water and food supply to each pen		

APPENDIX 4 (D): AN ASSESSMENT OF THE LIVESTOCK MARKET IN GARISSA COUNTY, KENYA, USING THE WORLD BANK TOOL FOR EVALUATION OF LIVESTOCK MARKETS – GROUND DRAINAGE AND OFFICES

Section 1 - Physical Infrastructure, continued.					
S/No.	**Feature**	**Levels of advancement**		**Indicators**	**Remarks/ Assessed Score**
		Marking Score	**Description**		
1.	**Ground Surface and Drainage**	**Market place flooring should be suitable for safe and hygienic livestock handling all year round, allow cleaning and prevent run-off to cause environmental pollution**			
		0	Waste management problems and no special flooring	Observation, presence of waste, environmental assessment, site-plans and inspections	The market grounds were flat and covered with sand. There were no facilities for drainage or waste disposal. Manure and carcasses were left to dry in the sun and the market was littered with polythene papers. **0**
		1	No waste management capability		
		2	Modified flooring and some attempt to solve waste management and drainage problems		
		3	Waste management problems not fully corrected by modified flooring and drainage		
		4	Purpose–built flooring with effective drainage and waste storage facilities		
2.	**Market Office**	**Markets should have functional offices with adequate facilities**			
		0	No market office	Site –plan, observation, inspection	Market officers worked in an office shed with only I table and chair. **1**
		1	Market office with inadequate facilities to function effectively		
		2	Market office is fully functional		

APPENDIX 4 (E): AN ASSESSMENT OF THE LIVESTOCK MARKET IN GARISSA COUNTY, KENYA, USING THE WORLD BANK TOOL FOR EVALUATION OF LIVESTOCK MARKETS – TOILETS, WEIGH SCALES AND VEHICLE WASHING

Section 1 - Physical Infrastructure, continued.					
S/No.	**Feature**	**Levels of advancement**		**Indicators**	**Remarks/ Assessed Score**
		Marking Score	**Description**		
1.	**Public Toilet Facilities**	**All markets should have adequate hygienic toilet and washroom facilities for staff and patrons**			
		0	No toilets	Site –plan, observation, inspection	There were toilets under construction. **1**
		1	Toilets are inadequate in number and quality for hygienic use		
		2	Hygienic toilets and hand-wash facilities are used		
2.	**Weigh Scales**	**All markets should provide livestock weigh scales**			
		0	No weigh-scales	Site –plan, observation, inspection	The market had no weighing scales. **0**
		1	Weigh scales not operative		
		2	Weigh-scales operative and used		
3.	**Truck Wash**	**All markets should have facilities for cleaning and disinfecting trucks and disposal of waste**			
		0	No truck cleansing capability	Site –plan, observation, inspection	There were no truck cleansing facilities in the market. **0**
		1	Truck cleansing capability inadequate		
		2	Truck cleaning capability adequate with strong waste control		

APPENDIX 4 (F): AN ASSESSMENT OF THE LIVESTOCK MARKET IN GARISSA COUNTY, KENYA, USING THE WORLD BANK TOOL FOR EVALUATION OF LIVESTOCK MARKETS – MANAGEMENT STRUCTURE AND LIVESTOCK INSPECTION

Section 2 - Organizational Infrastructure					
S/No.	**Feature**	**Levels of advancement**		**Indicators**	**Remarks/ Assessed Score**
		Marking Score	**Description**		
1.	**Management Structure and Policy**	**Regardless of its size, a market should have a well-defined management structure which ensures strong application of national regulations to allow application of disease control protocols that safeguard livestock and human health and welfare, maintenance and cleanliness**			
		0	No coordinated market management structure	Management structure, observation, records, written policy, financial records, reports	The institutions involved in management held ad hoc meetings to solve problems but there were no written protocols. **2**
		1	Management is unstructured and results in poor running and upkeep		
		2	Structured management but no written policy, weak organization and poor control of practices, including animal welfare		
		3	Market is run efficiently and maintained in good condition but has no regular financial inputs		
		4	Management is effective in all aspects including financial status		
2.	**Livestock Inspection**	**All livestock should be inspected on arrival and movement details of source and identifications should be collected; any animals requiring testing or treatment should be handled according to written instructions**			
		0	No inspection of livestock on entry	Observation, records, written protocols, inspection of facilities and market place activity, data collection, laboratory results	Incoming livestock were not inspected and only CBPP testing was done for outgoing animals. **2**
		1	Cursory inspection with no data recorded		
		2	Some inspection of stock but incomplete protocols		
		3	Complete status recording with ability to isolate or treat clinical cases		
		4	Accurate livestock identification and health status recording of all animals with ability to collect samples or apply vaccination as necessary		

APPENDIX 4 (G): AN ASSESSMENT OF THE LIVESTOCK MARKET IN GARISSA COUNTY, KENYA, USING THE WORLD BANK TOOL FOR EVALUATION OF LIVESTOCK MARKETS – STAFF TRAINING AND MARKET INSPECTION

Section 2 - Organizational Infrastructure, continued					
S/No.	**Feature**	**Levels of advancement**		**Indicators**	**Remarks/ Assessed Score**
		Marking Score	**Description**		
1.	**Staff Training and Audit**	**All staff should be trained in practical skills to ensure the health and welfare of livestock and people at the market**			
		0	No staff training program.	Staff list, details of training programs, course details and curricula, results of training, audit reports	Staff was posted in the market on their separate technical qualifications and there was no special training on market duties. **0**
		1	Only some staff trained but not all		
		2	Staff training program covers all staff		
		3	Trained staff ensure good practice by animal owners and traders		
		4	Routine program to audit staff proficiency.		
2.	**Market Inspection Service**	**All markets should be inspected by an independent inspectorate on a continual basis to ensure that all regulations are being correctly applied and both animal and human welfare are protected.**			
		0	No independent market inspections	Written details of inspection program, inspection reports, observation, written records of improvements, market reports	The Headquarter and Provincial Veterinary and Livestock officers only visited occasionally on tour or during special problems such as market closure or cattle thefts. **0**
		1	Irregular inspections		
		2	Inspection reports do not relate to observed status		
		3	Inspection reports and recommendations are followed		
		4	Efficient reporting system and prompt action to correct weaknesses		

APPENDIX 5 (A): GARISSA LIVESTOCK MARKET PERFORMANCE DATA COLLECTION SHEET – <u>FOR SELLERS</u>

Date: ---/---/----- Name of trader: ------ Origin of livestock: Local [ ], Cross-border [ ]; **Means of livestock transport:** Truck [ ], Trek [ ] **Name of origin:** …… **Costs and cost items (KShs):** Transport ----; Food & accommodation -----; Total route & market taxes -------

Animal sex and age category	**Cattle Breed** Shawar (Zebu) = 1 Aadey (Boran) = 2 Gadud (Sahiwal) = 3	**No. brought to market**	**Purchase price at origin (KShs)**	**No. sold today**	**Unit selling price (KShs)**	**Total sales (KShs)**	**No. left over unsold**
Cattle Males							
Steers							
Adults > 6 years							
Immatures 3 – 6 years							
Young < 3 years							
Cattle Females							
Adults > 6 years							
Immatures 3 – 6 years							
Young < 3 years							
All Camels							
All Goats							
All Sheep							

Detail taxes here:

APPENDIX 5 (B): GARISSA LIVESTOCK MARKET PERFORMANCE DATA COLLECTION SHEET – FOR BUYERS

Date: -------/-------/---------- **Name of trader:** ----------

Destination of livestock: ---------- **Means of livestock transport:** Truck [ ], Trek [ ]

Costs and cost items (KShs): Transport ----------; Food & accommodation ----------; Total route & market taxes ---------

Animal sex and age category	**Cattle Breed** Shawar = 1 Aadey = 2 Gadud = 3	**No. bought**	**Unit purchase price (KShs)**	**Total purchase price (KShs)**	**Purpose** Slaughter = 1 Fattening = 2 Breeding = 3 Draught power = 4	**Detail taxes here:**
Cattle Males						
Castrates						
Adults > 6 years						
Immatures 3 – 6 years						
Young < 3 years						
Cattle Females						
Adults > 6 years						
Immatures 3 – 6 years						
Young < 3 years						
All Camels						
All Goats						
All Sheep						

END