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Role of Beef Production and Marketing in Enhancing Welfare of the Communities in Arid and Semi-Arid Lands in Kenya

Baragu Geoffrey and Tobias Opana

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Abstract

The beef sector plays a significant role in the livelihoods of communities in Kenya's arid and semi-arid lands (ASALs). Despite the importance of beef production, ASAL communities continue to experience high poverty rates. By leveraging the sustainable livelihoods framework and employing Ordinary Least Squares (OLS) regression, this study analyses the relationship between beef production, marketing, and welfare in ASAL communities. Financial, social, and physical capital are important in improving welfare. With regards to beef marketing, commercial livestock farming households and paved county roads had significant negative correlations with monetary poverty. Aridity levels were also found to have a statistically significant influence on monetary poverty, implying the need for targeted policies that acknowledge the distinct economic and environmental conditions of ASALs. To enhance access to formal financial services in ASALs, the recommendation is to establish strategic partnerships with mobile money providers and leverage innovative insurance products such as weather-indexed insurance. In addition, to strengthen commercial livestock farming, this study advocates the formation of cooperatives or associations among beef farmers in ASALs, aiming to bolster their bargaining power and broaden market access. Prioritizing investment in crucial transportation routes connecting beef-producing regions to markets is also imperative for optimizing the physical capital in ASALs. Finally, due to the correlation between high aridity levels and heightened monetary poverty, it is important to have targeted interventions based on aridity levels. Specifically, for purely arid counties, this study proposes the introduction of feedlot initiatives as a strategic approach to fortify beef production and marketing. This would provide a controlled environment for livestock production, thereby safeguarding cattle farmers vulnerable to climate-induced shocks.

Abbreviations and Acronyms

ASALs	Arid and Semi-Arid Lands
GDP	Gross Domestic Product
KIPPRA	Kenya Institute for Public Policy Research and Analysis
KNBS	Kenya National Bureau of Statistics
MoALF	Ministry of Agriculture, Livestock and Fisheries
NIPFN	National Information Platform for Food Security and Nutrition
OLS	Ordinary Least Squares
SLA	Sustainable Livelihood Approach

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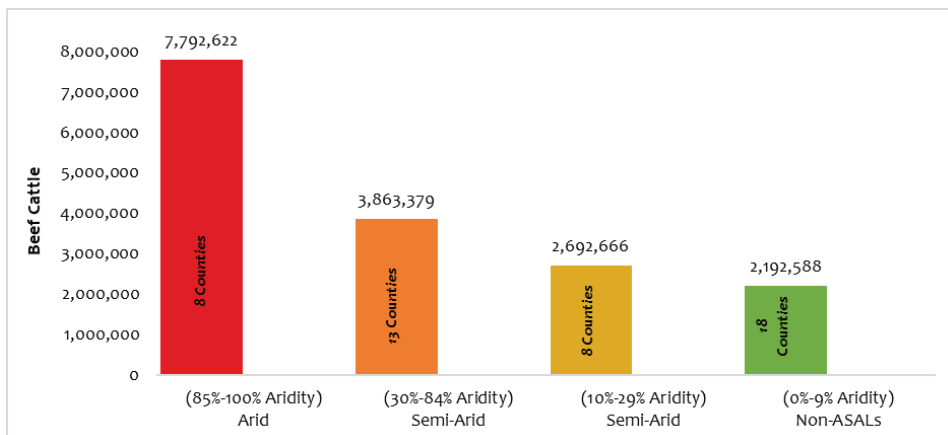
1. Introduction

Kenya's arid and semi-arid lands (ASALs) heavily rely on livestock for income, employment, and food security. Notably, livestock production is the predominant economic activity within ASALs, supporting the livelihoods of over 14 million people and approximately 70 per cent of the nation's livestock population (Omollo et al., 2018). Moreover, approximately 4.7 million households in the country engage in livestock keeping, contributing 3.6 per cent to the overall GDP and 16 per cent to the Agricultural GDP (KNBS, 2023).

Variations in ecological characteristics and economic conditions of Kenya's ASALs collectively influence the livestock landscape and its significance across different regions, mainly for pastoral and agro-pastoral households for whom livestock is a crucial asset (Gichure et al., 2020). Counties categorized as ASALs generally exhibit high ambient temperatures and humidity, low and erratic rainfall, and poor soil (MoALF, 2019). However, the economic dynamics vary depending on the counties' aridity level. Purely arid counties rely primarily on mobile pastoralism as their dominant economic activity, while semi-arid counties benefit from better water availability and infrastructure and exhibit a more mixed economy. The semi-arid areas encompass a mix of rain-fed and irrigated agriculture, agro-pastoralism, agribusiness, and activities related to conservation or tourism.

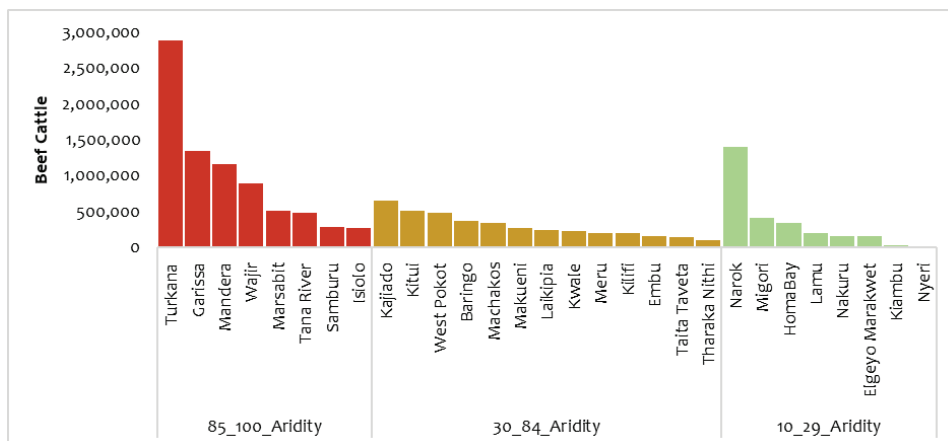
These distinct ecological conditions and economic dynamics among arid and semi-arid counties ultimately shape the livestock profile across ASAL and non-ASAL regions. According to data from the National Information Platform for Food Security and Nutrition (NIPFN) collected by the Kenya National Bureau of Statistics (KNBS) in 2020, the total livestock population in Kenya was estimated at 148.9 million of which Cattle accounted for 15 per cent of the total livestock population, with an estimated population of 21.6 million; 76 per cent (16.5 million) were beef cattle, while 24 per cent (5.1 million) were dairy cattle. Notably, 87 per cent (14.4 million) of beef cattle were in ASALs, signifying the reliance of ASAL communities on beef cattle. In comparison, the distribution of beef cattle across Kenya and within ASALs emphasizes the significance of beef cattle in supporting livelihoods and the economy in ASALs.

Figure 1.1: Distribution of Beef Cattle in ASAL and non-ASAL Regions by Aridity



Source of Data: NIPFN, 2020

Figure 1.1 depicts the distribution of beef cattle across counties with varying levels of aridity. Aridity is determined by examining long-term trends in evapotranspiration and precipitation. Aridity levels are considered higher when the rate of water loss from the soil to the atmosphere exceeds the amount of precipitation (State Department for Development of the Arid and Semi-Arid Lands, 2018). In purely arid counties, characterized by 85-100 per cent aridity, there is a high concentration of 7.79 million beef cattle, accounting for 54 per cent of the total number in ASALs. In contrast, there are 3.86 million beef cattle spread across 13 semi-arid counties with aridity levels between 30 and 84 per cent, which is equivalent to 27 per cent of beef cattle in ASALs. An additional 2.69 million beef cattle are found in eight semi-arid counties with aridity ranging from 10-29 per cent, representing 19 per cent of beef cattle in ASALs. Non-ASAL counties, encompassing 18 regions with an aridity range of 0 to 9 per cent, have a total of 2.19 million beef cattle, accounting for 13 per cent of beef cattle in Kenya. A more detailed glance at ASAL counties is depicted in Figure 1.2.

Figure 1.2: Number of Beef Cattle in ASAL Counties in Kenya

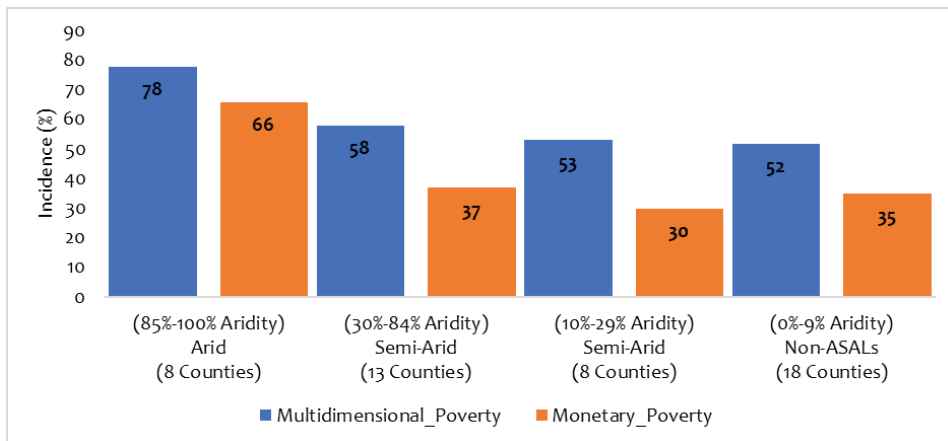
Source of data: NIPFN, 2020

Figure 1.2 above illustrates the number of beef cattle per county by level of aridity. Turkana had the largest beef cattle population, at 2.9 million. Narok, Garissa, and Mandera followed closely, each with a population exceeding one million beef cattle. Except for Narok County, which had an aridity level of 10 to 29 per cent, counties with the highest aridity ranging from 85 to 100 per cent essentially had more beef cattle.

The substantial number of beef cattle in ASALs emphasizes the critical role that livestock production has as a source of income for households, offering economic stability and resilience in the face of climatic change and limited agricultural alternatives. As a predominant source of livelihood, accounting for 90 per cent of employment and more than 95 per cent of family incomes (Nyariki & Amwata, 2019), livestock production helps diversify income sources and mitigate the vulnerability of ASAL communities to external shocks. Hence, the sale of beef cattle and associated products contributes to household incomes, allowing families to meet their basic needs and invest in education, health, and other essential services.

Given the significant contributions that livestock production makes to household incomes in ASALs, it is essential to acknowledge the hurdles that emerge when the income does not translate to enhanced welfare. ASAL communities become disproportionately affected by poverty despite the deep dependence on livestock production. The Kenya Economic Report 2020 highlights that counties situated in the ASAL regions exhibit low Gross County Product (GCP) per capita, correlating with higher poverty rates in Kenya (KIPPRA, 2020). These socio-economic challenges faced in ASAL regions call for a rigorous examination of the intricacies that underlie the connections between beef production, market dynamics, and the overall welfare of these communities. This is because the constraints faced ultimately impact the well-being of ASAL populations, as underscored by the reliance on beef cattle and the high poverty headcount ratios in ASALs. Figure 1.3 shows how poverty rates vary across counties based on aridity.

Figure 1.3: Incidence of Multidimensional and Monetary Poverty in ASAL Counties



Source of data: KNBS, Comprehensive Poverty Report, 2020

It can be observed that as the level of aridity increases, the welfare of communities tends to decrease. Areas with higher aridity tend to have a greater incidence of both multidimensional and monetary poverty. Based on data from the Comprehensive Poverty Report, on average, purely arid counties had an incidence of 78 per cent in multidimensional poverty and 66 per cent in monetary poverty. The average incidences of multidimensional poverty and monetary poverty were 58 per cent and 37 per cent, respectively, in semi-arid counties with aridity levels ranging from 30 to 84 per cent. Comparatively lower average rates of multidimensional (53 per cent) and monetary (30 per cent) poverty were observed in semi-arid counties with the least amount of aridity (10–29 per cent). Non-ASAL counties had the lowest incidence of multidimensional poverty, with only 52 per cent of people affected, and the second lowest monetary poverty rate affecting 35 per cent of people residing in these counties.

This paper, therefore, aims to explore the relationships encompassing beef production, beef markets, and the well-being of communities in Kenya's arid and semi-arid lands. More precisely, the study endeavours to investigate the effects of beef production on the well-being of ASAL communities while concurrently scrutinizing the consequential role of beef marketing in shaping the socio-economic welfare of these communities. The specific objectives of the study are as to: Investigate how the welfare of communities in ASALs is influenced by beef production and Examine the importance of marketing beef on the welfare of communities in ASALs.

The rest of the paper is structured as follows: Section 2 reviews relevant literature, providing context and identifying gaps. Section 3, details the methodology. Section 4 presents the empirical findings Section 5 concludes

2. Literature Review

This section outlines the theoretical and empirical literature reviewed to inform the study. The Sustainable Livelihood Approach (SLA) forms the theoretical basis of the study. Available empirical literature is reviewed, and gaps are identified.

2.1 Theoretical Literature

2.1.1 Sustainable Livelihoods Approach

The sustainable livelihoods approach refers to a framework that contextualizes livelihoods in terms of people's access to different capital assets. It examines the various resources, capabilities, and strategies people use to make a living and improve their well-being. The five different types of core asset categories that people can draw upon to sustain their livelihoods include natural, human, social, physical, and financial capital. Natural capital encompasses the valuable reserves of natural resources, including land, water, forests, and biodiversity, that are accessible to individuals and communities.

In the context of beef cattle production in arid and semi-arid lands, natural capital plays a vital role by offering abundant grazing lands and reliable water sources (Campbell et al., 2002). These natural resources form the foundation for sustainable agricultural activities, enabling the thriving production of beef cattle in these challenging environments. Erenstein, Hellin, and Chandna (2007) also identified the herd size (number of livestock) as an indicator of natural capital. Human capital, on the other hand, represents the knowledge, skills, abilities, and health of individuals. In the context of beef cattle production, human capital can include indicators such as population density, labour availability, education, and other relevant skills necessary for sustainable cattle production (Erenstein et al., 2007). Social Capital, which refers to the social relationships, networks, and institutions that facilitate cooperation, trust, and collective action, also plays a vital role. In the context of beef cattle production, social capital involves access to markets, access to government, and membership in organizations such as community organizations, cooperatives, and self-help groups (Tacoli, 1999).

Physical capital encompasses the infrastructure, tools, equipment, and technologies that support livelihood activities. For beef cattle production, physical capital includes transportation facilities, roads, buildings such as slaughterhouses, water supply (storage and distribution systems), and technology (Adato & Meizen-Dick, 2002).

Lastly, financial or economic capital represents the monetary resources available to individuals and communities to invest in their livelihood activities. It includes savings, access to credit, the number of livestock, as well as inflows (income/remittances) such as state transfers (Adato & Meizen-Dick, 2002; Campbell et al., 2002; Erenstein et al., 2007; Quandt, 2018). Financial capital is essential for investing in cattle, purchasing inputs such as fodder and veterinary services, and adapting to changing market conditions.

2.1.2 Social Exchange Theory

The study also acknowledges the social exchange theory, which was initiated by Homans in 2015. The theory was developed to understand the social behaviour of humans in economic undertakings. Exchange theories make use of rewards, costs and resources when discussing the foundation of interpersonal exchange. Chernyak-Hai (2018) opined that the key tenet of social exchange theory is that human behaviour is, in essence, an exchange, particularly of rewards or resources of primarily material character (wealth). The theory views actors as dealing not with another actor but with the market responding to various market characteristics. It proposes that social behaviour is the result of an exchange process. Social ties among market actors are seen as conduits for information about exchange opportunities and conduits for trust; stronger social relations allow for the sharing of more complex information between the buyer and seller than simply price and quantities Podolny (1992).

The theory also proposes that human beings always act under constraints, but they still compete with one another in seeking to make profits in their transactions. The purpose of this exchange is to maximize benefits and minimize costs. According to this theory, people weigh the potential benefits and risks of social relationships. When the risks outweigh the rewards, people will terminate or abandon that relationship. There are several actors in livestock marketing, and this theory can explain their dealings. Actors, in exchange, are not only individuals but also groups. In-group processes and intergroup relations are more complex than being sets of market transactions, Blau (2017). The actors are the traders, producers and the middlemen.

2.2 Empirical Literature

In their study, Kristjanson et al. (2009) highlighted the significance of asset-based approaches in comprehending poverty dynamics in Kenya. Their study adopted an asset-based approach to examine reasons for long-run household poverty transitions across Kenya and how these transitions differed depending on the major livelihood opportunities available. The livelihood-based approach established connections between livelihood assets and the activities, such as crop and livestock production that individuals engage in to meet their needs and enhance their welfare. They examined a stratified sample of 4,773 households extracted from Kenya's 2005-6 Integrated Household Budget Survey, which had been stratified based on poverty incidence, agroecological zones, and market access.

The findings of the study were presented and interpreted through the lens of livelihood zones, that is, areas where people shared similar livelihood patterns - common crops, livestock types, or activities. One key insight revealed that the pastoral livelihood zone, encompassing regions in northern and northeastern Kenya (such as Wajir, Marsabit, and Tana River), experienced the highest net increase in poverty, amounting to 27 per cent over 15 years from 1990 to 2005. Drought was identified as one of the key factors accounting for 24 per cent of all

observed instances of increased poverty (Kristjanson et al., 2009). The impact of drought was most profound in pastoral and agro-pastoral regions, explaining over two-thirds of the poverty increase in northern and northeastern Kenya and a 21 per cent increase in the agro-pastoral zone. Livestock-related losses due to diseases and predators were another significant cause of the increase in poverty, constituting 17 per cent. Predominantly occurring in pastoral and agro-pastoral zones, these losses were associated with diseases such as foot rot, East Coast Fever, anthrax, and pneumonia. The study also identified five primary reasons associated with escaping poverty in Kenya. These factors included diversification of income sources, engagement in formal sector employment, crop-related, livestock-related, and social factors (Kristjanson et al., 2009). Notably, over a third of households successfully exited poverty through livestock-related strategies, which varied across different livelihood zones.

Using cross-sectional data, Mwangi et al. (2020) assessed beef production between pastoralism and large-scale ranchers. Gross margin analysis showed that beef production is profitable for pastoralists and large-scale ranchers. However, the study reveals significant differences in the live weight of cattle, prices, livestock selling channels and cost of production. Drought, livestock diseases, invasive plant species, lack of water and human-wildlife conflict were among the factors limiting the productivity of pastoralists. The pastoralists are recommended to improve their earnings through product, process, and functional upgrading through strategies and programs enhancing cattle fattening, provision of livestock extension services, affordable feed inputs and collaboration between the two production systems. However, the study is limited because it does not reveal the significance of beef production to the welfare of the people living in ASALs.

Using Rural Agricultural Livelihoods Survey data, Namonje-Kapembwa, Chiwawa, and Sitko (2022) investigated the factors influencing herd sizes and access to livestock markets for smallholder livestock farmers in Malawi. While employing probit analysis, their study determined that the selection of appropriate marketing channels for livestock products is influenced by different factors such as herd size, gender of the decision maker, transaction costs, and geographical location. In particular, herd size was influenced by several underlying variables, including the age of the household head, household size, prevailing management practices, landholding size, and supplementary off-farm income sources. Additionally, livestock marketing groups were found to be effective in increasing the profits of small-scale farmers. These collective associations are instrumental in reducing transaction costs, improving market access, and facilitating more favourable price negotiations for livestock (Namonje-Kapembwa et al., 2022).

Jones (2022) conducted empirical research examining the impact of livestock marketing on the livelihoods of pastoralists in Kenya. The study identified challenges hindering effective livestock and livestock product trade in ASALs. These challenges encompass various geographical, economic, political, and social issues. The study further identified critical stakeholders in livestock marketing, noting that most positively impact the sector. However, there needs to be more coordination among these stakeholders, including government agencies, despite resource constraints. Other entities like NGOs, livestock marketing associations,

civic authorities, and transporters also play vital roles.

Despite the presence of livestock marketing stakeholders, poverty persists, highlighting the need to reassess development strategies. The findings of this study revealed that the persistent poverty in arid and semi-arid land (ASAL) counties can be attributed to several factors within the livestock marketing system. These factors include inadequate market structures, deficient slaughterhouses, limited processing facilities, inadequate stock routes, insufficient holding grounds, absence of disease-free zones, and inadequate water facilities (Jones, 2022). However, it is important to note that this study was primarily a desk-based review. It did not delve into a comprehensive analysis of the livestock marketing system in ASALs or its direct influence on livelihoods.

3. Methodology and Data Sources

3.1 Empirical Framework

This study investigates the influence of beef production and marketing on the welfare of individuals residing in Kenya's ASALs. This objective is intertwined with the five capital assets outlined within the sustainable livelihoods approach. Quandt (2018) examined various studies that employed the sustainable livelihoods approach to identify the fundamental variables used by various authors to quantify and assess the five capital assets. In the context of beef production and marketing, the following factors emerge as particularly pertinent:

Table 3.1.1: The Five Capitals Assets as Reviewed by Quandt (2018)

Natural Capital	Financial Capital	Human Capital	Social Capital	Physical Capital
Land 1	Credit	Labour Availability 1,2	Access to Markets 2	Household Assets
Farm Size	Savings	Population Density	Cooperative Societies	Roads 2
Herd Size 1	Bank Facilities 1	Skills	Self-Help Groups	Water Supply
Freshwater Availability			Access to Opportunities 1	Distance to the Nearest Town
			Networks 1	Access to Paved Roads 2

Source: Quandt (2018)

Note: 1 denotes indicators pertinent to beef production, while 2 denotes indicators specific to beef marketing. These five capitals can and do overlap.

Table 3.1.1 forms the basis of our inquiry into the potential beef production and marketing factors that influence the welfare of ASAL communities. The sustainable livelihoods framework recognizes that the welfare of ASAL communities is affected by factors that can be grouped according to the five capital assets.

Welfare can, therefore, be outlined as a function of the capital assets that represent beef production and beef marketing, respectively. The economic model can be written as follows:

$$welfare = f(\text{beef production}_{(capital\ assets)}, \text{beef marketing}_{(capital\ assets)})$$

Welfare refers to the overall well-being and quality of life of individuals or communities. It is proxied by the monetary poverty. Welfare is thus closely linked to the financial resources available to households to fulfil their basic needs and

improve their living conditions. The Comprehensive Poverty Report (KNBS, 2020) describes monetary poverty as a measure that assesses the economic capacity of households to provide essential goods and services necessary for survival and development. Furthermore, Amartya Sen's (1981) entitlements theory emphasizes the importance of the entitlement set, representing all alternative goods an individual can acquire in exchange for their possessions or endowment set. This endowment set can be acquired through various means such as production (e.g., farming), labour provision, trade, or transfers through bequests or benefactions. The collapse in the endowment set leads to a collapse of the entitlement set. Therefore, poverty is defined as a situation in which the welfare derived from the command over resources of a household falls below a certain minimum welfare level called the poverty threshold (Hartog & Hagenars, 1988). This command over resources is tied to monetary resources. Therefore, monetary poverty captures income, expenditure and consumption patterns and is more sensitive to socio-economic shocks and benefits received, making it a good proxy of the achieved living standard (House & Suppa, 2016).

This study also adopts the Dodsworth (1972) definition of beef production as the process of raising beef cattle from birth to slaughter. This definition is particularly significant in ASALs due to the unique challenges and opportunities these regions present, such as limited water and infrastructure. Beef production in ASALs requires specialized approaches that optimize the resources available. Beef producers must navigate production and marketing constraints for sustainable operations. By extension, beef marketing refers to the activities and processes involved in promoting, distributing, and selling beef cattle, beef and beef-related products produced through the entire lifecycle of raising beef cattle, from birth to slaughter (Dodsworth, 1972).

Table 3.1.2 outlines the variables adapted to beef production and marketing that serve as proxies for the five capital assets and how they are measured and described.

Table 3.1.2: Measurement of Variables

Category	Capital Assets	Proxy Variables	Measurement	Description
Dependent Variable		Monetary Poverty	Incidence of monetary poverty per County	This variable is used as a proxy for welfare.

Beef Production	Natural Capital	Beef cattle	Number of Beef Cattle per Capita	This variable relates to beef production as it signifies the availability of beef cattle per person. It is a critical factor in assessing the capacity for beef production within a given area. Higher numbers suggest a higher capacity for beef production.
	Human Capital	Exclusively Livestock Farming Households	Number of Exclusively Livestock Farming Households	This variable is linked to beef production through labour availability. Households engaged exclusively in livestock farming often dedicate their resources to rearing and managing livestock, including labour, land, and capital. These households are likely to have a higher availability of labour for tasks related to cattle rearing and management. Therefore, a higher number of exclusively livestock farming households within a region signifies labour availability and commitment to beef production in that area.

	Financial Capital	Formal Financial Inclusion	Proportion of Population with Access to Regulated Sources of Finance Such as Banks and Digital Mobile Money Platforms	This variable is associated with beef production. Formal financial inclusion indicates the level of access and integration of livestock farmers into formal financial systems. It represents the extent to which financial services such as loans and insurance are available to households. This can impact the production of beef by influencing investment capacity. Formal financial inclusion can enable farmers to invest in higher-quality cattle and improve their farming practices, potentially leading to enhanced production and higher-quality beef.
Beef Marketing	Social Capital	Commercial Livestock Farming Households	Number of Households Doing Commercial Livestock Production	This variable is closely tied to beef marketing. Livestock commercialization involves shifting production from mostly home consumption to selling a significant share of the product (Kristjanson et al., 2009). Commercial livestock farming households are more likely to engage in livestock-related businesses, which include selling beef or beef products. They play a crucial role in marketing channels and existing trade networks.

	Physical Capital	Paved County Roads	Proportion of Paved County Roads	This variable primarily signifies an infrastructure conducive to marketing activities, as it allows for easier and faster movement of goods. This is especially important in the perishable goods sector, like beef. A higher proportion of paved roads within a county could enhance the efficiency of transporting beef products to markets. It can reduce transportation costs, decrease spoilage, and increase the reach of markets, all of which are significant factors in marketing.
ASALs Categorical Variable	Aridity	1 = Purely Arid (85-100 Aridity)	This variable allows us to compare the significance of welfare disparities across counties based on aridity levels	
		2 = Semi-Arid		
(30-84 Aridity)				
		3 = Semi-Arid – Pockets		
(10-29 Aridity)				
		4 = Non-ASALs		

Source: Authors

The econometric model can be specified as follows:

$$\begin{aligned}
 y = & \beta_0 + \beta_1 \left\{ \begin{array}{l} \text{Beef} \\ \text{Cattle} \end{array} \right\} + \beta_2 \left\{ \begin{array}{l} \text{Exclusively} \\ \text{Livestock} \\ \text{Farming} \\ \text{Households} \end{array} \right\} + \beta_3 \left\{ \begin{array}{l} \text{Formal} \\ \text{Financial} \\ \text{Inclusion} \end{array} \right\} + \\
 & \beta_4 \left\{ \begin{array}{l} \text{Commercial} \\ \text{Livestock} \\ \text{Farming} \\ \text{Households} \end{array} \right\} + \beta_5 \left\{ \begin{array}{l} \text{Paved} \\ \text{County} \\ \text{Roads} \end{array} \right\} + \beta_6 \{ \text{Aridity} \} + \varepsilon_i
 \end{aligned}
 \tag{1}$$

$$\varepsilon_i \sim N(0, \sigma^2) \quad i = 1, \dots, n$$

Where the expression $\varepsilon_i \sim N(0, \sigma^2)$ denotes that the error term ε_i is normally distributed with a mean of 0 and a variance of σ^2 .

3.2 Data Sources and Description of Variables

The study employed cross-sectional county-level (47 counties) data gathered from various sources to explore the socio-economic implications of beef production and marketing dynamics in Kenya’s arid and semi-arid lands (ASALs. All the variables are continuous. The data sources are as follows:

Table 3.2.1: Data Sources

Variables		Source of Data
Independent Variable	Monetary Poverty	Comprehensive Poverty Report, KNBS 2020
Beef Production Variables	Number of Beef Cattle Per Capita	The National Information Platform for Food Security and Nutrition (NIPFN), 2020
	Exclusively Livestock Farming Households	Kenya Population and Housing Census, 2019
	Formal Financial Inclusion	FinAccess Household Survey Report, 2021
Beef Marketing Variables	Commercial Livestock Farming Households	Kenya Population and Housing Census, 2019

	Proportion of Paved County Roads	Commission on Revenue Allocation - State of Inequality in Kenya Report, 2020
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3.3 Descriptive Statistics

This section discusses the descriptive statistics of the data and the outcome of the Ordinary Least Squares regression. As depicted in Figure 4.1, the mean, standard deviation, minimum, and maximum values of the variables are shown for ASAL and non-ASAL counties. These statistical insights provide a groundwork for our exploration into the spatial dynamics that influence beef production and marketing in the ASAL context.

Table 3.3: Descriptive statistics

		Observations		Mean		Std. Dev.		Min		Max	
		ASALs	Non-ASALs	ASALs	Non-ASALs	ASALs	Non-ASALs	ASALs	Non-ASALs	ASALs	Non-ASALs
Independent Variable	Monetary Poverty	29	18	42.97	35.07	17.79	11.3	18.9	16.6	78.5	68.2
	Number of Beef Cattle Per Capita	29	18	0.67	0.115	0.649	0.105	0.004	0.003	3.048	0.39
	Exclusively Livestock Farming Households	29	18	20884	8590	15386	3170	3024	4678	58691	15104
Beef Production	Formal Financial inclusion	29	18	79.16	84	9.801	6.241	57.7	73.9	93.8	95
	Commercial Livestock Farming Households	29	18	18092	33093	21011	23761	582	1704	81814	81226
Beef Marketing	Proportion of Paved County Roads	29	18	1.609	5.161	1.925	9.281	0.1	0.3	7.6	38.6

Source: Authors

On average, ASAL counties exhibit a higher incidence of monetary poverty, with an average of 43 per cent compared to 35 per cent in non-ASAL counties. This underscores the monetary deprivations faced by ASAL communities. Additionally, variables related to beef production highlight the significant role of ASAL counties in livestock farming. ASAL counties have a substantially higher number of beef cattle per capita, standing at 0.67, as opposed to non-ASAL counties with 0.12. This highlights the prominence of beef production as a livelihood strategy in counties with high aridity levels.

An analysis of the predominant household economic activities underscores the prevalence of livestock-centric livelihoods in ASALs. Specialization in livestock-related activities is higher within ASAL communities, as signified by the number of households exclusively engaged in livestock production. On average, ASAL counties have 20,884 such households, which is substantially higher than the 8,590 households in non-ASAL counties. Differences in access to formal financial inclusion are also apparent across these regions. The average proportion of people with access to formal/regulated sources of finance in ASAL counties is 79 per cent compared to 84 per cent in non-ASAL counties.

The data reveals that non-ASAL regions dominate for marketing indicators. For example, ASAL counties have fewer households engaged in commercial livestock production, with an average of 18,092 households, in contrast to non-ASAL counties, which have an average of 33,093 such households. Moreover, only 1.6 per cent of county roads in ASAL counties are paved compared to 5.2 per cent in non-ASAL counties. These infrastructural disparities could have a considerable impact on connectivity, market access, and transportation systems within these regions.

4. Results

This section presents an in-depth discussion of the findings of the study, highlighting the relationships and implications that were identified via the analysis.

Table 4.1: OLS Regression Results

Independent Variable (Monetary Poverty)	Capital Assets	Dependent Variables	Coef. & p-value
Constant			109.072***
	(0.000)		
Beef Production	Natural Capital	Number of Beef Cattle Per Capita	-3.489 (0.400)
	Human Capital	Exclusively Livestock Farming Households	0.0002 (0.221)
	Financial Capital	Formal Financial inclusion	-0.583*** (0.003)
Beef Marketing	Social Capital	Commercial Livestock Farming Households	-0.0002*** (0.001)
	Physical Capital	Proportion of Paved County Roads	-0.566** (0.016)
Aridity	Semi-Arid (30-84)	Semi-arid counties with 30-84 per cent aridity	-20.696*** (0.001)
	Semi-Arid (10-29)	Semi-arid counties with 10-29 per cent aridity (Pockets)	-24.951*** (0.000)
	Non-Asals (0-10)	Non-ASAL counties	-15.808** (0.021)
Number of obs. = 47			
Adjusted R-squared = 0.7464			
p-values are reported in parentheses.			
*, **, *** indicates significance at the 90%, 95%, and 99% level, respectively.			
The base category for aridity is "purely arid" counties with between 85-100 per cent aridity.			

Source: Authors

4.1 Beef Production

Natural Capital: Although a negative association was observed between the quantity of beef cattle per capita and monetary poverty, it was not statistically significant. The coefficient was -3.489 and had a p-value of 0.400. This suggests that the presence of a higher number of cattle per person does not significantly influence monetary poverty levels.

Human Capital: As expected, exclusively livestock farming households exhibited a positive relationship with the incidence of monetary poverty. That is, failure to diversify livelihood strategies is associated with an increase in poverty. However, this relationship was not statistically significant. The coefficient for exclusively livestock farming households is 0.0002, and it has a p-value of 0.221. This implies that the presence of exclusively livestock farming households doesn't have a statistically significant effect on monetary poverty.

Financial capital: The coefficient for formal financial inclusion is -0.583, and it is statistically significant (p-value = 0.003). This indicates that access to formal financial inclusion has a significant negative impact on monetary poverty. Specifically, a unit increase in access to formal and regulated financial sources is associated with a 0.583 unit reduction in monetary poverty. This suggests that formal financial services play a crucial role in reducing monetary poverty by facilitating investment in the beef sector. It enables households to acquire cattle, secure improved grazing areas, and invest in essential inputs like feed and veterinary care. Furthermore, access to formal financial services acts as a robust risk management tool for ASAL communities, offering a financial cushion during adverse events like droughts or livestock losses through insurance products. This resilience fosters sustained beef production and mitigates the risk of impoverishment in ASAL regions.

4.2 Beef Marketing

Social Capital: The involvement of households in commercial livestock farming exhibited a statistically significant negative relationship with monetary poverty. A unit increase in these households was linked to a significant reduction of 0.0002 in monetary poverty. This means that an increase in the number of households involved in commercial livestock farming is associated with a significant reduction in monetary poverty. The significance of livestock commercialization is connected to the potential for market expansion, which can lead to increased income generation for households. Commercial livestock production often requires engagement with formal markets, where farmers can command higher prices for their products. This access to broader markets can result in increased income for livestock farmers, contributing to poverty reduction.

Physical Capital: Investments in road infrastructure showed a statistically significant negative impact on monetary poverty. A unit increase in the proportion of paved county roads corresponded to a 0.566 unit reduction in monetary poverty.

This highlights the importance of physical capital in improving access to markets and services, thereby reducing poverty.

4.3 Aridity and Welfare

Semi-Arid (30-84%): Semi-arid counties with 30-84% aridity exhibited monetary poverty that was 20.7 units lower compared to purely arid counties. This suggests that areas with moderate aridity levels tend to experience significantly lower levels of monetary poverty.

Semi-Arid (10-29%): Similarly, semi-arid counties with pockets of (10-29%) aridity had a lower incidence of monetary poverty of 24.9 units than purely arid counties.

Non-ASAL Counties (0-10%): In comparison to purely arid counties, Non-ASAL counties with less than 10% aridity also exhibited monetary poverty levels that were statistically significantly lower. These counties were estimated to have an average incidence of monetary poverty that was 15.8 units lower compared to purely arid counties. This findings imply that areas with lower aridity experience significantly lower levels of poverty compared to regions with higher aridity.

5. Conclusion and Policy Recommendations

5.1 Conclusion

This discussion paper examined the relationship between beef production, marketing, and the welfare of ASAL communities in Kenya. The study was motivated by the elevated poverty rates in ASAL counties despite the key role of livestock (beef cattle) production in supporting the livelihoods of households in these regions. Through a comprehensive analysis utilizing the sustainable livelihoods framework and OLS regression, this study analyzed relationships between various capital assets and welfare.

Financial Capital: The empirical analyses underscored the influence of financial capital in mitigating monetary poverty. This observation not only validates the importance of financial inclusivity but also underscores its potential as a catalyst for transformative investments in the beef sector. In particular, formal financial services serve as robust risk-mitigation mechanisms for ASAL communities, providing a buffer against adversities such as protracted droughts and livestock losses through insurance instruments. Improved resilience and access to credit bodes well for the sustenance of beef production and the reduction of poverty in ASAL regions.

Social Capital: The importance of social capital as denoted by commercial livestock farming households, was strikingly evident in its negative association with monetary poverty. This inverse relationship exemplifies the positive effects of livestock commercialization, signifying its potential for market expansion and subsequent augmentation of household income. Commercial livestock production necessitates interaction with formal market channels, where farmers can command better prices for their products. Such enhanced market access has a discernible ripple effect, leading to an increase in revenue for livestock farmers, thereby reducing poverty.

Physical Capital: Furthermore, the study unveiled the instrumental role played by physical capital, especially investments in road infrastructure in curtailing monetary poverty. An increase in the proportion of paved county roads was observed to exert a substantial negative impact on monetary poverty. This empirical observation gives credence to the pivotal role that infrastructural development plays in enhancing accessibility to markets and essential services.

Aridity levels also have a substantial influence on welfare, with semi-arid regions exhibiting lower monetary poverty incidences compared to purely arid areas. These findings highlight the need for tailored policies and interventions that acknowledge the distinct economic and environmental conditions of ASALs.

5.2 Recommendations

Beef Production

Promoting Access to Formal Financial Inclusion in ASALs: Given the statistically significant impact of financial capital on reducing monetary poverty, the government could prioritize initiatives that enhance access to formal and regulated financial services. By doing so, ASAL households can readily access credit and make critical investments in the beef sector, including the acquisition of cattle, improved grazing areas, and essential inputs like feed and veterinary care. The government can do this through the:

Strategic Partnerships with Mobile Money Providers:

Promoting access to formal financial inclusion in ASALs can be significantly advanced through strategic partnerships with mobile money providers. This approach offers a practical and cost-effective means for beef cattle farmers, including pastoralists, to access financial services, even in remote regions with limited or no access to traditional banking infrastructure. These financial services encompass mobile banking, savings, credit, and insurance products. The government can offer incentives to financial institutions and mobile money providers to encourage their involvement in underserved ASAL areas. This may include tax incentives or subsidies for technological infrastructure development in network coverage and mobile connectivity.

Bolstering Financial Capital Through Formal Insurance Products: To further strengthen the resilience of ASAL communities via financial capital, it is important to explore the provision of specialized insurance products to beef cattle farmers. These insurance policies can safeguard against losses due to droughts or livestock-related events, providing a crucial layer of protection for vulnerable households. This can be implemented through:

Public-Private Partnerships:

Establish strong public-private partnerships with insurance companies specializing in agricultural and livestock insurance. Collaborative efforts can lead to the creation of affordable and comprehensive insurance products that cater specifically to the needs of ASAL livestock keepers.

Weather-Indexed Insurance:

Introduce innovative insurance products to promote formal financial inclusion, such as weather-indexed insurance that triggers payouts based on predetermined weather conditions, providing timely compensation to farmers during adverse climate events. One of the key risks faced by beef cattle farmers is extreme weather events, which lead to lower yields and loss of productive assets or income. Weather index insurance helps stabilize farmers' incomes – allowing them to continue farming regardless of disaster and weather uncertainties. The indemnity (promise to pay) is based on realizations of a certain weather parameter measured over a predetermined period at a given weather station. The insurance products would guard against index realizations that are either too high or too low and are

anticipated to result in beef cattle losses. Whenever the realized value of the index exceeds or falls below a set threshold, then an indemnity is paid.

Beef Marketing

Fostering Commercial Livestock Farming: Recognizing the significant impact of social capital, as represented by commercial livestock farming households, on reducing monetary poverty, county governments could encourage and support initiatives that facilitate commercialization. This may involve endeavours that:

Encourage the Formation of Cooperatives or Associations

To foster commercial livestock farming, the government could actively encourage the formation of cooperatives or associations among beef cattle farmers. By doing so, farmers can consolidate their resources, collectively market their products, and negotiate more favourable prices in formal markets. These cooperatives can also provide a platform for knowledge sharing, allowing farmers to access valuable market information and insights into modern farming techniques. Promoting and supporting the formation of such cooperatives is important as they play a crucial role in empowering farmers, strengthening their bargaining power, and expanding their market access, ultimately contributing to the growth and sustainability of the beef industry.

Investing in Road Infrastructure: Strategic infrastructure investments are crucial, given the associated impact on reducing monetary poverty. One possible approach to maximize the advantages of investments in road infrastructure is:

Prioritize Key Transportation Routes

County governments could conduct comprehensive assessments to identify key transportation corridors critical for linking livestock (beef cattle) producing regions to major markets. Subsequently, they can allocate resources to upgrade and maintain these roads, ensuring they are all-weather and suitable for livestock transportation. Public-private partnerships could be explored to accelerate road development. By improving transport networks, county governments will stimulate economic activities, reduce transportation costs, and ultimately elevate the overall economic well-being of communities.

Targeted Welfare Interventions

Targeted Interventions Based on Aridity Levels: Recognizing the significant variations in monetary poverty across counties with different aridity levels, county governments may consider tailoring interventions to suit local conditions. These tailored programs may include livestock insurance schemes and support for alternative livelihood strategies to address varying vulnerability levels. For ASAL counties with high aridity levels, feedlots can impact beef production and marketing activities greatly.

Introduce Feedlot Initiatives: In regions characterized by high aridity levels, the introduction of feedlot initiatives represents a strategic approach to bolstering beef production and marketing. Feedlots present a controlled and semi-intensive environment for livestock production, which in turn offers numerous benefits for

cattle farmers who are vulnerable to climate-induced shocks. Feedlots not only address resource scarcity and climate-related vulnerabilities but also enhance the overall productivity and income potential. Some of the specific benefits accrued from feedlot initiatives include:

Resource Conservation: High-aridity regions often suffer from scarce and overgrazed natural pastures. Feedlots help conserve these limited grazing resources by reducing the pressure on them. Cattle are provided with specially formulated diets, reducing their dependence on already stressed natural forage.

Climate Resilience: In areas prone to climate-induced shocks like prolonged droughts or extreme heatwaves, feedlots act as a safeguard. These controlled environments offer stable access to food and water, ensuring the well-being of cattle even during adverse weather conditions. This, in turn, secures the livelihoods of households reliant on cattle farming.

Improved Weight Gain: Feedlots are designed to optimize cattle growth. Through precise feeding regimens and monitoring, cattle in feedlots tend to experience faster weight gain compared to free-range grazing. This translates into quicker returns on investment for farmers.

Disease Control: The controlled environment of feedlots enables better disease management. Cattle can be closely monitored for signs of illness, and preventive measures can be implemented more effectively, reducing the risk of disease outbreaks.

Quality Meat Production and Skill Development: Feedlot-fed cattle often yield higher-quality meat due to controlled diets and reduced stress levels. Therefore, farmers can access premium markets through exports, increasing their income. Furthermore, introducing feedlots creates the opportunity to empower beef cattle farmers through training and capacity-building on efficient livestock management.

References

- Adato, M., & Meizen-Dick, R. (2002). Assessing the impact of agricultural research on poverty using the sustainable livelihoods framework, FCND discussion paper 128, and EPTD discussion paper 89. International Food Policy Research Institute.
- Blau, P. M. (2017). *Exchange and power in social life*. Routledge.
- Campbell, B., Sayer, J. A., Frost, P., Vermeulen, S., Pérez, M. R., Cunningham, A., & Prabhu, R. (2002). Assessing the Performance of Natural Resource Systems. *Conservation Ecology*, 5(2). <http://www.jstor.org/stable/26271815>
- Chernyak-Hai, L. (2018). Social exchange theory. In *The Oxford Handbook of Multidisciplinary and Behavioral Approaches to Health and Social Sciences* (pp. 23-38). Oxford University Press.
- LeSage, J., & Pace, R. K. (2009). *Introduction to Spatial Econometrics Statistics*. Taylor & Francis Group, LLC.
- Dodsworth, T. L. (1972). Chapter 1 - The present position and possible developments. In T. L. Dodsworth (Ed.), *Beef Production* (pp. 1-4). Pergamon. <https://doi.org/10.1016/B978-0-08-017016-9.50003-8>
- Erenstein, O., Hellin, J., & Chandna, P. (2007). *Livelihoods, poverty and targeting in the Indo-Gangetic Plains: A spatial mapping approach Research Report*. New Delhi, India: CIMMYT/RWX. Retrieved from: [http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.597.5921&rep=rep1\\$type=pdf](http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.597.5921&rep=rep1$type=pdf).
- Homans, G. C. (2015). *Social behaviour: Its elementary forms*. Routledge.
- KNBS. (2020). *Comprehensive Poverty Report*.
- Quandt, A. (2018). Measuring livelihood resilience: The Household Livelihood Resilience Approach (HLRA). *World Development*, 107, 253-263. <https://doi.org/10.1016/j.worlddev.2018.02.024>
- Kenya Institute for Public Policy Research and Analysis (KIPPRA). (2020). *Kenya Economic Report 2020*.
- Jones, M. (2022). The Role of Livestock Marketing in Improving the Livelihoods of Pastoralists: A Critical Literature Review. *American Journal of Livestock Policy*, 1(1 No.4), 32-44.
- Mwangi, V., Owuor, S., Kiteme, B., & Giger, M. (2020). *Beef Production in the Rangelands: A Comparative Assessment between Pastoralism and Large-Scale Ranching in Laikipia County, Kenya*. Department of Geography and Environmental Studies, University of Nairobi.
- Nyariki, D. M., & Amwata, D. A. (2019). The value of pastoralism in Kenya: Application of total economic value approach. *Pastoralism*, 9(1), 1-13. <https://doi.org/10.1186/s13570-019-0144-x>
- Namonje-Kapembwa, T., Chiwawa, H., & Sitko, N. (2022). Analysis of goat production and marketing among smallholder farmers in Zambia. *Small Ruminant Research*, 208, 106620. <https://doi.org/10.1016/j>

smallrumres.2022.106620

- Omollo, E. O., Wasonga, O. V., Elhadi, M. Y., & Mnene, W. N. (2018). Determinants of pastoral and agro-pastoral households' participation in fodder production in Makueni and Kajiado Counties, Kenya. *Pastoralism*, 8(1), 1-10. <https://doi.org/10.1186/s13570-018-0113-9>
- Tacoli, C. (1999). Understanding the opportunities and constraints for low-income groups in the peri-urban interface: the contribution of livelihood frameworks. London, UK: Development Planning Unit: Strategic Environmental Planning and Management for the Peri-Urban Interface Research Project. Retrieved from: http://www.ucl.ac.uk/dpu-projects/drivers_urb_change/urb_economy/pdf_Urban_Rural/DPU_PUI_Takodi_opportunities.pdf.
- Gichure, J. N., Njeru, S. K., & Mathi, P. M. (2020). Sustainable livelihood approach for assessing the impacts of slaughterhouses on livelihood strategies among pastoralists in Kenya. *Pastoralism*, 10(1), 1-10. <https://doi.org/10.1186/s13570-020-00184-z>
- State Department for Development of the Arid and Semi-Arid Lands. (2018). Strategic Plan (2018 – 2022): Unlocking the Potential of ASALS for Accelerated National Development. Nairobi, Kenya: Ministry of Devolution and Asals. <https://www.asals.go.ke/asal-info/>
- Kristjanson, P., Mango, N., Krishna, A., Radeny, M., & Johnson, N. (2009, June 25). Understanding Poverty Dynamics in Kenya. *Journal of International Development*, 978-996. <https://doi.org/10.1002/jid.1598>
- Hartog, J., & Hagenaars, A. J. M. (1988). Poverty and the Measurement of Individual Welfare. *The Journal of Human Resources*, 23(2), 243. <https://doi.org/10.2307/145778>
- House, Q., & Suppa, N. (2016). Oxford Poverty & Human Development Initiative (OPHI) Oxford Department of International Development OPHI WORKING PAPER NO. 103 Comparing Monetary and Multidimensional Poverty in Germany. https://ora.ox.ac.uk/objects/uuid:4302c7c8-0a69-4ae0-a817-e5826866ea6a/download_file?file_format=application%2Fpdf&safe_filename=OPHIWP103_1.pdf&type_of_work=Journal+article
- Sen, A. (1981). *Poverty and Famines: An Essay on Entitlement and Deprivation*. Oxford: Clarendon Press.
- KNBS. (2023). *Economic Survey*. Nairobi: Kenya National Bureau of Statistics.
- MoALF. (2019). *National Livestock Policy*. Nairobi: Ministry of Agriculture, Livestock, Fisheries and Irrigation.
- KNBS. (2020). Retrieved from National Information Platform for Food and Nutrition: https://nipfn.knbs.or.ke/?page_id=267
- Podolny, J. M. (1992). A Status-Based Model of Market Competition. *American Journal of Sociology*. <https://doi.org/10.1086/230091>

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