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Original Article

Re-Evaluating Livestock Production and Marketing Strategy: A Transformational Agenda for Drylands Livestock Industry Based on Evidence from Literature

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Abstract: *The systematic review study aimed to consolidate knowledge on livestock production, marketing, and other critical industry issues, specifically relating the findings to the context of livestock farming in Kenya's Turkana pastoral area while re-evaluating strategies and pathways to promote profitable and sustainable livestock farming and trading in drylands. The study's objectives were (i) to review developments in the livestock sector across various dryland regions of Sub-Saharan Africa, (ii) to evaluate the performance of the livestock industry in both Kenya's high-potential and dryland areas, (iii) to determine the effectiveness of pastoral livestock farming systems and identify development opportunities; and (iv) to examine the impact of climate change and other hazards on the livestock economy in dryland regions. The research methodology employed was a systematic review of the chosen literature. From the 142 research outputs identified according to the research topic and following a quality assessment for inclusion eligibility, 66 research outputs were ultimately selected for the study. The research indicates that the optimisation of livestock development in Africa and Kenya can be achieved by effective policies, strategic investments, and market-oriented production techniques. Arid and Semi-Arid areas of Ethiopia, Botswana, Nigeria, and Somaliland possess the capacity to produce livestock and by-products, notwithstanding obstacles such as inadequate infrastructure, disease prevalence, and climatic variability. Artificial insemination and animal breeding enhancement initiatives can rectify local breed deficiencies and sub-optimal productivity. Transforming pastoral agricultural systems to intensive and semi-intensive methodologies can enhance production efficiency and improve market access. Climate finance and information technology can mitigate the effects of climate change on livestock and agricultural livelihoods. Re-evaluating livestock production and marketing strategies for drylands is essential for sustainable growth. The study advocates for enhanced research in industrial development, climate change mitigation, conflict resolution, finance, and feed production, owing to the potential for livestock production and commercialisation, which can foster competitive and sustainable development in dryland areas.*

Keywords: *Livestock Production, Strategy, Market Access, Pastoral Economy, Turkana County, Pastoralism, Resilience.*

I. INTRODUCTION

This research output is a product of an analysis of research studies and publications made in Kenya, the Horn of Africa, Sub Saharan Africa and other dryland contexts of the world. It shows that drylands account for more than 40% of the Earth's land surface and support around 20% of the human population. Such drylands are classed as arid or semi-arid, with arid parts receiving between 200mm and 400mm of summer rainfall each year. Drylands are home to 40% of the population and make up many of Sub-Saharan Africa's poorest countries. In Kenya, 11 counties are classified as arid, 19 as semi-arid, and 6 as having high annual rainfall but pockets of dryness and semi-aridity. Turkana County, in northwestern Kenya, which shares international boundaries with Ethiopia, South Sudan, and Uganda, is the largest region in Kenya but least developed due to its remote nature. Annual rainfall ranges between 300 and 400 millimetres, with core zones receiving barely 150 mm. Education, health, water, investment, trade, institutional support, and people's participation in decision-making are still low.

Turkana's nomadic pastoralist economy is primarily reliant on livestock production, particularly goats, sheep, cattle, and camels. Livestock, particularly cattle and sheep, are economically and culturally valuable. During droughts, pastoralists shift to places with better rainfall for grazing and browsing to ensure the survival of their herds. Turkana's human population is around 70% nomadic or semi-nomadic, with the majority of their income being from livestock sales or goods and natural resource management practices are centred on communal land tenure and livestock herding. Survival is dependent on favourable relationships and adaptive behaviours such as herd separation, raiding, hunting and gathering, and social values events. There is no official insurance, and migration is handled by groups linked to specific clans. Pastoralists strike a balance between pasture and water availability, rainfall, safety, and national borders, as well as market and infrastructure access. They prefer established migration routes and have long-term exchange arrangements with counterpart customary institutions.

Pastoralism has been Turkana's primary source of income for many years, but recent events, such as cross-border movement restriction and severe droughts, have hampered long-distance livestock movements and impacted nomadic pastoralists' livelihoods, resulting in catastrophic livestock losses and a significant constraint on livestock-based incomes. Droughts disproportionately affect poorer populations with smaller livestock holdings and less developed social networks. They generate humanitarian issues, environmental degradation, long-term poverty, the burden on veterinary services, and spatial marginalization. Pastoralists are driven into inhospitable terrain, climate instability risks are increasing, and technical advancements enable agriculture and agropastoralism to grow in hitherto undiscovered places.

The growing human and animal populations in Turkana, combined with the introduction of trypano tolerant breeds and increased veterinary care, have created a perilous situation for nomadic pastoralism. This has resulted in greater competition and decreased cooperation within tribal clans, as well as between neighbouring tribes in Uganda, South Sudan, and Ethiopia. Climate shocks have pushed pastoralists deeper into poverty, resulting in enormous flows of international humanitarian aid to the Arid and Semi-Arid Lands (ASALs). Traditional remedies to these difficulties have included food aid, which has kept the region's human and livestock populations at unsustainable levels. This has resulted in a shift towards settled farming or commerce, which is a successful technique for reducing resource-based demand.

II. RESEARCH METHODOLOGY

A) Rationale for the Systematic Review Study

To consolidate existing knowledge from past studies on livestock production and marketing, a systematic review was chosen as a form of research study methodology. By examining and delineating the boundaries of each scholarly literature source, analysis of results, implications, and conclusions of the selected past scientific studies encompassed critical pieces of evidence and discoveries about various facets of the research subject. The systematic review's objectives were to inform judgments about livestock production and marketing theory and practice and to provide a summary of the evidence bolstering the accomplishments and progress of research on the studied topic. All relevant sources of evidence on the research subject were found using an objective and repeatable search strategy in accordance with the procedure for conducting a systematic review. As explained in section B (a), the exclusion and inclusion criteria were finally used to define the literature resources used. Finding gaps in livestock development and topicalizing study findings were made easier by the review process.

B) Methods and Procedures

a. Eligibility Criteria and Literature Search Strategy

The methods and processes involved in the selection of the scholarly knowledge materials for systematic review were based on eligibility criteria, primarily guided by the research question: *What are the determinants of effective livestock production and marketing strategy for the drylands livestock industry?* The keywords *Livestock Production, Strategy, Market Access, Pastoral Economy, Turkana County, Pastoralism, and Resilience* determined the grounds for selecting scholarly and peer-reviewed scientific literature resources from internet-based databases. Sifting of literature sources through pre-screening and relooking the scope of knowledge captured on the research study aspects led to the selection of the most eligible research outputs, which depicted comprehensiveness and completeness of the information on the livestock industry. The quality and sensitivity analysis of past studies was done with a clear focus on livestock industry components. The selected studies presented concrete results, actions, transformative recommendations, and areas for future research. The diagram below shows a stepwise process of determining the eligibility of scholarly research outputs for use in the systematic review research study.

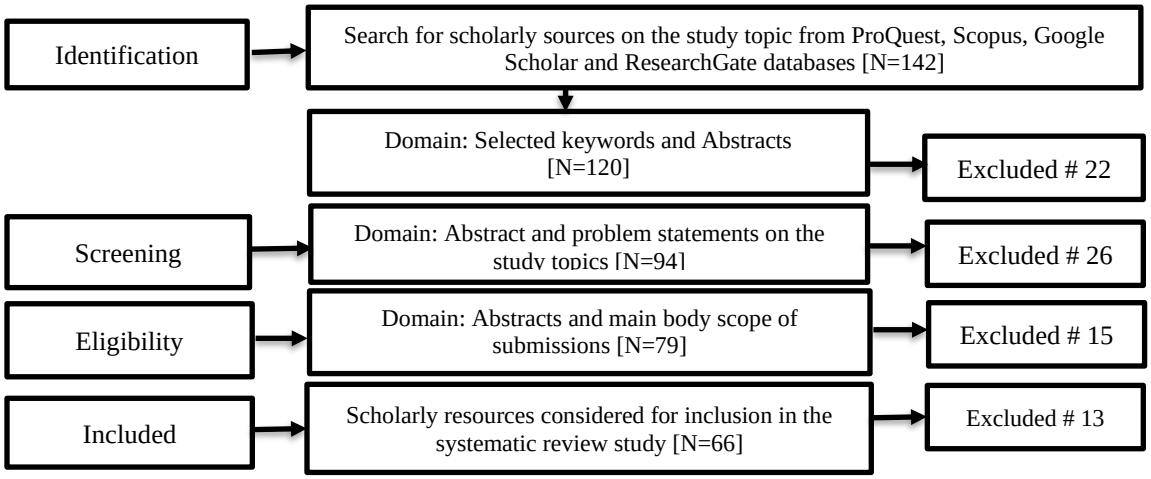

Figure 1: Selection of scholarly research outputs for systematic review study

III. ANALYSIS OF THE SELECTED LITERATURE MATERIALS

A) Livestock Development in Africa and Kenya

a. A Perspective of the Livestock Industry

Livestock is a global resource contributing to the development of economies. Africa adopts and facilitates livestock production systems based on the needs of livestock-keeping communities and market opportunities (Asante et al., 2016). Because it is difficult to predict yearly offtakes, livestock output, and market demand, the livestock sector in Africa is dynamic and subject to rapid change. According to Wambui et al. (2016), some countries and regions have neglected the livestock sector due to increasing production costs, deteriorating factors of production, and countries' agriculture policy inclinations. According to both research, quality control regulations, price fluctuations, and disease outbreaks, all have a significant negative economic impact on the cattle industry and its future prospects.

Illegal livestock trading, as per arguments in Berihun (2017), devalues foreign exchange and exacerbates broken marketing systems in Africa, undermining trust in the livestock and value chains traded. Bitetti (2019) also identify that a lack of entrepreneurial awareness, linking production to market needs, inability to maximize market gains, lack of genetic improvement, and differentiation of local livestock breeds defeat the purpose of commercialized livestock production systems. Because of this, Ebel (2016) said that the problems with livestock development in Africa were caused by limited financing and unrealistic budgets from governments, especially in the developing world. This makes it hard to produce and sell livestock in a way that is sustainable and competitive.

b. Livestock and the Economy of the African Continent

Livestock farming is vital to the African economy. In Africa, the livestock sector accounts for 20-50% of the value-added agriculture (Ihle et al., 2017). Livestock is owned by nearly two-thirds of rural African families. Up to 80% of Botswana's agricultural GDP comes from cattle, suggesting that the continent's livestock markets may provide profitable commercial prospects. Businesses that want to engage in the livestock industry must understand how the market influences the demand for animal goods. As IGAD (2017) point out, livestock not only provide savings and insurance but also manure, animal power, transportation and a source of capital for expanding and sustaining business opportunities.

In Sub-Saharan Africa, more than 90% of livestock keepers' revenue comes from the sale of meat, milk, eggs, hides and skins, and live animals. However, less than 10% of the income of half of all livestock-keeping households in Africa comes from animals. Thirty percent of Africa's agricultural GDP comes from livestock, which makes up 53 percent of the agricultural stock. Africa's dryland farmers do not have access to markets, money, or livestock inputs. Osei-Amponsah (2020) argues that many African entrepreneurs trade identical livestock species and goods in the same markets throughout the seasons due to a lack of specialization. In a highly competitive business climate, this results in the delivery of duplicate enterprises, which hinders market growth and the full exploitation of them by customers and entrepreneurs.

c. Livestock Sector in the Eastern Africa Region

Pastoral, agro-pastoral, nomadic, and sedentary livestock-dependent communities are the chief producers of livestock in eastern Africa, and the roles played by livestock and non-pastoral commodity markets are all equally important for the economies of eastern African countries, regions, and communities (Nyariki and Amwata, 2019). This outcome is facilitated by economic incentives and policy frameworks designed for rural development and market capitalization. Unfortunately, according to the findings of Dido (2019), the implementation of most of the rural development policies for Eastern Africa is constrained by a lack of adequate funding to achieve the set goals. Because of this, traders in eastern Africa have a hard time getting to markets as well as an inability to fully support livestock-based businesses.

Large tracts of land used to keep livestock are a precious production resource hobbled by increasing urbanization, changing land-use priorities, and land-grab tendencies. Despite massive government investments in the livestock sector, many countries have failed to meet their national livestock production targets, rendering established industries non-functional (Abay et al., 2019). Social, economic, political, and environmental issues all have an impact on Kenya's complicated cattle industry. The cattle industry contributes $4.5 billion, or almost 12% of the country's GDP. If livestock production and productivity, live animal selling, and product value chain diversification in eastern Africa for markets remained steady and increasing, this number may increase.

d. The Livestock Sector in Kenya’s Drylands

Kenya's land is 80% arid or semi-arid. In 2020, there were 21.7 million cattle, 36 million goats, 25.3 million sheep, 3.34 million camels, and 1.8 million donkeys. Around 60% of livestock is found in arid and semi-arid areas. According to Ojango et al. (2017), rangelands and communal production resources in drylands and pastoral areas are essential for large-scale livestock production. The traditional economy of livestock production in Kenya's pastoral areas is still influenced by sociocultural factors and is highly dictated by pastoralism, which is the philosophy of life of the pastoral communities. Intensive livestock production is ideal for commercial farming with a high animal density per unit area. Analysis by Tilahun

et al. (2017) shows that climate change and variations in the seasons, as well as the slow adoption of intensive and semi-intensive livestock-keeping systems, make it hard, till today, to successfully introduce and implement intensive livestock farming systems in the drylands of Kenya.

Livestock health is a concern for livestock production and marketing due to diseases spreading when animals congregate in grazing fields, watering points, and markets (Abraham et al., 2018). During times of extended droughts, pastoralists prefer to move as a method of keeping their animals alive and productive as well as sustaining households' livelihoods. Pastoralism, a traditional and nomadic livestock farming technique, is immensely significant in Kenya as a production strategy that incorporates people, animals, and the environment. The safeguarding of pastoral community land rights remains an issue, as policies have not been successfully formulated or implemented. Pastoralism is a hazardous method of production due to its mobility, food and water scarcity, and instability. Kenya National Bureau of Statistics (2018) advocates communal grazing. Njiru (2017) discovered that the ranching system has made marginal land valuable and productive for animals. It has proved to be better structured and safer since it does not have the difficulties that pastoralism does.

B) The Performance of Kenya's Livestock Markets

a. The State of Livestock Markets and Marketing Activity

Kenya's livestock markets are increasingly being flooded with livestock, reducing demand and threatening market performance (Nyariki and Amwata, 2019). Poorly established livestock distribution networks provide opportunities for middlemen to profit from market dynamics. Seasonality in cattle production and marketing generates market surpluses and deficits. Such constraints slow the transition of cattle agriculture in Kenya. Other studies undertaken in Kenya showing the state and performance of livestock markets are Isako et al. (2019) and Shabana and Matanda (2019). The studies clearly reveal that the consequences of numerous problems have a huge influence on production and marketing efforts. They also provide clear advice on how to leverage every component of the livestock industry in dryland areas to get the most out of the market.

The management of trade routes, animal health, productivity, marketing, climatic change, and poverty among the communities that maintain livestock are some of the crucial topics covered in dryland research projects. Conflicts based on pastoral resources, the dynamics of local and international livestock trade, and cross-border livestock trade incentives are other topics that are frequently studied. These topics are crucial for the livestock industry to succeed via policy, strategic knowledge bases, and best practices. The low application of technology in shaping livestock marketing systems is due to the lack of awareness and literacy levels of livestock producers and entrepreneurs (Pereira, 2019). Using all available resources to support effective livestock production, breeding, research and extension, marketing management, and institutional capacity building, Kenya's National Livestock Policy (2019) also seeks to ensure that livestock farming may continue for a long time.

b. Livestock Production Interventions and Marketing Outcomes

Livestock keeping is a critical economic activity for states and regions in the world's arid and semi-arid regions (Feliciano, 2019). It stabilizes dryland economies through livestock development and empowers smallholder livestock farmers to nurture healthy and productive livestock enterprises. Livestock keeping is critical for food and income security and as a source of capital for a diversified economy. Despite the risks inherent in drylands, Fraval et al. (2018) work on integrating urban and rural areas emphasizes the need for strengthening the viability of dryland economies, emphasising the importance of using mixed farming practices and technologies to power livestock production and marketing in the drylands. This action will also make sure that people living in hard-to-feed areas have food all year round.

Understanding livestock production in Africa requires considering animals as assets, a store of wealth for resilience, and a factor of production in mixed farming. Semango et al. (2019) findings on possible improvements in livestock sector programmes affirm the possibility of increasing livestock production resources through strategic investments. Livestock agriculture and related commercial possibilities make it simpler to obtain animal-based meals and revenue. Despite Africa's problems with livestock production, Ethiopia boasts the greatest number of animals on the continent: 65 million cattle, 40 million sheep, 51 million goats, 8 million camels, and 49 million poultry. It brings in 40% of agricultural GDP, 18% of total GDP, and 19% of foreign exchange earnings, which improves household income, ensures food security, and advances the socioeconomic standing of livestock-dependent communities (de Glanville et al., 2020). Encouraging pastoral livestock production systems shows that government policies on livestock production and pastoralism have been important in fostering not only livestock-keeping activities but also trade and investment in nations like Ethiopia and Botswana. In the same nations, cattle breeds are housed in diverse environments, utilizing various climate zones, with enhanced technological implementation and ongoing government assistance for livestock-producing communities and business owners (Herzog et al., 2019).

In areas with limited livestock production resources, livestock keepers employ nomadic livestock management and mobility techniques (Taban et al., 2018). Many arid-land households continue to rely on small-scale peri-urban and urban agriculture, as well as medium to large-scale commercial animal agriculture. According to Simonet and Carabine (2021),

women are typically in charge of feeding animals, cleaning barns, milking, processing milk, and marketing livestock products locally. This obligation constitutes one of the most significant tasks that women in rural areas do to improve food security and alleviate poverty, despite the fact that it takes a long time for women to be included in wealth ownership and decision-making in homes, neighbourhoods, and even at the national level in most developing countries.

c. Livestock Feed and Feeding Systems

Feed is an essential component of producing healthy, productive, marketable, and competitive livestock and products (Muricho et al., 2019). It improves livestock feed resources through good production, conservation, and preservation. It will help maintain season-long livestock productivity in pastoral areas. In the characterization of livestock production systems using the case of Northern Tanzania, Diawara et al. (2017) study on the viability of pastoral production systems in West Africa's Sahel regions and the importance of livestock producers' strategies for managing livestock feeds shows many possibilities for increasing the viability of pastoral rangelands and the availability of various livestock feeds for various uses. Due to a lack of rainfall, excessive grazing, a lack of reseeding initiatives, and environmental stress, the nutritional qualities of livestock fodder species are gradually declining in Ethiopian rangelands compared to other pastoral ecosystems in eastern and western Africa. These findings are related to the results of the Alemayehu et al. (2017) review study on major feed resources in eastern Africa and the Wasonga et al. (2016) study on the importance of vegetative resources for livestock production and productivity in dryland areas.

Many rangeland ecosystems in Africa are losing biodiversity, which is important for competitive livestock production, and some of the most important ones have lost it completely. As a result, there are fewer types of forage for livestock and they don't get enough nutritional requirements. On the potentiality of African rangelands to support livestock production and pastoral livelihoods, Mwaura et al. (2015) argue that the economic viability of livestock feed production and formulation interventions is critical for livestock keepers in the drylands to minimize animal shocks, improve productivity, and attain food security for pastoralist communities through sustained access to production inputs and markets. The impact of climatic variability on forage varieties, quantities, and quality; landholding; pastoral land reduction; fodder trees and pasture enclosures; and rangeland viability are determinants of efficient management of livestock forage resources. Hidosa and Tesfaye (2018) also say that long droughts and famines, which are common in Sub-Saharan Africa, make problems associated with inadequate livestock feeding worse.

d. Artificial Pasture Growing and Livestock Feed Formulation

It is presented in Hassan et al. (2020) that due to livestock production challenges, livestock-keeping communities in some areas (not many) have been able to adopt artificial pasture growing, hay production, fodder tree cultivation, and the formulation of concentrates for livestock feed supplementation. The ability of livestock farmers to generate and manage feed for their animals is severely hampered by a number of factors, including drought, water and feed scarcity, a lack of expertise, wildfires, and disorganized grazing patterns, even with the adoption of fodder production and conservation methods. Berhe et al. (2016) argue that such barriers can be overcome through a sound policy framework, technological investments, research, and a pro-innovation attitude. Omollo et al. (2016) come to the same conclusion that access to productive land, water availability, drought-tolerant pasture seeds, business capital, and ways to get around all affect how livestock producers participate in fodder production and marketing.

Promoting stakeholder engagement in fodder production, conservation, and marketing activities requires structured grazing systems, household affluence, and peaceful cohabitation. Large numbers of animals can be protected during extreme droughts by producing and commercializing artificial pastures through community, civil society, and government initiatives. According to Muricho et al. (2019), additional interventions that increase the productivity of diminishing grazing areas include reseeding the retreating grazing areas, implementing various grazing strategies, and implementing the Holistic Natural Resource Management (HNRM) framework. Animal feed resources will last longer in the field and in storage if they are properly treated and protected from bad weather. Feed insecurity as a result of prolonged and recurrent droughts continues to be a persistent impediment to livestock production and a major source of resource-based conflict in the drylands of many developing countries, including Kenya (Mwaura et al., 2015). According to what Jolliffe and Prydz (2016) found, weather and market information, land tenure systems, shock exposure, off-farm income, age, gender, and proximity to towns all affect the ability of livestock and fodder producers to make money from markets.

Pastoralists' access to requisite institutional support services for fodder and livestock markets, as well as their integration into the livestock development programmes, are emphasized as critical for their integration into the livestock resource market economy. Developing pastoralists' resilience and adaptations to climate change, making sure that livestock feed enterprises are profitable, restoring degraded lands, and making sure that livestock feed management helps minimize risks associated with livestock feeding are essential strategies for adding value to pastoralism and coping mechanisms that pastoral communities use to leverage health and production of their livestock resources through access to feeds and nutritional

supplements (Kula et al., 2016).

e. Livestock Breeding and Breed Upgrading

Breed improvement has been used in the tropics to increase the meat and milk production of indigenous animals. The adoption of genetic breeding technologies is a strategy for improving livestock performance and yields. Livestock breeding, as per submissions in the Kebede et al. (2018) study, aims to improve livestock body conditions, lactation length, calving interval, meat and milk yields and market potential. According to Osei-Amponsah et al. (2020), livestock breeding is crucial for boosting producers' revenue through markets and ensuring the stability of families' food security. They discuss how cows give birth at a young age. Programs for livestock breeding were successful in Ethiopia and Liberia, respectively, showing that when production and management resources are available, livestock breeding may provide fruitful outcomes. Ndlovu et al. (2019) support these findings by stating that enhancing livestock breeds benefit Indigenous breeds' health, the quantity and caliber of their output, and the revenue that livestock farmers and business owners may earn from domestic and international markets.

i. The Inferiority of Local Breeds in Pastoral Areas

animal productivity and output are declining due to inferior animal breeds and a lack of market competition. Increased livestock production viability leads to a larger market share for meat and milk as well as foreign exchange from overseas markets, according to Simonet et al.'s (2020) study on livestock production features and livestock market functioning and competitiveness. According to Melesse et al. (2020), the natural breeding of indigenous livestock varieties and the lack of alternative reproductive systems like artificial insemination (AI) and controlled transfer of traits hurt the potential for livestock production and access to markets. The sluggish acceptance of improved livestock breeds and phenotypes, as well as the widening disparity between supply and demand for AI services, are the reasons for the poor adoption of livestock breed improvement programs. The unsustainable nature of AI components, such as laboratory and extension services, and a strong preference for conventional breeding techniques are further factors contributing to this disparity. According to Taban et al. (2018), there are deficiencies in livestock production regulations and staff training in several nations concerning livestock breeding, which hinders the potential for local breed improvement as well as the financial development of entrepreneurs and the communities who raise animals.

ii. Livestock Breed Improvement Programmes and Outcomes

Numerous livestock breeding programmes in Sub-Saharan Africa have been successful to varying degrees. According to Mdladla et al. (2016), insufficient funding, incorrect policies and guidelines, unsatisfactory farmer and stakeholder engagement, and genotype environmental incompatibilities continue to stymie livestock development efforts for livestock breed improvement. Also, innovative, state-of-the-art breeding technologies and government policies and funding programmes were important for successful livestock breeding, improved performance of local breeds, and better quality and quantity of products. Breed improvement submissions by Olawumi and Farinnako (2017) show that vegetation has significant effects on the genetic potency of indigenous animal breeds. The primary issues affecting the effectiveness of livestock breeds in developing economies and drylands are the absence of Artificial Insemination (AI) services, inadequate systems for keeping track of breed performance, human and institutional resource limitations, the illiteracy of most livestock keepers, a lack of information, the expensive nature of breed upgrades, and the effects of climate change.

It is identified by Kebede et al. (2018) that a lack of data and information systems is a barrier to evidence-based livestock breeding projects. Breed improvement initiatives are hampered by factors such as ineffective modeling of cattle genetic traits, a lack of farmer participation in programs aimed at improving breeds, and an inability to fully use the genetic potential of new animals. Additionally, it is discovered that the establishment of breeding programs among indigenous and pastoral communities, the transportation of livestock breeds and genetic materials, and research and innovation all enhance the likelihood that different types of livestock development stakeholders will adopt and replicate technology transfer, knowledge, skills, and attitude change. According to Osei-Amponsah et al. (2020), positive outcomes from breed phenotypes that have already been introduced would boost breeding's acceptability and flexibility as a foundation for animal health and productivity and a crucial component of market access.

f. Leather Industry and Value Chains Development

The assessment of livestock hides and skins marketing in Adamawa State, Nigeria, by Jaáfar-Furo et al. (2021) and the examination of Somaliland's hides and skins value chains by Wanyoike et al. (2018) demonstrate that hides and skins have a number of economic uses in many countries and, consequently, enhance the standard of living for rural residents who engage in by-product marketing. One of the commodities that is traded the most globally is leather. The leather industry is growing quickly. Every year, it is worth about $100 billion. African nations generate just 4% of the world's leather and contribute only 3% of its value while owning one-fifth of the world's cattle.

Ethiopia's leather sector generated approximately $110 million in 2016, according to Kenea (2019). The economic systems of most emerging nations, especially Ethiopia and Somaliland, benefit from the use of hides and skins. Additionally, the leather sector benefits the economies of India and Pakistan. The hide, skin, and leather industry, which comprises cattle hides, pigskins, and semi-processed leather goods, generated $1.62 billion in trade revenues for the United States of America (USA) in 2018, providing a glimpse into the Western global economy. Nigeria has long been regarded as one of the world's biggest exporters of hides and skins, and the United Kingdom (UK) exported £1.42 billion worth of leather in 2017 (Yakasai, 2019). According to the Nigerian Economic Summit Group (NESG, 2017), there is a dearth of information on the leather industry, and it can occasionally be challenging to get trustworthy statistics. Despite this, there is a lack of information on demographic and local research that may be utilized to expand the leather sector and draw in profitable and feasible partnerships.

Balehegn et al. (2021) underscore the importance of farmers having socioeconomic policies that help them use value addition and innovation to get the most out of livestock value chains as the industry faces a number of structural, economic, and technological problems that are worse in the developing world. Insufficient funding, inconsistent taxation, deterioration of quality, lack of market information, inadequate infrastructure, price volatility and inefficiencies, and animal diseases and parasites are just a few of the major issues affecting the leather industry. Other leather industry challenges discussed by Gabdo et al. (2020) include uncoordinated hide and skin collection, limited capacity of rural collectors and aggregators, non-functionality of some potential tanneries, and migration of livestock away from markets, abattoirs, and reliable road networks. Although Kenya was once a major centre for leather footwear in East Africa, it is now a negligible exporter of leather and leather products worth $140 million, accounting for 0.14 percent of global exports. Wanyoike et al. (2018) say that most Kenyan leather is now made and sold as a commodity, with little thought to quality or style.

C) Pastoral Livestock Farming Systems and Development Opportunities

a. State of Pastoral Livestock Farming and Livelihood Systems

Pastoral livestock farming systems are dwindling as a result of increasing urbanization and shifting land use. This is evidenced in the studies by Mengistu et al. (2020), where livestock farming (just to mention two regions) is no longer the economic backbone of Ethiopia's Borana region and Uganda's Karamoja sub-region as it used to be in the past three decades. The diversification into crop farming in pastoral areas, according to Mengistu et al. (2020), may exacerbate future environmental degradation by diverting attention away from the resources available to other livelihood options if appropriate precautions are not taken. Balehegn et al. (2021) say that pastoralists should be careful about the trade-offs of combining crop and livestock production. The long-term viability of pastoralism is in doubt due to increasing climate variability, leading to a consistent drive to adopt more efficient, quick-yielding, and sustainable livelihoods. Conversely, it is noted by Muricho et al. (2019) that livelihood diversification in pastoral areas requires extensive analysis and optimization. Increased crop cultivation has a detrimental effect on pastoral rangeland productivity, especially in more fertile range areas and change in market opportunities caused by competing land-use systems and priorities, is also a cause of agricultural and urbanization encroachment on rangelands.

b. Rangeland Management and Grazing Systems

Overgrazing of livestock results in significant land degradation in Sub-Saharan Africa, leading to the destruction of 48% of rangelands (Wynants et al., 2019). better feed quality, range and grazing land restoration, the introduction of better forages, silvopastoral systems, and herd genetics are some strategies for sustainable livestock intensification that can boost output and resource economics in pastoral environments. Intensification techniques for sustainable farming are not always well received. Therefore, policy guidance, funding, and technical help are needed by smallholder farmers across Africa. For millions of smallholder livestock farmers in Africa, who make up one-third of the world's livestock population, livestock is an essential source of income and food. In Africa, increased investment in livestock is being driven by both urbanization and wealth development. The sustainability of dairy production in low-income nations was examined by Tricarico et al. (2020), who found that increased investment in cattle farming is a result of both urbanization and income growth.

Findings by Balehegn et al. (2019) show that Africa's growing livestock population is causing environmental problems such as overgrazing, land degradation, increased Greenhouse Gasses (GHG) emissions or production, bush encroachment, and desertification. With the expected increase in the number of African livestock in the future, GHG emissions and other negative environmental effects of herding will likely increase as well. Ng’anga and Robinson (2018), it is also said that the current technologies and methods for livestock production make it possible to focus on increasing productivity per animal rather than increasing the number of animals, which reduces the negative effects of livestock on the environment.

c. Livestock and the Environmental Stability

Animals and the environment have been closely related since the beginning of time, and in situations where pastoralism and nature protection are closely related and demand substantial management attention, harmonious livestock-environment

interactions are necessary. The development of a sustainable livestock sector in a range of agro-ecosystem contexts depends on an understanding of the interactions between livestock and the environment, as demonstrated in Otte et al.'s (2019) study on a comparative overview of livestock and environmental interactions using the case of Sub-Saharan Africa. Further environmental deterioration and the development of livestock and human epizootics are caused by an imbalance between livestock and the natural resources available for production, as well as by a rise in the number of wild animals in regions that may be used for livestock production. It is argued by Basamba et al. (2016) that unstructured and uncontrolled livestock grazing can deplete rangeland resources and render them unsuitable for biodiversity. Therefore, local organizations will be encouraged to create community-based environmental management frameworks that provide checks and balances in the use of the environment if they are empowered. Along with concepts like HNRM, Natural Resource Management (NRM), and Disaster Risk Reduction (DRR) that seek to improve the relationship between livestock and their environment, the study also emphasizes the advantages of well-managed rangeland ecosystems and livestock farming operations.

Karmeback et al.'s (2015) study, "Evaluating gender roles in a changing landscape: Diversified agro-pastoralism in the drylands of West Pokot, Kenya," demonstrates the value of using nature preserves to safeguard rangeland health and the connection between managing wildlife and cattle in the same ecosystems. Although Uganda's rangelands are comparatively superior to many rangelands in eastern Africa, the food, income, and nutrition insecurity of pastoralists is made worse by declines in animal production resources, especially during the year's dry season. The same is true in the sub-humid zones of Burkina Faso, where opinions about the sustainability of pastoralism and the welfare of pastoralists depend on the way land use plans are created, as well as on development and contingency plans that help pastoral communities adjust to the effects of climate change (Mayanja et al., 2015).

D) Value of Pastoralism in Kenya

According to Nyariki et al. (2019), Kenya's pastoral economy and pastoralism are valued at $1.13 billion, of which 92% (or $1.04 billion) is attributed to the livestock industry and 8% (or $0.903 billion) to the non-livestock sector. The yearly meat offtake at 154,968 tonnes was projected to be worth $0.389 billion, while the annual national pastoral livestock offtake was valued at $0.189 billion. An estimated 553,200 tons of meat are consumed annually in the nation; 154,968 tonnes, or 28% of that amount, come from pastoral meat. The Total Economic Value (TEV) method takes into account the various ways that pastoral systems contribute to the economy, including frequently disregarded market and non-market products and services. Amwata et al. (2015) demonstrate that an accurate estimate of pastoral production's contribution can be instrumental in lobbying for increased investment in pastoral areas to promote environmentally sound development. With regards to factors that make agropastoral and pastoral households in the drylands of Kenya vulnerable to food insecurity, climate change and low adaptive capacities are identified as the main challenges. IGAD (2017) study shows how important resilience interventions are for improving livestock production, the well-being of pastoralists, and the contribution of the pastoral economy to the local and national economies of Kenya.

E) Climate Change and Pastoralism in Kenya

a. Climate Change Impacts on the Livestock Economy

Climate change has been established to be real, and it is already influencing economies and the livelihoods and lives of communities in a number of countries and areas (Kimaro et al., 2018). Large-scale livestock producers depend on rangeland ecosystems, which are increasingly affected by the phenomena of climate change. The food chain is being severely impacted, which, in turn, reduces the overall benefits of agriculture. Changes in the atmosphere are one of the physical drivers of climate change, which is a serious worry for cattle production systems worldwide. An FAO (2019b) research on water consumption in livestock production systems and supply chains found that decreased rainfall in livestock production zones is increasingly harming cattle health and output as well as the well-being of livestock keepers.

In order to increase the availability of livestock and forage resources as well as the capacity of rangeland ecosystems to recover, it is crucial to consider the growing significance of precipitation variability on the world's livestock grazing lands as well as the various approaches to managing climate change risks in livestock husbandry and environmental management. Carabine et al.'s (2015) study identified opportunities for ASAL resilience strengthening that can be achieved by countries attempting to resolve drought emergencies through policy as the drought in eastern Africa worsens. These policies are domesticated and implemented to strengthen community-based rangeland adaptive capacity. Trade-offs for climate-resilient pastoral livelihoods in Kenya's Maasai Mara and other wildlife-livestock interface contexts necessitate organized land-use systems to protect animal resources, preserve their economic value, and contribute to local and national economies.

b. Sustaining Livestock Production and Marketing Interventions amidst Climate Shocks

Some of the most crucial strategies to combat climate change in Sub-Saharan Africa include market-based conservation programs, institutional development, regulatory frameworks, and promoting the use of climate data to achieve long-term development goals. Soil organic carbon storage and other soil quality indicators are impacted by the intensity of grazing (Dass

et al., 2018). The consequences of climate change on small-scale farmers and pastoralists in dry regions are becoming increasingly apparent, and the significance of climate risk information and the necessity of season-long resilience and creative adaptation strategies to the effects of climate change are critical for pastoral areas. Pastoralists will be more equipped and able to enhance their approaches to coping with the consequences of climate change if they employ climate forecasting techniques. Rojas-Downing et al. (2015) say that climate change is linked to changes in biodiversity because of low precipitation and the increasing environmental over-exploitation and abuse.

Schielein and Borner (2018) discuss recent changes in land use and land cover dynamics across a range of vegetation ecosystems and conclude that the impact of extreme heat stress on milk and meat production, as well as the requirement for light grazing, will strengthen livestock keepers' resilience, particularly in terms of livestock production resource economics. Also, incorporating technology into livestock husbandry and value chain development will increase the efficiency and effectiveness of livestock development interventions, which are critical for managing climate change dynamics. That is why Bedelian and Ogutu (2016) emphasize the importance of using technology to improve livestock production and marketing systems, as well as to give livestock stakeholders the knowledge and skills they need, especially in this time of climate change and decreasing livestock production resources.

IV. RESULTS AND DISCUSSION

The study found that the livestock industry in Africa faces challenges such as rising costs of production and processing, quality control issues, price changes, disease outbreaks, illegal trading, lack of entrepreneurial awareness, and limited government funding. Livestock farming in Africa contributes to 20-50% of value-added agriculture, with countries such as Botswana and Ethiopia’s livestock sector contributing significantly to agriculture's GDP. In African countries, livestock offers savings, insurance, manure, animal power, and transportation, among other benefits. However, specializations in the sector are still minimal, thus affecting its growth and competitiveness in global and regional potential markets.

Eastern Africa's livestock production is crucial for the economic growth of states and the well-being of livestock-dependent communities, and Kenya's livestock sector is one of the economic sectors contributing significantly to the GDP and the livelihoods of over 16 million people in the dryland areas. Whilst 80% of Kenya's landmass is arid or semi-arid, the modes of livestock farming are largely extensively influenced by sociocultural factors and pastoralism. Many literature sources reviewed show the significance of challenges of dryland agriculture, which include climate change, seasonal changes, and slow adoption of intensive farming systems. Despite health and productivity reasons, Kenya's National Livestock Policy (2019) promotes community ranching for organized and safer livestock farming in drylands.

The study also recognizes the increasing urbanization and land-use changes as critical factors decimating the livestock sector and industry developments, especially in Kenya’s pastoral areas. Regarding the performance of the livestock sector, Kenya's livestock market faces challenges, including increased livestock supply and poor distribution systems, seasonality, and low technology application. While dryland livestock research focuses on improving animal health, production, marketing, trade routes management, climate change, and poverty eradication among smallholder livestock farmers and pastoralists, the outcome challenge of making livestock keeping in arid and semi-arid regions a dependable source of food, income, nutrition, and capital, requires urban-rural integration and mixed farming practices for year-round livestock economy.

It is worth noting that livestock farming in Sub-Saharan Africa is crucial for wealth storage, income generation, and food security. For example, Ethiopia contributes 40% of agricultural GDP and 19% of foreign exchange earnings. This is because the government of Ethiopia, like other African countries embracing livestock farming, put in place effective policies to promote livestock-keeping, trade, and investments. It is also factual that dryland agriculture relies on nomadic livestock management, with women's involvement being crucial. However, women's participation in wealth ownership is slow in developing economies.

The study underscores the importance of sustainable access to livestock feed and reliable feeding systems. Livestock feed production is crucial for healthy, productive, and competitive livestock ventures. Studies in Tanzania, West Africa, and Ethiopia show deteriorating nutritional characteristics of natural forage materials due to limited and unpredictable rains, overgrazing, and environmental stress. Climate variability impacts forage varieties, quantities, quality, landholding, and rangeland biodiversity and viability. Artificial pasture growing and livestock feed formulation are less established in dryland areas, making livestock highly dependent on nature feed resources.

Regarding the prime livestock production challenges such as drought, water scarcity, and unorganized grazing systems, the identified sustainable solutions include market-based policy frameworks, technological investments, research, innovation, and value addition. Promoting stakeholder participation in fodder production, addressing feed insecurity in developing countries, and supporting pastoralists in fodder and livestock markets are essential to building climate resilience adaptations, land restoration, and minimization of production and market risks in the livestock sector.

Genetic breeding technologies are being utilized to improve indigenous animal meat and milk production in tropical regions. These technologies aim to enhance livestock performance, yields, and market potential, ultimately increasing producers' income and food security reliability. Successful breeding programs have been found in Liberia and Ethiopia. In many parts of Africa, livestock production and market competitiveness are hindered by inferior breeds, natural breeding, and a lack of reliable and competitive livestock reproductive systems. The study finds that the adoption of Artificial Insemination (AI) services is slow due to demand and supply gaps, traditional breeding methods, and sustainability issues. The study, therefore, underscores the need for Sub-Saharan Africa to make investments in livestock breed improvement programmes more efficient for better results. This outcome is cognizant of the fact that successful breeding programs face challenges like insufficient funding, inefficient policy guidelines, and genotype environmental incompatibilities. To succeed in this development, viable solutions include innovative breeding technologies, robust and competitive government policies, and sustainable funding programs, especially in developing countries and dryland areas.

In the leather industry and product value chain development, livestock hides and skins marketing in Nigeria and Somaliland benefits rural livelihoods and the leather industry and trade. The sector generated approximately $110 million in 2016. However, challenges facing the leather industry include information scarcity, lack of localized research to improve investments of those countries involved in it, and structural issues such as limited industries for leather processing, non-functionality of many turneries established, poor road networks and challenges of market access, market quality standards, and poor access to capital.

The prioritized solutions to improve the leather industry in the region include enhanced infrastructure and factory facilities upgrade, limiting livestock mobility for the reliability of the supply of leather by-products, reduced costs of processing, and maximizing the economies of scale in all components of leather value chain. The study also established that livestock-environment interactions are crucial for pastoralism and nature conservation. The imbalance between livestock and production resources contributes to environmental degradation. This is typical in the resource-starved pastoral areas, which are often overgrazed with minimal rain to regenerate the biodiversity.

V. RECOMMENDATIONS FOR APPLICATION

To confront the numerous obstacles that impede the development of the livestock industry in the Turkana pastoral region, which is one of the largest livestock-producing regions in Kenya, Turkana pastoralists must progressively transition from extensive livestock farming systems to intensive and semi-intensive systems. This paradigm will assist in reducing the risks that extensive systems pose to livestock and herders, as well as the rapidly increasing costs of livestock production in the drylands. Livestock husbandry systems that are extensive but unregulated are not considered formal and are not acknowledged by policy. The policy and mitigation programs should be informed by the following aspects of livestock production and marketing: illicit trading, disease outbreaks, price changes and volatility, lack of entrepreneurial awareness, and limited government funding. Additionally, there are regulatory and control issues that are of poor quality.

Insufficient specialisation in livestock production, marketing, and industry necessitates an increase in personnel proficiency in diverse aspects of the livestock value chain. Expertise in technology development and application, information management systems, feed and product processing and value addition, early warning systems, risk management and mitigation, and banking services will facilitate the transformation of the livestock sector and industry advancements, rendering them competitive, profitable, and sustainable. Notwithstanding its advantages, specialisations are limited, hindering expansion and competitiveness. Considering the abundant rangeland ecosystems in Turkana, the establishment of ranches and conservancies could facilitate livestock husbandry and biodiversity conservation.

The unestablished and dysfunctional livestock markets in Kenya's drylands perpetuate difficulties associated with supply and demand, inadequate distribution infrastructure for livestock and products, seasonality and drought impacts, and minimal technological application. Local and regional governments might invest in enhancing the variability and profitability of the livestock sector in arid regions. Consequently, animal resources can serve as a valuable source of sustenance, revenue, nutrition, and capital for livestock keepers and businesses, as well as facilitate urban-rural integration. Market-oriented and technology-driven mixed agricultural strategies can enhance the livestock sector. Given that livestock husbandry in arid regions is predominantly subsistence-based, integrating livestock into national and regional economies can enhance wealth accumulation and preservation, foster significant and sustainable revenue production, and ensure enduring food security.

Access to sustainable livestock feed via dependable systems is essential for the production and productivity of animal resources in arid regions. It serves as a strategy for addressing climate variability, insufficient rainfall, overgrazing, and environmental stress that impede anticipated economic returns from livestock investments, hence jeopardising pastoral economies and livelihoods. The evaluation of current policies and strategies for livestock production and marketing in drylands should be improved by incorporating feed production and management systems. To achieve this goal, livestock development in the drylands must be founded on sustainable solutions, encompassing market-oriented policies, technological investments,

research, innovation, and value addition. Facilitating pastoralists and enhancing stakeholder engagement is essential for climate resilience and land restoration while implementing adaptive contingency and development strategies for managing droughts and maintaining the health and productivity of animal resources.

Pastoral regions are renowned for the over-utilisation of specific animal breeds. Inbreeding has exacerbated the decline of native breeds, rendering them inferior. This inferiority is resulting in low productivity among most local breeds of livestock species in Kenya's drylands. It not only deprives livestock farmers of the quality and quantity of livestock and products but also results in diminished revenues from potential markets. To tackle this phenomenon, genetic breeding technologies should focus on enhancing livestock keepers' understanding of optimal breeding procedures to elevate indigenous breeds and enhance the health and production of livestock. The enhancement of market weight in indigenous breeds, along with improvements in milk and meat quality, can significantly attract a substantial market for pastoralists. To achieve success in this program, governments and development partners must enhance funding for livestock development initiatives, optimise livestock policy guidelines, address genotype-environmental incompatibilities, and include innovative breeding technology.

Dryland areas in Kenya lead in livestock resource output due to vast farming techniques. It is also true that huge livestock production implies a high production of livestock and products using market-based systems. Considering the successes achieved in Nigeria, Ethiopia, and Somaliland in making hides and skins businesses significantly contribute to rural livelihoods and the leather industry, governments and development partners can address the challenges of information scarcity, a lack of localised research, and structural issues that impede leather industry growth. This can be accomplished by upgrading leather processing infrastructure, controlling livestock mobility to ensure supply and demand for hides and skins, lowering processing costs, and capitalising on economies of scale. This system would aid in the production of numerous leather products from drylands, as opposed to the existing situation in which hides and skins are sold as a single commodity to processors, who benefit from the diverse and valuable product value chains developed.

VI. CONCLUSION

The study concludes that livestock development in Africa, Kenya, and other similar contexts around the world is promising and may be maximised provided the relevant policies, investments, and factors of production are properly deployed in a market-based manner. The livestock sector benefits the economies of states and communities that rely on livestock farming, both in high-potential and dryland contexts. The study presents the best examples of livestock development success in drylands, using Ethiopia and Botswana as regional and global market access cases, as well as Nigeria and Somaliland for leather industry developments.

It is also highlighted that Kenya's drylands have the potential to generate livestock and by-products despite constraints such as low infrastructural development, disease, extended droughts and climate variability, and a lack of strong production and marketing strategies. Dysfunctional livestock markets impede chances for livestock farmers and local entrepreneurs to maximise production and reap economic benefits from potential local and regional markets. Feed production and formulation are critical for dryland animal agriculture since they have a higher impact on the quality and quantity of livestock resources, as well as the competitiveness and profitability of livestock businesses.

Artificial Insemination (AI) should be used in Arid and Semi-Arid regions in addition to livestock breed improvement programs. This development would help to address the issue of local breed inferiority, as well as the issues of poor yield output and livestock productivity. The study also emphasises the need to transition pastoral farming systems from mostly extensive to intensive and semi-intensive. This move will increase production efficiency, market access, and stakeholder adherence to government policies promoting the best livestock production and marketing practices. Drylands require a management system that not only protects them from overgrazing and devastation but also supports regeneration activities through organised grazing and rangeland management plans.

The information in the selected literature sources demonstrates the huge impact of climate change on pastoral lands and agricultural livelihoods. This scenario can be handled via climate finance and information technology. Harnessing the value of pastoral economy and pastoralism as modes of livestock production in the drylands would help to ensure the long-term viability of livestock production and marketing activities. To reach these milestones, the study emphasises the importance of rethinking livestock production and marketing strategies for dryland areas, with a strong focus on the market.

VII. SCOPE FOR FUTURE RESEARCH

The livestock production and marketing potential of drylands, as well as the numerous challenges that impede its realisation, would necessitate advanced research in areas such as livestock industrial development, climate change effect mitigation and management, peace and conflict resolution, finance and banking services, and feed production and formulation. The resulting knowledge will lead to competitive and sustainable livestock development policies and plans for dryland areas.

Disclaimer

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