Hohenheim Working Papers on Social and Institutional Change in Agricultural Development

Working Paper 013-2022

Do African livestock policies address sustainability trade-offs? Evidence from Kenya, Zambia, and Burkina Faso

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Universität Hohenheim

April 2022

Hohenheim Working Papers on Social and Institutional Change in Agricultural Development (013-2022)

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Suggested citation: Kariuki, J., Yameogo, V., Daum, T., Birner, R., Chagunda, M. Do African livestock policies address sustainability trade-offs? Evidence from Kenya, Zambia, and Burkina Faso. Hohenheim Working Papers on Social and Institutional Change in Agricultural Development. 013-2022. University of Hohenheim.

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Abstract

The livestock revolution has the potential to reduce poverty and (hidden) hunger but can also be associated with a "long shadow", that are potential sustainability trade-offs, including regarding environmental and human health as well as animal welfare. As livestock development is high on the agenda of policymakers across Africa this report reviews the flagship livestock policies of three African countries, Kenya, Zambia, and Burkina Faso, to assess the extent to which trade-offs in livestock development have been incorporated. While all three case countries are committed to livestock development and have dedicated livestock policies and programs, the results suggest that several trade-offs including adverse environmental impacts, uneven distribution of socio-economic benefits between men and women, negative animal and human nutritional outcomes receive minimal attention in the reviewed policies. To address these challenges, the report calls for more integrated approaches in policy making processes, and presents potential strategies to engage a wider set of stakeholders to compensate for any blindspots in the design and implementation of livestock policies.

Key Words

Livestock policies, trade-offs, synergies, commercialisation, intensification

Acknowledgments

We are equally grateful for the financial support from the "Program of Accompanying Research for Agricultural Innovation" (PARI), which is funded by the German Federal Ministry of Economic Cooperation and Development (BMZ).

1. Introduction

The past 50 years have witnessed an unprecedented expansion of the livestock industry in many of the world's developing countries, referred to famously as Livestock Revolution (Delgado et al, 2001). The forces behind the revolution include increasing human population, urbanization, and demand for animal-sourced foods (ASF). Although the rate of livestock expansion has levelled off in many parts of the world, continued growth in African countries persists (Latino et al, 2020). For instance, between 2000 and 2010, Africa's per capita consumption of eggs, meat, and milk grew by 24, 25, and 47 percent respectively (FAO, 2019). Projections estimate that between 2015 and 2050, the demand for meat and milk on the continent will triple and double, amounting to an annual per capita consumption of 26kg and 64kg respectively (Latino et al, 2020; AU-IBAR, 2016; Malabo Montpellier Panel, 2020). While the expansion of livestock production promises to fulfil the multifaceted needs of especially rural poor households in sub-Saharan Africa (SSA), such as reducing poverty and hidden hunger, the negative trade-offs that accompany expansion are an increasing global concern. These negative trade-offs are well captured in an FAO publication on "Livestock's Long Shadow" (Steinfeld et al, 2006).

Of particular concern is the increasing contribution of livestock production to land-use-change, biodiversity loss, and greenhouse gas emissions (GHG)(Eisen & Brown, 2022; Filazzola et al., 2020; Herrero et al., 2016). While a livestock revolution promises to reduce poverty, an uneven distribution of economic benefits between smallholder and commercial farmers, or between men and women, may also be a consequence of policies that fail to accommodate for inclusivity of services, especially for marginalized producers (Bernués & Herrero, 2008; Clay, Garnett, & Lorimer, 2020; Ransom, Bain, Bal, & Shannon, 2017; Tavenner et al., 2019). There are concerns that uncontrolled livestock intensification can contribute to the deterioration of human health and animal welfare as the expansion of livestock production in a finite amount of space brings humans and animals into increasingly closer proximity and often in poor conditions, which increases the risk of transmission of harmful zoonotic diseases (Salmon et al, 2018). Recent research found that since 1940, agricultural drivers have been associated with over 25% of all — and over 50% of zoonotic infectious diseases in humans (Rohr et al. 2019). As such, infectious disease, stress levels, and parasite burdens rise, which often compromises animal welfare and decreases the productivity of individual animals (Upton, 2000). Efforts to facilitate the *sustainable* transformation of the livestock sector are therefore paramount in the policy arena. Multiple studies show that negative impacts associated with livestock intensification as a popular approach to expansion, are often exacerbated by policy distortions as well as external

pressures (de Haan et al, 2002). Inadequate policies can inadvertently exacerbate the already poor management habits such as deforestation and overgrazing when the true costs associated with environmental damage are not represented (Godde et al, 2018; Delgado et al, 2001).

The concern is that such negative effects and more can and will continue to occur if agricultural policies fail to adequately accommodate for trade-offs. Policies are under increasing scrutiny to integrate measures that mitigate the negative impacts of increasing livestock production without undermining the benefits derived from livestock production. Compared with the Global North where policies can be designed to reduce consumption (e.g. taxes) and generate win-win outcomes for human and environmental health, in the Global South, policies that aim to reduce livestock's long shadow may undermine the realization of its many benefits. For these reasons, decision-makers must promote economically, socially, and environmentally conscious measures while designing policies that will help meet the rising demand for livestock products. The extent to which policy measures are guided by and reflect a thorough knowledge of trade-offs plays a critical role in shaping the future of Africa's Livestock Revolution into a source of socio-economic and environmental prosperity.

This report explores to which extent livestock policies in Africa accommodate trade-offs associated with livestock development. With Africa's diverse range of livestock systems - from small and large ruminant pastoral systems, mixed crop-livestock systems, and urban and rural monogastric systems, each at various stages of development - Kenya, Zambia, and Burkina Faso have been selected as case study countries for which livestock system transitions and trade-offs can be examined from a policy perspective. To meet this objective, the report reviews the key livestock policy(ies) in each country, assesses how trade-offs in livestock development have been incorporated, and discusses implications for future policy measures. The report presents a short review of the literature; methodology; results; discussion and conclusions.

2. Livestock trade-offs framework

The livestock sector remains a priority development area in sub-Saharan Africa (SSA). Many countries leverage livestock to improve livelihoods, increase income and reduce (hidden) hunger and poverty. To support this development process, governments have developed policy frameworks and specified policy objectives spanning different livestock domains. Nevertheless, for the livestock sector to remain viable, governments need to account for the trade-offs and risks subsumed in livestock production and intensification. Forward-looking policies and programs that anticipate long-term changes in the livestock sector and that assess trade-offs are required to drive livestock development and make sure it is sustainable from an environmental, economic, social, and public health perspective.

Trade-offs are a concept used in economics to define the opportunity costs and risks involved in making decisions among alternative options. Trade-offs occur when decisions to improve one component of a situation have adverse consequences on other domains. In livestock decision-making, trade-offs may arise along all stages of the livestock value chain, from input supply, to production and consumption. The following sections examine the potential trade-offs related to environmental, socio-economic, human and animal health associated with two selected livestock policy objectives: i) increase livestock production through livestock intensification and ii) promotion of livestock competitiveness and commercialisation. (Figure 1). These two policies cut across all three case countries and offer an entry point for evaluating potential trade-offs.

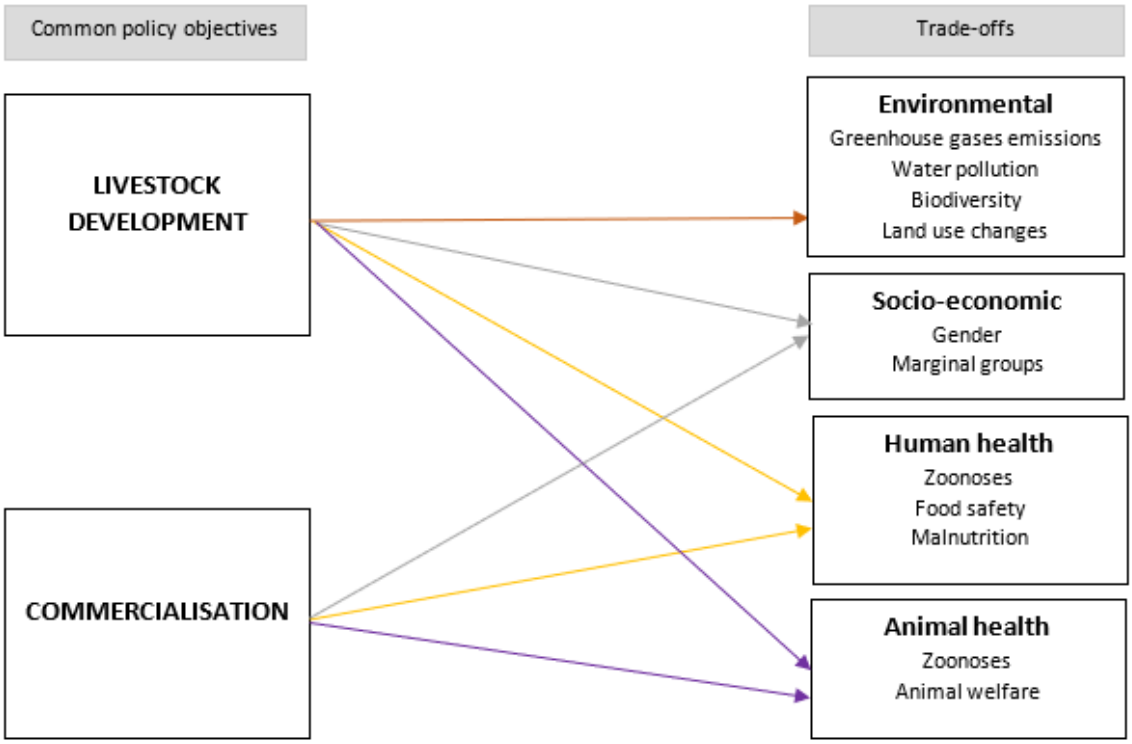

Figure 1: Relationship between livestock development pathways and related trade-offs

2.1. Livestock intensification and environmental trade-offs

Livestock-environment linkages have been sufficiently demonstrated in the past decades (Mario Herrero et al., 2015; Opio, Gerber, & Steinfeld, 2011; Paul et al., 2020). Resources, including land, biomass, and water, among others, are major inputs in livestock production. Livestock production, for example, accounts for about 4,387 km3 of the blue and green water used globally (Heinke et al., 2020). Furthermore, livestock production is characterized by large scale land occupation with more than 60% of agricultural land allocated to grazing. Moreover, livestock produces externalities, in the form of greenhouse gases emissions (GHG) and nutrient flows, contributing to climate change and water pollution (Opio et al., 2011).

With increased demand for animal-sourced food (ASF), governments are pushing to intensify livestock production to boost productivity and ensure food security. However, these transitions are likely to put additional pressure on natural resources and the environment, as feed and water requirements for livestock increase. Depending on the nature and scale at which these changes operate, livestock intensification may exacerbate the trade-offs arising from livestock production. Therefore, understanding the complex interactions between livestock and the environment is crucial for tailoring policy interventions. The next sections assess the relationship between increased production and a number of environmental indicators.

2.1.1. Livestock intensification, GHG and climate change

Livestock is a major contributor to GHG (Paul et al., 2020). The most important greenhouse gases from animal agriculture are methane and nitrous oxide (Berhe, Bariagabre, & Balehegn, 2020; Eisen & Brown, 2022; Mario Herrero et al., 2016), responsible for global warming and climate change. Methane (CH4) and nitrous oxide (N2O) are emitted by ruminants through anaerobic digestion of organic waste in the rumen and manure, as well as denitrification and nitrification processes in manure. Globally, livestock emissions range between 5.6 and 7.5 GtCO2eq/yr (Herrero et al., 2016), marked by regional disparities in the intensities of emissions (Herrero et al., 2016; O'Mara, 2011), and differences across livestock production systems.

There is increased evidence that different livestock production systems do not contribute equally to GHG (Berhe et al., 2020; Opio et al., 2011; Paul et al, 2020). Significant differences are observed in the amount of greenhouses gases along intensity gradients (Bellarby et al., 2013; Berhe et al., 2020). For instance, Bellarby et al. (2013) showed that grassland-based cattle and dairy production, as compared to intensive grain-fed agriculture, can result in lower GHG emissions, depending on land use patterns and land use change. A study by Herrero et al. (2016) revealed that crop-livestock systems account for 58 percent of total livestock emissions, whereas grazing-based systems contribute 19 percent of livestock emissions; industrial and other systems contribute to the remaining emissions.

The amounts of GHG observed in the different systems is closely linked to the practices inherent to feeding strategies, manure and herd management. Livestock intensification often involves a change in feeding strategies of animals, through the introduction of feeding technologies and feed concentrates (Chagunda et al., 2016; Domingues, Ryschawy, Bonaudo, Gabrielle, & Tichit, 2018; Salmon et al., 2018). Animals may be stall-fed on supplements, rather than grazing on rangelands. Furthermore, additional forage would need to be produced to account for the increased demand in feed (Rudel et al., 2015). Because feeding contributes the most to off-farm emissions, the intensification of livestock production systems is likely to be detrimental to the environment through GHG (Eldesouky et al., 2018). Likewise, increased volumes of manure must be managed as livestock production intensifies and specializes, which is a source of greenhouse gases such as methane (CH4) and nitrous oxide (NOx) (N2O)(Petersen et al., 2013). This often stems from the mismanagement of animal dejections, which results from a shift from grazing pasture to stall-feeding or supplemental feeding systems, leading to leakages and GHG emissions. There is a great potential to reduce GHG from all types of productions systems, provided sustainable management practices are in place (Berhe et al., 2020). Unless livestock

intensification integrates livestock management practices, with respect to manure management and feeding strategies, it may increase pressure on the environment.

2.1.2. Livestock intensification and water pollution

Beyond the impact on GHG emissions, livestock farming constitutes a threat to the quality of surface and groundwater. The leakages emanating from livestock farms cause adverse environmental effects, through the contamination of waters. Nitrogen (N) and phosphorus (P) losses from livestock production are considered the two major sources of water pollution (McDowell et al., 2017). In Europe, for example, both N and P account for up to 73% of water pollution (Leip et al., 2015), whereas in China N and P contributed 34 and 60% of water pollution, between 1980 and 2010 (Hou et al., 2014).

The drivers of these emissions are diverse and multiple and can be traced back to the livestock production systems and the management of nutrients. The excess nutrient supply, which derives from livestock manure seeps into surface and ground waters, leading to eutrophication (Tullo, Finzi, & Guarino, 2019). The export of these nutrients into catchments relate to the changes in hydrologic flow routes impacting N and P delivery and the changes in sediment generation influencing N and P delivery (Smith et al., 2013). The degree of water pollution is also intrinsically linked to the intensity of the livestock production systems, resulting in higher concentration of N and P from various water catchments (McDowell et al., 2017; Smith et al., 2013).

Livestock intensification is one of the major drivers of this environmental damage. The increased livestock production, driven by the greater demand in livestock protein has fostered intensive livestock practices, including overstocking, feed imports, or the increase of output per hectare of land allocated to livestock production (Stott & Gourley, 2016). The intensification of dairy farming has led to increased nitrate leakage into streams and rivers (Foote, Joy, & Death, 2015; McDowell et al., 2017). For instance, Wilcock et al. (1999) monitored a dairying catchment in the Waikato region of New Zealand and found large concentrations of phosphorus (P) and Ammoniacal nitrogen (N), as well as the presence of Faecal coliform and enterococci bacteria concentrations, amounting to 64–26000 and 7–23000 cfu in water. This pollution also affects the quality of drinking water, as a result of contamination from animal faeces (Udo et al., 2011). In developing countries, water pollution is expected to rise due to livestock intensification, particularly if poorly regulated, or unregulated as indicated in the renowned publication on Livestock's Long Shadow (Steinfeld et al, 2006).

In light of the above, livestock intensification, a policy objective in many developing countries, may lead to further degradation of water quality, unless fundamental changes to

the farming systems or physical changes implemented in the catchment such as more effective riparian buffers or treatment wetlands are implemented (Smith et al., 2013).

2.1.3. Livestock intensification, biodiversity and land use change

Biodiversity is a major topic in current debates regarding nature and environmental conservation. These debates are even more heightened in the livestock sector given the direct link between animal production and the conservation of biodiversity (Ajmone-Marsan, 2010; Alvarado et al., 2018). Livestock development has been associated with practices and land use strategies which have implications for the conservation of biological diversity (Henry M'ikiugu & Kilonzi, 2018; Opio et al., 2011; Williams et al., 2017). On the one hand, animal genetic diversity may be reduced where specific breeds are preferred to meet productivity objectives (Dumont et al., 2020; Sponenberg et al., 2019). On the other hand, the land use changes associated with livestock production can result in losses of plant and wildlife biodiversity (Alkemade et al., 2013; Pozo et al., 2021), jeopardizing the conservation of the global biological pool.

Maintaining global livestock biodiversity is important for ensuring the performance and resilience of livestock production systems (Brito et al., 2021; Dumont et al., 2020) and food security. With increased demand for ASF there is mounting pressure to intensify production for increased output. However, despite its undeniable benefits in terms of productivity and income generation, livestock intensification can lead to a uniformisation in the gene pool within the livestock systems (Hoffmann, 2011). Intensification of livestock production systems is often associated with the introduction of "improved" breeds with limited genetic diversity. Producers, motivated by the potential gains from high-yielding breeds, tend to invest in the animals that meet their profitability objectives, at the expense of genetic diversity. This situation is particularly salient in the dairy sector, where intensification has been accompanied by lower livestock biodiversity (Henry M'ikiugu & Kilonzi, 2018). Balancing food production with biodiversity conservation is thus crucial for the sustainability of livestock systems (Sponenberg et al., 2019). Policies that promote livestock intensification can help to alleviate the overall strain on rangeland biodiversity, but measures that address climate change and infrastructure development are required to mitigate biodiversity loss (Alkemade et al., 2013).

The practices inherent to livestock production are equally damaging to the environment through the loss of plant and wildlife biodiversity. Agricultural production to feed livestock drives land use changes globally, leading to deforestation and loss of savannah. To meet the growing demand for livestock feed, large areas of land are converted into forage crop fields, causing a loss in plant diversity. The anthropogenic effects of livestock grazing on

rangeland biodiversity has also been demonstrated, and grazing patterns have been shown to reduce the presence of herbivores, pollinators and predators (Filazzola et al., 2020). Findings from research in Kenya shows a 76% increase in sheep and goat populations coupled with a 68% decline in wildlife populations between 1977 and 2013 (Ogutu et al, 2016). Where livestock intensification adopts land-sharing rather than land-sparing strategies to livestock feeding, more concerns over the conservation of biodiversity will be raised (Alvarado et al., 2018).

2.2. Livestock intensification, commercialisation and socio-economic dynamics

The impacts of livestock intensification must be socially acceptable to create the right incentives for livestock intensification to occur (Bullock & Crane, 2021; Ransom et al., 2017; Tavenner, Crane, & Saxena, 2021). Most policies tend to focus on the economic benefits of livestock production intensification, failing to address some of the socio-cultural implications of these transitions. There is evidence, however, that the development of the livestock sector may have differential costs and benefits and thus implications for different categories of the population. Many of the technologies and institutional changes taking place within intensified livestock production systems are often detrimental to the most vulnerable people, including women and youth. In the following sections, we present current literature on how increased productivity, commercialisation and major livestock policy objectives, may intensify social and gender inequalities in livestock production systems.

2.2.1. Livestock intensification, commercialisation and gender (in)equity

Livestock production systems are characterized by a gender division of labour and a gendered pattern of resource allocation. Gender roles are often divided between in-house livestock management and management away from the homestead (Yurco, 2018). Where livestock is kept in the household, women often take on the burden of feeding, watering and cleaning the animals' sheds (Bain, Ransom, & Halimatusa'diyah, 2020; Ransom et al., 2017).

Evidence suggests that livestock intensification may exacerbate gender inequalities (Bain et al., 2020; Salmon et al., 2018; Tavenner et al., 2019). Where livestock intensification of livestock may exacerbate the burden on women labour and responsibilities (Njuguna-Mungai et al., 2022; Ransom et al., 2017), limiting their opportunities to engage in income generating activities. For instance, a dairy production program, which introduced crossbreed cows in Uganda, showed that women faced more time poverty than men, as a result of their increased burden of fetching water for cattle watering (Ransom et al., 2017). The greater water requirements of the "improved" cattle have, thus, translated into less time

for women to engage in other activities and leisure. Similarly, a study in Kenya indicated that women and girls spent extra time harvesting fodder as a result of the introduction of improved forage production in the livestock system (Njuguna-Mungai et al., 2022). This time poverty often translates into a decline in women's control over associated incomes, which may have negative effects on household nutrition (Njuki et al, 2016; Kariuki et al, 2013).

Livestock and livestock-products' commercialisation is an important policy objective in livestock sector development. However, as much as livestock commercialisation can yield important sources of income for households, it may have unexpected outcomes on social inequality and gender equity (Bullock & Crane, 2021; Tavenner & Crane, 2018; Tavenner et al., 2021, 2019). The gender dynamics underpinning livestock commercialisation may deepen gender disparities, where no action is taken to mitigate these effects. Livestock commercialisation has been linked to a reduced control over the sale of livestock products by women (Tavenner et al., 2019). As household become more market-oriented, men control over the sale and income from livestock increases at the expense of women. This is particularly of concern regarding the appropriation of commercialized commodities historically under women's domains which has been documented more widely in the agricultural sector (Carney and Watts, 1990; Dolan, 2001; Quisumbing et al., 2015). Women's financial status can also serve to subjugate them, especially if men's household expenditure reduces as women manage more income. For example, a study in Nigeria (Aromolaran, 2004) found increases in women's income share slightly reduced per capita calorie intake, which conflicts with the hypothesis that increases in the share of income under women's control will increase calorie intake. Furthermore, technological change in livestock production may alter traditional roles and responsibilities, transferring more duties to women (Gallina, 2016; Mullins, Wahome, Tsangari, & Maarse, 1996). A study of dairy production intensification in Kenya revealed that women's contribution to household nutrition and child education increased as a result of increased productivity and better access to income from dairy. This inequality in roles and access to benefits from increased productivity are also identified in the commercialisation of livestock products (Njuki et al, 2013).

Besides, there is increasing evidence that women have limited access to formal markets, relying mostly on informal livestock markets institutions (Bain et al., 2020; Tavenner et al., 2021). Women tend to rely on intermediaries and collection centres (in the case of milk) to sell their products, as norms prevent them to engage directly in the sale of livestock and livestock products. As policies focus on developing the formal market infrastructures and institutions, women may be excluded from the opportunity to negotiate better prices for their livestock products (Njuki & Miller, 2012). This gender-blind approach to livestock policy

development, thus poses the risk of creating unexpected outcomes, promoting perception biases and potentially undermining overall household welfare (Njuki et al., 2011; Kariuki et al, 2021; Djoudi et al, 2011).

2.2.2. Livestock intensification, commercialisation and social (in)equality

The livestock revolution presents a unique opportunity to increase incomes along the value chain, improve livelihoods and reduce poverty. With population growth, there is an urgent need to shift production and management practices to capture the income growth opportunities induced by the growing demand for ASF. Livestock intensification appears as one of the major strategies that could accompany this transformation but major questions remain: Whom does the intensification of livestock production systems benefit to? Are there losers and winners in the intensification, and what do policies do to counter these trade-offs? What strategies and policies should be implemented to ensure an equitable distribution of the benefits offered by the livestock revolution.

Livestock farming is characterized by different categories of producers, from extensive to more commercial types. Extensive systems rely on the extensive use of natural resources, greater herd mobility and dependence on the quality and availability of feed in the commons (Manzano et al., 2021). More industrial or intensive systems, on the other hand often involve greater number of animals per area of land, with increased use of inputs, including feeding with concentrates, stall-feeding and the use of technologies (Gerssen-Gondelach et al., 2017; Salmon et al., 2018). These disparities in production systems imply that policy pathways would have differential effects on categories of livestock farmers (Salmon et al., 2018).

Evidence suggests that missed opportunities for the poor smallholder farmers may be encountered, where policies do not take into account the heterogeneity which characterized livestock production systems (Bernués & Herrero, 2008). Some interventions may be biased towards large livestock farms, especially where the skills and technology needed to operate the new system is not accessible to the poorest farmers. Given the skills needed to operate some of the technological resources in livestock production (Paul et al., 2020), some categories may be crowded out of the system as a result of limited possibilities to adopt the required technologies (Bernués & Herrero, 2008). Furthermore, the power imbalances inherent to livestock, and the inability of small-scale farmers to compete on prices with large farms, may lead to the abandonment of the activity by (Clay et al., 2020), and creating a labour surplus, which may exacerbate rural urban movements. Promoting intensification of livestock production systems at all costs, may therefore be counterproductive, where it fails to create the right environment for heterogeneous groups of livestock farmers to strive.

2.3. Livestock intensification and human health

Zoonotic diseases and concerns with food safety pose an important threat to human health. Examples of disease transmission between livestock and humans have been well-documented, underscoring the human-livestock nexus. In recent years, in particular, the upsurge in zoonotic diseases, have led to worldwide epidemics (Ferreira et al., 2021; Kilpatrick & Randolph, 2012). Furthermore, the inadequate livestock-related diets are having adverse consequences on public health in Africa (Diarz et al., 2020; Mensah et al., 2021). In the next section, we elaborate on these interrelationships and how livestock intensification and commercialisation may contribute to exacerbating the situation.

2.3.1. Livestock intensification and zoonoses

Zoonotic diseases represent around 60% of infectious pathogens and make a quarter of emerging infectious diseases (Conraths et al., 2011; Goodwin et al., 2012). These diseases' prevalence is due to both direct and indirect factors, ranging from environmental drivers to the changing practices in livestock production (Ferreira et al., 2021; Grace et al., 2011). Additionally, the lack of awareness with respect to the risks associated with livestock husbandry (Hundal, Sodhi, Gupta, Singh, & Chahal, 2016; Lowenstein, Waters, Roess, Leibler, & Graham, 2016; Tebug et al., 2015), contributes to a widespread transfer of zoonoses to humans. The emergence of zoonoses has also been attributed to the livestock systems within which production operates.

The shift in livestock practices to intensive production systems has been associated with the emergence of zoonotic diseases (Clay et al., 2020; Ferreira et al., 2021; Guyomard et al., 2021) and antimicrobial resistance (AMR) (Rushton et al., 2018). The practices, inherent to intensive production, including feeding and land use strategies create a conducive environment for livestock diseases to strive (Gilbert, Thomas, Coyne, & Rushton, 2021; Smit & Heederik, 2017). The increased stocking densities which characterize intensive systems, the shift away from forage-based systems, animal confinement, and increased use of technical inputs such as veterinary treatments and high-productivity genetic resources, facilitate the emergence and spread of zoonoses (Gilbert et al., 2021).

As livestock density rises, the interactions between humans and livestock increases the potential for transmission of zoonoses (Ferreira et al., 2021; McDaniel, Cardwell, Moeller, & Gray, 2014; Smit & Heederik, 2017), as the proximity between livestock farms and neighbouring human residences increases. This closeness fosters the emergence of pathogens, easily transmitted to animals and to humans (Smit & Heederik, 2017). The persistence of brucellosis in pastoral communities and air-borne Q fever is an example that changes in production systems, unsupported by public health measures, can constitute a

risk to human health (Clark & Soares Magalhães, 2018; Racloz, Schelling, Chitnis, Roth, & Zinsstag, 2013).

2.3.2. Livestock commercialisation and food safety

Beyond the contamination risks associated with direct contact with sick animals, human health could be affected through the consumption of animal-contaminated foods (Asakura, Makingi, Kazwala, & Makita, 2018; Lencho & Seblewongel, 2018). Contamination can occur at different stages of food processing, from production, to transport and handling of ASF. The likelihood of food being contaminated in the processing stage is closely linked to the level of intensification within the production systems. In the dairy sector, in particular, the use of improved breeds, combined with the lack of knowledge of farmers with regards to milk-borne diseases, increases the risk of food contamination (Lencho & Seblewongel, 2018; Nyokabi et al, 2018; Mosalagae et al., 2011). The intensification of livestock production in livestock systems may, thus, exacerbate livestock food borne- diseases, where no actions is taken to sensitize livestock farmers and actors along the livestock value chains. But livestock- related diseases are not only an outcome of contaminated food or direct contact with sick animals.

2.3.3. ASF consumption and negative heath implications

There are strong arguments in favour of ASF consumption. Across the continent, livestock contributes significantly to food security and improved nutritional outcomes (Herrero et al, 2021; Njuki et al, 2013; Herrero et al, 2013; Randolph et al, 2007). ASF are among the highest-valued nutrient-rich foods which are largely missing from plant sources and contribute considerably to addressing the high stunting rates that prevail across SSA (WHO, 2014; UNICEF, 2019). These characteristics make the consumption of ASF vital for physical and cognitive development, especially for the rural poor who lack access to or cannot afford other nutrient-dense foods (Otten et al., 2006 cited in Enahoro et al, 2019; Balehegn et al, 2021; Headey et al., 2018). Furthermore, owning livestock has been associated with a 20 percent increase in potential caloric nutrition at the household level within SSA countries, including Zambia, Kenya and Burkina Faso (Frelat et al, 2016; Enahoro et al., 2018; Hoddinott et al., 2015).However, despite the nutritional benefits ASF can provide, overconsumption can lead to adverse health outcomes, leading to chronic diseases, including colorectal cancer and cardiovascular disease and obesity (Daneshzad et al., 2021; Godfray et al., 2018). A study in Tanzania shows that red meat consumption was associated with the prevalence of hypertension and hyperlipidaemia among Masai pastoralists (Diarz et al., 2020). In the past few years, meat consumption per person/day in sub-Saharan Africa has reached unprecedented levels, up to 98 g, well-above the

recommended 70g (Mensah et al., 2021). These consumption patterns are influenced by cultural practices, which link meat consumption to higher social status (Gorski et al., 2016). Public authorities and livestock policy makers should therefore be aware of the consequences of increased meat availability and consumption, and tailor interventions accordingly.

2.4. Livestock intensification and animal health

Animal health and welfare is a major concern in livestock husbandry. Mortality rates due to animal diseases remain high, reaching 10 % in cows in East Africa (McDermott et al., 2010), and leading to reduced livestock production efficiency. With increased demand for ASF and the ensuing changes in livestock production systems, animal health and welfare are gaining momentum within the general public and policy makers. That is because livestock management strategies, feeding regimes, housing patterns and use of drugs, have implications for animal health and welfare status (Browning & Veit, 2021; Voutzourakis et al., 2021). In comparing dairy farming production in France, Fourichon et al. (2001) found that clinical mastitis was more common in dairy farming systems with the highest intensification. Likewise, Ducrotoy et al. (2015) found the incidence of brucellosis was lower in extensive systems relative to intensive ones, owing partly to the different confinement strategies adopted in both systems. In the former, the opportunity that livestock had to remain outdoors, reduced the disease incidence. Livestock intensification of dairy production has also been linked to less time for grooming outdoors and more lameness (Stafford & Gregory, 2008).

Likewise, the changing feeding patterns characterizing livestock intensification may result in negative animal health and welfare outcomes. In comparing cattle fed with concentrates with cattle who received no supplemental feeding on concentrates, Ertl et al. (2014) found that cows on farms where concentrate supplementation was not used adapted their performance to the decreased nutrition supply, resulting in lower metabolic stress and a higher likelihood of better fertility and animal health. As a consequence, the costs of veterinary services in these systems were reduced. This result is in line with that of Lean et al. (2008) who observed that acidosis often occurs in pasture-based dairy systems where cows are supplemented. Animal welfare remains rather neglected in African livestock policies more generally. Lusk & Norwood (2011), for example argue that in high output systems, producers would not be incentivized to consider animal welfare in their production choices. This is because farmers do not integrate the full social cost of production in the prices, producing externalities in the form of poor animal welfare management (Harvey & Hubbard, 2013). In light of these findings, it is crucial to consider the health and welfare

trade-offs in livestock productivity projects to ensure that animal health and welfare is not traded for increased productivity.

3. Methodology

The multi-functionality of livestock presents a particularly strong case for understanding the extent to which trade-offs are accounted for in policy making. To achieve this, the study adopted a desk-based approach consisting of an internet search for policies, followed by a content analysis (Stemler, 2001) of the principle livestock policies in Kenya, Zambia and Burkina Faso. All three countries are part of the "Program of Accompanying Research for Agricultural Innovation" (PARI) funded by the German Federal Ministry of Economic Cooperation and Development (BMZ). The countries were selected because they have a long history of livestock production, and are undergoing significant transformations in the livestock production systems. Besides, with the integration into the market economy and the increased population, policy makers in these countries have initiated policy frameworks to accompany the development of the livestock sector.

The Internet search was conducted through Government websites of the respective country ministries (Ministry of Agriculture, Livestock, Fisheries and Cooperatives in Kenya; Ministry of Fisheries and Livestock in Zambia; and the Ministry of Livestock and Fisheries in Burkina Faso). Where policy documents were not available on official websites, a complimentary search was conducted using the Google search engine. Overall, 61 policy documents were found, consisting of Policies, Bills, Sessional Papers, Acts, Plans, Frameworks, Strategies. In Kenya, Burkina Faso and Zambia, these accounted for 38, 13 and 10 documents respectively. The documents retrieved varied in terms of types of documents (legislative; frameworks/strategies/plans) as well as geographic scope (continental; regional). The principle policy document(s)[1], namely Kenya's Draft National Livestock Policy (2019); Zambia's National Livestock Development Policy (2020), and Burkina Faso's National Sustainable Livestock Development Policy, and the Livestock Sector Investment Plan (2010), was (were) selected and the components reviewed systematically using the value chain approach.

To explore the extent to which trade-offs are incorporated, the policy documents were assessed according to four general criteria (environment, economic, social and governance) recommended by the Food and Agriculture Organization's (FAO) Sustainability Assessment of Food and Agricultural Systems (SAFA) (FAO, 2014). Each policy was reviewed to identify the range of objectives along with the presence and detail of measures to address any potential negative trade-offs between the SAFA categories.

[1] Two policy documents were reviewed from Burkina Faso, the National Sustainable Livestock Development Policy (PNDEL) and the Livestock Sector Investment Plan (PAPISE), which are respectively the policy framework and the implementation plan. The PAPISE provided a concise approach for addressing the policy objectives introduced in the PNDEL.

The analysis of negative trade-offs focused on the absence of explicit measures included in the policy objectives and also took into consideration strategies that were not overtly listed as a 'measure to address a named trade-off' but that were a) listed in policies with general relation to said trade-off and b) contributed to practices along the value chain that would directly minimize the said trade-off. To better understand the different extent to which trade-offs we accommodated in the policies, the study developed a scoring methodology whereby the degree to which negative trade-offs are accounted for in policy were allocated different scores. Namely if a negative trade off was explicitly accounted for in a policy, a high score of 2 was allocated; if a negative trade off was only mentioned (for example, as part of the situation analysis or a cross cutting issue) without a direct measure stated for its mitigation, an intermediate score of 1 was allocated; whereas, if a negative trade off was not mentioned and no measures were accommodated in the policy, a low score of 0 was allocated. A general limitation of the study is that it reviewed mostly policy language, however, secondary literature (other policies, peer reviewed papers) were referred to where possible to triangulate findings regarding the extent to which the approaches to address trade-offs were accommodated for in policies from related sectors either nationally, regionally and/or continentally representative.

Table 1: Basic facts about livestock in selected case countries

Overview of the livestock sector			
	Burkina Faso	**Kenya**	**Zambia**
Livestock share of GDP (%)	20	26	30
Share of population employed in livestock (%)	86	70	>50
Distribution of livestock species (heads/1000 people)			
	Burkina Faso	**Kenya**	**Zambia**
Cattle	470	335	195
Sheep	499	335	9
Goat	748	521	185
Chicken	1817	576	794
Pigs	121	62	58
Donkey	58	-	-
Camel	-	55	-

Sources: Ministry of Livestock and Fisheries Burkina Faso (2018), Livestock census in Kenya (2019, Kenya National Bureau of Statistics), Zambia National Livestock Development Policy (2020)

4. Results

The following results are based on a thorough review of existing National livestock policy documents in Kenya, Zambia and Burkina Faso. Namely, Kenya's Draft National Livestock Policy (2019); Zambia's National Livestock Development Policy (2020), and Burkina Faso's National Sustainable Livestock Development Policy, and the Livestock Sector Investment Plan (2010). A summary of all the policy documents uncovered in the search can be found in Annex 1. The review highlighted several livestock policy similarities among the selected countries, but also revealed country-specific priority areas (Table 2). The overall livestock policy objectives (Policy Statement; Policy Objective and Measures) concentrate on promoting a livestock development pathway that is both commercially-oriented and sustainable. The objectives stated in all the documents give priority to developing the sector to improve and enhance livelihoods and socio-economic outcomes. In taking this development stance, all countries aim to reduce poverty and increase income by promoting livestock productivity and competitiveness.

4.1. Overview of policy similarities between selected case countries

Table 2 presents the results from the analysis of the major livestock policy document in each of the countries. The majority of the strategies designed for livestock development were similar across countries, with some variations in the formulation and focus of the policies. To achieve the proposed policy outcomes, i.e., to generate income and improve livelihoods, all countries elaborate on policy pathways with regards to animal health, sustainable management of animal genetic resources, animal welfare, environmental management, food safety and standards of production, institutional collaboration as well as research and development and/or extension. To varying degrees, each of the countries has integrated these major policy strategies into their livestock development framework. Overall, the policies address all stages of the livestock value chain: Inputs and services, production, trade and processing, and consumption. Overall, measures are promoted to improve access to services and inputs and considerable emphasis is placed on enhancing the factors of production. Efforts to promote processing and trade are integrated and expected to boost the sector across all three countries. While aspects of food safety and consumption are prioritized considerably less across the countries, livestock sector expansion with respect to various commonly acknowledged cross cutting issues are overtly expected to accommodate for sustainable growth. Taking each node in the livestock value chain, the main policy measures are presented in more detail in Annex 1. Table 2 describes the broad policy objectives identified in the selected National livestock policy documents, and

assesses the importance accorded to each broad objective by the three countries. Where an objective is clearly stated in the policy document, a triple plus code is used to account for the integration, where the objective is only indirectly mentioned, a double plus is used and a 0 is applied where no mention of a given objective appears in the policy document.

Table 2: Major livestock policy objective in Kenya, Zambia and Burkina Faso

	KENYA	ZAMBIA	BURKINA FASO
OVERALL POLICY OBJECTIVES	The broad objective is to contribute to food and nutrition security and improved livelihoods while safeguarding the environment.	The overall objective is to transform the livestock industry in order to enhance socio-economic development.	The overall objective is to strengthen the contribution of livestock to the growth of the national economy and to improve the food and nutritional security, and the livelihoods of the populations.
SERVICES			
Animal healthcare	++	++	++
Animal Genetic Resources (AnGR)	++	++	++
Extension services	++	++	++
Finance	++	+	++
Insurance	+++	o	o
INPUTS			
Livestock nutrition	++	++	++
Feeds and feeding	++	+	++
PRODUCTION			
Land	+	+	++
Water	+	++	++
Labour	o	o	o
Human-livestock-wildlife interactions	++	+	o
PROCESSING AND TRADE			
Marketing	++	++	++
Value addition	++	++	++
Agribusiness	++	++	++
CONSUMPTION			
Consumption	++	+	+
Food safety	++	++	++
CROSS CUTTING ISSUES			
Climate change	++	+	+
Enabling infrastructure	++	++	++
Security	++	o	++
Information/data management	++	++	++
Gender	++	+	+
Youth	++	+	+
Other marginalised groups (people with disabilities; HIV/AIDS)	++	o	o
Drugs/substance abuse	++	o	o
Animal welfare	++	++	o
Research & development	++	++	++
Biotechnology	++	o	o

++ **Clearly** stated in policy document (as a policy objective or policy measure)
+ **Indirectly** stated in policy document (mentioned in situation analysis or elsewhere)
o **Absent** from policy document (not mentioned in policy document)

4.2. Trade-offs among livestock development polices

Trade-offs between policy objectives were captured through a cross country comparison to identify negative correlations with livestock development trajectories. The analysis of trade-offs focused on the absence of explicit measures included in the policy objectives and also took into consideration strategies that were not overtly listed as a 'measure to address a named trade-off' but that were a) listed in policies with general relation to said trade-off and b) contributed to practices along the value chain that would directly minimise the said trade-off. Trade-offs were said to exist where documents provided no measure for mitigating the effects of a given policy.

Five overall categories were identified where combinations of objectives could incur positive outcomes at the expense of adverse impacts, namely with the environment, socio-economic dynamics and human/animal health. For example, environmental trade-offs (GHG, water pollution, biodiversity, soil degradation, human-wildlife interactions) may be undermined due to increased livestock production and offtake to meet growing consumer demand. Unintended socio-economic costs (intensified gender and age inequality, wealth disparities, etc.) may be incurred if the costs and benefits of intensified production, increased commercialisation and access to respective livestock inputs/services are unevenly distributed. Whereas, livestock intensification of herds/flocks with low genetic diversity may weaken anti-microbial resistance (AMR), compromise animal welfare and increase the likelihood of zoonotic diseases. Intensification and commercialisation may also increase much-needed access to ASF but negatively affect human nutrition. Whereas, resource governance, especially regarding land tenure may contribute to intensifying insecurity. It is striking how some of the risks associated with livestock production and livestock development are not discussed in policy documents. Specifically, climate change effects, water pollution and the double burden of malnutrition are aspects that are ignored in livestock policies despite their adverse consequences on both the environment and human health. Figure 1 introduced a summary of different trade-offs associated with policy objectives. Results from each trade-off identified are presented in Table 3 and at least one of the key trade-offs is discussed in more detail in the corresponding section. We identify the trade-offs and specify whether they were accounted for in the policy frameworks. Where a clear statement was made regarding a given trade-off with actions taken to integrate the trade-off, an individual score of 2 was assigned (++). On the other hand, in policy documents where the potential trade-off was referred to without any specific measure to addressing it, then a score of 1 (+) was attributed. Finally, a score of 0 (o) was assigned when the policy document did not mention the related trade-off. The "scoring" column is the sum of all scores obtained for all three countries. A score of 6, for example implies that all three countries integrated the trade-offs in their policy design. A score of 0 on the other hand implies that

none of the three countries accounted for the trade-off in their policy document. In subsequent sections, we select one trade-off from each sustainability component for further discussion.

Table 3: Trade-offs associated with policy objectives

POTENTIAL POLICY TRADE-OFFS	SPECIFIC TRADE-OFFS	ACCOUNTED FOR IN POLICY DOCUMENTS			SCORING
		Kenya	*Zambia*	*Burkina Faso*	
Environment	GHG emissions	o	o	**o**	**0**
	Biodiversity	++	o	+	3
	Soil degradation	++	o	o	2
	Water pollution	o	o	o	0
	Human-wildlife interactions	++	o	o	2
Socio-economic	Gender equity / equality	++	+	**+**	4
	Price stability/volatility	++	o	**o**	2
Human health	Double burden of malnutrition	o	o	**o**	0
Animal health	Animal welfare	++	++	**o**	4
	Zoonotic and infectious disease	++	++	++	6
Governance	Conflict / insecurity	++	o	+	3
	Land tenure security	o	o	++	2

++ **Clearly** stated in policy document (as a policy objective or policy measure) (score=2)
+ **Indirectly** stated in policy document (mentioned in the situation analysis or elsewhere) (score=1)
o **Absent** from policy document (not mentioned in policy document) (score=0)

4.2.1. Livestock intensification and environmental trade-offs

The reviewed policies outline clear objectives to enhance livestock production along the value chain. These include measures to improve animal health care and livestock extension as well as strategies to promote livestock marketing, value addition and agribusiness opportunities. With growing demand for ASF, successful combination of these measures is expected to incentivise expanded livestock production, which can occur at the expense of various environmental functions. Possible trade-offs include degradation of soil and water, destructive activities due to competition for land and water resources (deforestation and land use change), increased greenhouse gas (GHG) emissions and threats to species diversity due to the encroachment of livestock and humans into wildlife habitats. All three country documents present an overarching commitment to achieving sustainable livestock production. For example, the Burkina Faso policy explicitly focuses on livestock production 'respectful of the environment'.

However, the extent to which environmental trade-offs are recognised and accommodated for varies within and across the policy documents. In general, none of the countries integrated policies to address GHG emissions and water pollution associated with livestock production. Land use change through deforestation and the management of livestock-related GHG are mentioned only as cross-cutting issues affecting future livestock production in the Zambia policy, with no direct measures for mitigation; no such attention to deforestation is allocated in the Kenya policy. Few direct measures and clear strategies to ensure environmental sustainability of livestock production are presented in the Zambia and Burkina Faso livestock policies. Kenya's livestock policy encompasses safeguarding the environment in the overall objective and weaves various concrete strategies to minimise negative outcomes throughout the document. Nonetheless, shortcomings in the measures presented to manage negative environmental outcomes of increased livestock production are noted in all three documents. Specifically, poor soil quality and erosion are identified in all three policy documents as a concern for livestock production, however measures to improve soil health are absent in both Burkina Faso and Zambia policy documents. Whereas, explicit measures to manage water availability for livestock production are pronounced in the Burkina Faso and Zambia policy, but clear strategies to manage water quality are absent in all documents. The prevalence of land degradation is recognised in all country policies however, measures to rehabilitate degraded lands are only included in the Kenya policy, and alternative land management practices such as reseeding are absent from all documents. While the complexities of livestock production under communal tenure systems are acknowledged in Kenya and Zambia livestock policies, precise approaches to address challenges of land fragmentation and conversion for livestock production are lacking. For example, the Kenya policy document promotes the increased production of cereals and oilseeds crops for concentrate livestock feed resources, but no direct measures to mitigate against the implications for increased demands for land are identified. The Kenya policy does however integrate measures to manage the coexistence of humans, livestock and wildlife alongside policy objectives for promoting utilisation / exploitation of animals classified as wildlife, no such measures are considered in the Burkina Faso or the Zambia policy.

Although few measures are presented to mitigate against *specific* environmental outcomes, the commitment towards sustainable livestock management more generally, especially in the rangelands is evident in the three policy documents (Specific Objective 1 and 7 in Kenya and Zambia, respectively).[2] Implicit in these measures are soil improvement practices that are expected to enhance or minimise damage to soils, such as promoting appropriate

[2] Kenya: Specific Objective 1 'improve the management of rangeland resources'; Zambia: Specific Objective 7 'improve the management of rangelands and livestock water resources'

(communal) grazing management strategies/practices and sustainable pasture/forage utilisation and conservation. The Zambia policy emphasises the adoption of technology, whereas the Kenya policy states measures to monitor and control rangeland deterioration and promotes a commercially oriented approach for pasture/forage management. That both policies promote rangeland management practices indirectly indicates a commitment to water pollution prevention practices (such as keeping livestock out of sensitive or degraded areas and providing alternative sources of water from livestock). Furthermore, measures in all three policy documents promote locally adapted or indigenous livestock breeds which suggests strategies towards the efficient matching between livestock breeds and resource (feed/forage/water) availability. It is likely that the negative environmental impacts of increased livestock production are indirectly accommodated for under the objective on livestock research and development which is common to all three policies. The same may also be the case for objectives on AnGR whereby establishing livestock breeding programmes will promote access to improved and local animals with suitable genetic potential thus minimising adverse environmental outcomes. The latter may help compensate for the accumulation of animals with the stocking of fewer livestock of greater genetic potential, a challenge facing African production systems.

4.2.2. Livestock intensification, commercialisation and social (in)equality

Market chain improvement including approaches to enhance access to inputs and services and create opportunities for the processing and trade of livestock and livestock products is promoted in the three documents. The documents also acknowledge that livestock keepers are heterogeneous, differentiated in terms of size of holding (smallholders and ranchers), gender (male and female) and geographic location (rural and urban). In order to leverage livestock as an effective entry point to improve livelihoods (Kenya overall policy) and enhance socio-economic development (Zambia and Burkina Faso overall policy), it is necessary for policies to integrate appropriate measures that ensure the benefits of an improved livestock sector do not bypass or negatively impact certain categories of the society.

Overall, all three policy documents acknowledge categories of social differentiation, but to varying degrees of specificity. For example, the Zambia policy document prioritises two Guiding Principles, firstly of Equity and Equality and secondly, Inclusiveness,[3] and makes mention of gender mainstreaming. These principles are reflected in recognition of the challenges smallholders face with unsecured guarantee to land tenure and the limited

[3] Guiding Policies on Equity and Equality: The Policy will endeavour to ensure that livestock development programmes reach the poor and vulnerable households and on Inclusiveness: The Policy will endeavour to ensure that citizens participate in livestock development programmes.

recognition to their application of indigenous knowledge and practices (IPK). Interestingly, the Burkina Faso policy states the inclusion of gender in the design and implementation of livestock policies but provides no clear guidelines on how this outcome would be achieved. In addition to making the differentiation based on gender, the Burkina Faso document acknowledges that traditional livestock keepers have low education levels and aims to integrate them into livestock development policies. The ultimate objective is to enhance school enrolments rates among transhumant herders whose children are often left out of school. The Kenya document on the other hand, makes concrete policy provisions for gender and social inclusion with measures to 'ensure that public and private sector supported livestock development programs are gender sensitive in their design and implementation'. Social inclusion in the Kenya document also accommodates for enhanced involvement of the youth in the livestock sector.

More generally, the documents acknowledge socio-economic factors (age, gender, education and poverty levels) that determine risks of exclusion as value chains expand and become more profitable. The Kenya policy even makes provisions for uneven access to benefits for what is termed 'persons with disabilities' (PWD). The policy recognises that on one hand, increased and sustained livestock production and profitability contributes to food and nutritional security enabling households to mitigate the effects and impact of HIV-AIDS. On the other hand, the policy recognises that intensive livestock related activities may increase the effects of HIV-AIDS as increased incomes can raise the likelihood of engaging in risky behaviour at market centres.

4.2.3. Livestock commercialisation, competition and increased and price volatility

From an economic perspective, most countries specify into their livestock development policies, more competitive markets and the integration of livestock into the. For small economies, competition on international markets for livestock products may be detrimental to the local farmers if no policies are implemented to buffer against world market prices which are often volatile and with shocks which may not be absorbed by the local herders. In the Burkina Faso policy document, efforts are made to facilitate producers' access to markets but no clear measures are taken to protect local producers against price shocks in the global markets. The Kenya policy document (Section 3.4: Marketing of Livestock and Livestock products: Livestock and Livestock Products Aggregation, Transportation and Trade), on the other hand mentions measures to strengthen security and deter dumping while promoting competitiveness of local products to cushion producers.

4.2.4. ASF consumption and negative heath implications

All three policy documents recognise the critical and strategic role of the livestock sector in contributing to food and nutrition security. The Kenya policy specifically prioritises food and nutrition security as a specific policy objective accompanied by relevant measures (3.10), whereas the Zambia policy highlights the direct benefit to food security of improved animal health service delivery. Burkina Faso recognises and emphasises the importance of strengthening the value chains that enhance the food and nutritional security of the population. All the policies are therefore written with a justified recognition that increased access to ASF can considerably address the challenges of food insecurity and malnutrition faced by a considerable proportion of Africa's populations. Despite these overwhelming advantages, increased access to and availability of ASF does not always lead to improved overall nutrition. On the contrary, the double or multiple burden of malnutrition whereby overconsumption of ASF (e.g. of calories) replaces important sources of micronutrients from alternative food groups co-occur across or within countries, households or individuals, can be an unintended outcome of increases in income per capita and ASF consumption. Nevertheless, despite the projected increase in 'per capita consumption of livestock products (50% by the year 2030) and the ensuing increase in the demand for livestock products' (identified in the Zambia policy), measures to compensate for any associated negative health outcomes are absent from all documents, which bypasses measures to address the negative implications for health outcomes in the future.

Overall, all three policy documents integrate measures to ensure that consumers are protected by integrating policies on food safety across the livestock value chain. However, only the Kenya policy document dedicates an explicit focus on 'the consumer' in the livestock value chain by integrating measures to promote the consumption of livestock products as well as to support consumer rights to information and quality livestock products. In none of the policies is the increased production and consumption of ASF accompanied by strategies to promote 'good human nutrition and health'. Furthermore, although the Kenya and Zambia policy documents lay out the institutional framework highlighting other stakeholders and their roles, only the Zambia policy includes the Ministry of Health, but purely in the capacity to 'facilitate the training of livestock farmers on food safety and handling' (and not on educating the consumer side of the value chain).

4.2.5. Livestock intensification and negative animal health and welfare implications

The policies provide a structure to guide the livestock sector in meeting the growing demands for ASF in the reviewed countries. Despite the potential income and human welfare benefits for actors along the value chain, a concern over the low levels of animal

welfare is presented only in the Kenya and Zambia documents for which a number of measures is presented. These measures range from regulation and enforcement of animal welfare standards to the strengthening of institutional cooperation and improvement in public awareness. However, as demand for ASF grows and systems transition towards more commercially-oriented and industrial production, room exists to accommodate for potential negative animal health and welfare impacts. Possible animal health and welfare trade-offs associated with increased production in intensified systems appear not to be adequately accommodated for and measures against harmful selective breeding of fast-growing animals (which causes discomfort for animals; separation of calves from cows and a risk of reduced genetic diversity), practices of mutilation and increased risks of anti-microbial resistance (AMR) are lacking.

Except for Burkina Faso, the policies prioritise the promotion of animal welfare. Nevertheless, it remains unclear whether the system and value chain-specific animal welfare are sufficiently recognised. Overall, the Zambia policy is relatively detailed with respect to coupling specific animal welfare challenges in the livestock production environment with specific policies, which clearly demonstrates the cross-cutting nature of animal welfare issues.[4] However, the apparent bias towards rangelands systems may bypass specific measures required to address animal welfare issues occurring as systems intensify that may be unique to particular livestock species.

While the Kenya and the Zambia policies recognise the importance of 'housing', and measures for regulation and enforcement are alluded to, complementary measures to enable that all livestock keepers can comply with regulations for appropriate housing facilities appear missing, especially in the Zambia policy where mention of mechanisms to increase access to financial services are absent. Furthermore, the conditions for housing in intensified livestock systems are particularly important, especially regarding conditions of livestock crowding and waste disposal. Although all three country policies also prioritise the management of AnGR and the enhancement of breeding programmes, concrete measures to manage breeding for industrial or commercial offtake are absent. This absence is important to recognise because increased production of livestock in intensified systems can incur negative animal welfare trade-offs in cases where clear policies for selective breeding for large muscles and fast growth are lacking. Such selective breeding applies especially in poultry and pigs raised for meat. Without well-articulated and enforced policies selective breeding policies may compromise animal welfare in terms of physical problems,

[4] Animal welfare challenges such as poor Management of Rangelands and Water Resources, weak Animal Health Delivery Services and limited Application of Indigenous Knowledge and Practices coupled with specific policies such as the policies to improve the management of rangelands and livestock water resources and to improve animal health service delivery; for which the application of Indigenous Knowledge and Practices is promoted in both.

cardiovascular inadequacy and heightened risk of mortality. Ultimately, these challenges undermine the freedom of livestock to express normal patterns of behaviour and may particularly compromise livestock's freedom from physical discomfort, pain and injury.

Both the Kenya and Zambia policies also recognise that animal health is integral to animal welfare, and the Burkina Faso policy emphasises animal health without referring to animal welfare. Of particular concern are the implications for animal welfare and human health of rising AMR under intensified systems. The Kenya policy integrates measures to manage increased AMR in intensified systems. In the policy, AMR is recognised as threatening 'the ability to treat common infectious diseases resulting in prolonged illness, disability and death' and accommodated for by a clause to develop national AMR action plans. While the Zambia policy promotes improved access to animal health service delivery (such as preventative treatment), the extent to which measures are accommodated in the policy to manage increased AMR under intensified systems is unclear. Growing AMR not only undermines livestock's freedoms from disease and death, but also has negative human health implications along the food value chain. Such risks may be compensated for by the policy inclusions on the need to improve overall management practices to increase food safety. However, no mention of the rules and regulations for slaughter – an activity that increase contact with animal fluids - and other biosecurity measures are integrated in either of the policy documents.

5. Discussion

The objective of this report was to explore the extent to which trade-offs associated with livestock development are incorporated into the policies of Kenya, Zambia and Burkina Faso. The results reinforce the recognition from all countries that livestock are a key livelihood source for millions of African households, providing important economic, nutritional and social needs (WEF, 2019; Schneider and Tarawali, 2021; Tarawali, 2021; Herrero et al, 2021; Herrero et al, 2012). However, while some trade-offs are accounted for in the policies, others are understated and even ignored. GHG emissions, water pollution, and negative implications of ASF consumption for human health are largely neglected in the policy documents, raising concerns about the sustainability of the livestock sector in the three case countries. This discussion explores the contribution of the results to current debates on environmental, socio-economic and health related outcomes of increased livestock production so as to present potential policy combinations for livestock development within the context of increasing demand for livestock products on the continent and beyond. The next section is structured as follows. First, we discuss the implications of livestock development for GHGs and why policies may fail to address them, then we discuss issues relating to gender mainstreaming in livestock policies, we move on to discuss the health implications of livestock policies, especially relating to overconsumption. In subsequent sections, issues with regards to multi-sectoral coordination for animal and human health are discussed, then we talk about issues relating to animal welfare and land tenure. The final section provides a synthesis and provides guidelines on how these issues could be addressed to ensure a more sustainable livestock development.

5.1. Trade-offs with environmental integrity and implications for and from climate change

Concern about increased negative environmental impacts from growing livestock numbers dominates global policy discussions (Greenpeace, 2020; Shukla et al, 2019; Searchinger et al, 2019; Herrero et al, 2015; Hilborn et al, 2018). While the livestock sector in Africa has been historically neglected from agricultural policies, the reviewed documents dedicated to livestock are testament to the growing commitment of African countries to promote sustainable growth of the sector. However, explicit measures to address livestock-related GHG emissions (as well as water pollution and deforestation) are absent from all policies, whereas measures to address biodiversity loss and soil degradation are absent in at least two policy documents. These findings partially indicate that the policy environment for managing environmental challenges associated with livestock production in Africa is still in its infancy or is ‘underdeveloped’ (Balehegn et al, 2021). The findings may also demonstrate

the policy-related challenge of prioritising among the multiple wicked problems facing African agriculture, such as food insecurity and poverty. As such, the results show that efforts to minimise the vulnerability of livestock-based livelihoods and widespread nutritional deficits are prioritised over measures that explicitly address GHG emissions; in some cases, it is not unusual that measures to promote adaptation receive more policy attention than those on mitigation (Balehegn et al, 2021; Ashley, 2019).

Of growing concern is the livestock sectors substantial contribution to SSA's GHG emissions (Ashley, 2019; FAOSTAT, 2019; Otte et al, 2019). Our study reinforces findings that strategies to reduce GHG emissions in various African countries are either weak, or entirely lacking (Ashley, 2019). Except for the Kenya policy, none of the documents explicitly integrate measures to address the impacts of livestock production on climate change, whereas none of the policies integrate measures explicitly targeted for the reduction of GHG emissions. This is surprising given that the contribution of the livestock sector to overall agricultural GHG emissions and east Africa's relatively high GHG emission intensity (four times greater than the global average) are important concerns for the future of the sector (Pressman et al., 2018)[5]. Overall, Africa is seeing the fastest rate of livestock-related emissions growth (Hauzer and Scoones, 2021) which is driven by high stock numbers and low livestock productivity (Adesogan et al, 2020; Thornton and Herrero, 2010). GHG intensities are higher for small ruminants with poor feed conversion efficiency lending to the general conclusion that production in extensive systems is responsible for the highest per animal GHG emissions (Steinfeld et al. 2006; Garnett et al. 2017). In Kenya, for example, livestock-related activities are estimated to contribute to 92 percent of the total GHG emissions from agriculture, mainly via enteric fermentation (20.8 Mt CO2eq or 55 percent) and manure left on pasture (13.6 Mt CO2eq or 36.9 percent) (WRI CAIT 2.0, 2017 cited in FAO, 2019). The reviewed policies clearly present strategies to promote livestock production with, at best, covert consideration of increases in emissions that would accompany the sectors expansion. Ashley (2019) notes that the absence of policy focus on mitigation could potentially conflict with existing frameworks which target the reduction of livestock sector emissions (for example, NCCAP, 2018-2022; CSA Strategy/Implementation Framework, 2018-2027; NDC). In Burkina Faso, for example, forest conservation policies may conflict with livestock policies, which encourage free access to protected areas in times of feed crises.

There is little consensus however on suitable policy options for Africa due to the complexity of interactions between livestock, ecosystems and producers. On the one hand, knowledge

[5] There are different estimates for the contribution of livestock to Africa's GHG emissions (Balehegn et al, 2021; Sere, 2020)

that monogastric animal production (poultry and pigs) has a lower GHG emission intensity per kg of meat produced and of the overall environmental resource requirements for livestock production, has led to strong calls to shift consumption away from ruminant meat (FAO, 2019; Searchinger et al, 2019; Gerber et al, 2013) or to abandon the consumption of ASF entirely (Garnett et al, 2017). The latter approach may be suitable for Burkina Faso where there is a growing trend of pig farming (AU-IBAR, 2015) and may also be an attractive option for Zambia given the country's rapidly expanding poultry sector (Krishnan et al, 2017) coupled with the country's progress towards enhancing the level of quality agriculture livestock inputs by 2025 (AU, 2019).[6] On the other hand, increased production of monogastric animals and changing of dietary patters faces considerable opposition. Promoting intensified and commercial poultry production requires the feeding of crop-based concentrates (cereals, oilseeds) that would otherwise be consumed by humans, would require land and inputs or foreign exchange to pay for imports (FAO, 2019). Whereas, an emerging narrative to abandon or reduce ASF is increasingly challenged on the basis of limited evidence, an overwhelming bias of evidence towards intensive and commercial agriculture and the associated misrepresentation of negative environmental impacts from pastoralism and other low input livestock systems (Hauser and Scoones, 2021).

Based on these limitations, studies are beginning to contest mainstream policy narratives. García-Dory et al (2021) for example, argue policies that fail to discriminate between livestock systems may perpetuate injustice; whereas Schneider and Coghe (2021) argue that adopting what they refer to as a 'monolithic' view of livestock production renders invisible the range of production objectives served by rearing animals. As such, Hauser and Scoones (2021) warn that the problematic assumptions with potential to inform generalised livestock policy prescriptions run the risk of 'damaging livelihoods, landscapes and the life chances' of people reliant on extensive livestock production. Policy-makers are presented therefore with a complex set of factors that require system-level verification to develop appropriate measures. Insomuch as the reviewed policies neglect livestock related GHG and climate change, these limitations may be compensated for by policies across the three countries that directly speak to issues of climate change more generally (for Kenya, see GoK, 2018 and Nyangena, 2017; for Zambia see Kabechani et al, 2016; for Burkina Faso see PNA, 2015). Limited knowledge on how to successfully integrate measures for GHG emissions reduction – without undermining livelihoods - poses significant challenges for appropriate policy development to harness gains from Africa's livestock revolution.

For these reasons, there are repeated calls to promote policy measures that support sustainable livestock intensification, which is often presented as the strategy with the

[6] Goal 3 of the Malabo Declaration (2014)

greatest potential to curtail livestock related GHG emissions and enable co-benefits (FAO, 2018; Sere 2020; Paul et al, 2020). Although the reviewed measures do not directly state the objective to reduce GHG emissions, there is significant merit in the promotion of livestock management practices that, in principle, would support sustainable intensification. For example, improvements in range management prominently feature in the policies and have the potential to promote carbon sequestration (Sere, 2020; Silvestri et al, 2012). Improving herd health, genetics, livestock feed production and feeding practices through grazing management are also among the promising integrated approaches from the three countries. These approaches have been shown to significantly reduce adverse environmental impacts of livestock production (see Hristov et al., 2013a, 2013b; Knapp et al., 2014; FAO, 2018 for examples in dairy systems). Efforts identified in the reviewed documents on livestock breeding, health, feed, and market efficiencies begin to present steps in a promising direction towards sustainable sector development. Potential options to limit livestock sector emissions that are absent from the policies include manure management, optimisation at age of slaughter strategies, sequestering carbon emissions from grazing and pasture lands (including avoiding deforestation) (Ashley, 2019).

Overall, policy measures to reduce GHG emissions require substantial financial investments for research and development, to fund proposed interventions and to develop or enhance appropriate and suitable institutional infrastructure. Allocating finances is difficult, especially because the reviewed countries allocate far less than 10% of their national budgets to the livestock sector leaving them dependent on attracting funds from foreign sources. In general, both public and private investors are reluctant to invest in livestock production due to livestock's adverse environmental and health related impacts (Ramirez-Villegas et al, 2021; Herrero et al 2015; Hilborn et al 2018). Furthermore, an adequately detailed account on financing policy strategies is absent from the reviewed policies, a finding also supported elsewhere (Ashley, 2019). As such, it is not surprising that concrete GHG reduction measures are absent from the reviewed policies. In Kenya for example, efforts to develop a Nationally Appropriate Mitigation Action for the dairy sector have faced considerable barriers with the drafted proposal yet to find investment support (NAMA Investment Proposal, 2014). For these reasons, Balehegn et al (2021) argue that the integration of GHG reduction policies on the continent more generally remain 'aspirational goals' limited to pledges stated in Nationally Determined Contributions (NDCs) emerging from the 2015 Paris Agreement.

5.2. Misunderstanding gender equity in livestock policy

Gender issues are at the core of most development and poverty discourses. Stakeholders at both global and regional scales have recognised the need to close the gender divide to

achieve sustainable growth and reduce poverty. This commitment is reflected in the fifth sustainable development goal (SDG5) which aims to reach equality between men and women by 2030. Countries have ratified these global commitments, designing specific country gender profiles to identify major gender inequalities and policy actions for reducing these gaps. Nevertheless, gender was not consistently addressed in all three livestock policy documents. The analysis revealed that only Kenya had a clear pathway towards achieving gender equality in the livestock sector. Both Burkina Faso and Zambia do not provide clear guidelines or an implementation plan to achieve gender equality.

The widespread neglect of gender in livestock policy can partly be understood from the strong sectoral bias which hampers the design of gender-sensitive policies in the case countries. Policy makers mostly emphasize the productivity and competitiveness outcomes of their interventions, failing to recognize the gendered structural power inequalities which characterises the practice of livestock husbandry. Yet, the differential access to resources and livestock markets has implications for women' empowerment and for reducing gender gaps in the livestock sector. In many communities women' ownership of some species is not positively appreciated (Lubungu & Birner, 2021; Wodajo et al., 2020). Therefore, policies and programs have tended to take on a gender accommodative approach to addressing the problems posed by social norms and values, perpetuating the gender inequality in terms of resource ownership (Njuki & Miller, 2013). Das et al. (2013) provide a striking example where the impacts of livestock transfer to women yielded mixed outcomes. While women gained control over these livestock assets, most other resources within the households fell under men' control.

Additionally, the sole development of formal markets are likely to exclude important categories of the population, especially women who rely mostly on informal market channels (Tavenner et al., 2019). The neglect of informal markets in policy design is motivated by economic incentives, with governments aiming at expanding their tax base and increasing their foreign exchange reserves (Bereda et al., 2016). Besides, informal markets are often beyond the official reach of regulation, increasing the costs for monitoring and enforcing the laws applied to these informal channels. Because policies that promote commercialisation can intensify inequalities between different gender groups, it may be of public interest to strengthen informal livestock markets, for women inclusivity in the livestock development process, while being sensitive to the requirements of men. One strategy to engage women in livestock sale and income generation would be to facilitate bottom-up, collective action approaches, such as participatory establishment of cooperatives, with an ultimate objective to integrate women, but also men, into formal markets. While women are more likely to

own livestock assets, this does not guarantee them equitable access to the benefits from livestock market development given that they mostly operate within the informal sector.

Scholars have been calling for gender transformative approaches to livestock policy design as they constitute one of the development pathways that creates synergies between productivity outcomes and gender equity issues (Njuki & Miller, 2013). Farnworth & Colverson (2015) suggests that extension programs should be design as a “facilitation system”, rather than a service, if they are to tackle the gender relations that constrain the empowerment of women in the livestock sector. So far, significant gender disparities have been observed with respect to access to extension services (Herrero et al., 2013; Sanginga et al., 2013). Smallholder livestock development will be more successful and efficient if gender relations are transformed, which includes building on existing collaborative gender norms and practices at the household and community level (Farnworth & Colverson, 2015; Farnworth et al., 2015).

5.3. Livestock intensification, commercialisation and implications of improved access to ASF on the rising double burden of malnutrition

Emerging research shows that increased availability of ASF does not always lead to overall improved nutrition. A growing dilemma which is not reflected in the policy measures reviewed regards the multiple burden of malnutrition wherein the coexistence of undernutrition and overnutrition across or within countries, households or individuals is on the rise (Walker et al., 2005; Abdullah, 2015; Popkin, 1994; Tzioumis and Adair, 2014). Abdullah (2015) highlights the increasing prevalence of the burden of double malnutrition. As national incomes increase, so too has the ratio of overweight to underweight (Neufeld et al, 2014; Cai, 2014). Kenya and Zambia are among the countries that have more overweight adults than malnourished children and overall, only in a few low-income countries does the prevalence of underweight outweigh that of overweight (Abdullah, 2015). Poor nutrition in early life has been considered a major factor in increasing obesity rates therefore countries that currently have a high prevalence of undernutrition will be at higher risk for an increased prevalence of obesity in the next decades, which may have important implications for countries such as Burkina Faso (Abdullah, 2015).

The limited attention given to the double burden of malnutrition, and the adverse consequences of ASF consumption in particular, has both structural and cultural explanations. On the one hand, there is no collaboration between different government institutions, such as ministries of health and livestock. In Zambia, and Kenya, especially, each ministry works independently. Collaboration would require some investments in human resources capacity development (Belay et al., 2017; Rasanathan et al., 2017) and

reducing the bureaucracies that cripple the public sector services. On the other hand, malnutrition is influenced by cultural practices, which link overweight and fat belly to wealth and well-being (Gorski et al., 2016). Eating certain types of meat, and in relatively high quantities is linked to higher social status. translates to meat consumption to higher social status. This cultural priority may be impeding the design of proper policies for addressing the health concerns of ASF consumption. Besides, for these countries, priority is given to undernutrition and ensuring that the most vulnerable get sufficient nutrients for their development. With limited resources, governments are making major investments in addressing undernutrition, overlooking the growing health concerns that obesity and vascular diseases, among others, pose to public health.

To address the future trade-off of increased incomes from and consumption of livestock, there are calls for integrated initiatives to reduce undernutrition while preventing obesity in both rural and urban areas. Without a coordinated and forward-looking approach, the double burden of malnutrition is expected to become a neglected factor in noncommunicable disease and new threat for health systems in developing countries (Abdullah, 2015). While inclusive social policies have succeeded in reducing poverty and in identifying new challenges related to obesity control or reduction, there is still a need for coordination between policies promoting livestock development and those promoting health (Abdullah, 2015). Measures promoted could be in the form of decentralized nutrition policies designed according to what types of malnutrition exist in each geographic area and may follow the principles of the Bhealthy approach (Abdullah, 2015). However, there is still limited knowledge on how to successfully integrate these negative components of nutrition within the livestock value chains of low- and middle-income countries (Häsler et al., 2017) which poses considerable challenges to policy-making around the specific measures that can both balance the livelihood benefits with the consumption costs of the unfolding livestock revolution (Enahoro et al, 2018).

5.4. The neglected animal-human health interface in livestock policy

Livestock and human health occupy a central place in livestock policy and livestock development debates. This commitment is highlighted in the three country policy documents which emphasise the prevention and control of livestock diseases. The development of food standards and control measures shows the willingness of public authorities to create a healthy and safe livestock value chain. Nevertheless, the animal-human-environment interface has not been clearly integrated in livestock policy design. Therefore, policies that promote the intensification of livestock sector may be incomplete when they fail to account

for human-animal health interactions (Ferreira et al., 2021; Lencho & Seblewongel, 2018; Smit & Heederik, 2017).

Ministries of health and veterinary services often work independently, not to mention the cumbersome bureaucracies and poor governance which characterises both services. Animal health authorities centre their policies on the provision of veterinary services, including strengthening the fight against contagious diseases in extensive livestock farming and strengthening the epidemiological surveillance of priority diseases. Trade-offs emerge as a result of the limited coordination and communication between the different services, slowing down the detection of diseases and the implementation of a quick response in the event of an outbreak. The poor governance which characterises public services in the developing countries also contributes to impeding the emergence of a joint policy approach to livestock and human health. Besides, the lack of adequate resources and limited expertise of the actors within each specialization is constraining the coordination of activities. Most countries rely on building the capacity of stakeholders in either of the domains, human or animal health, but fails to create a pool of experts with an understanding of both sectors and how they relate to one another. Some countries, including Burkina Faso, aim to connect ministries of the environment and human health with the ministry of livestock, but efforts should first be made to reduce the high bureaucracies within the administrative bodies and to strengthen collective action between these different government agencies by creating the right incentives for collaboration between stakeholders at different levels, from local to national and regional.

5.5. Livestock policy development and animal welfare

Current livestock policies do not fully integrate issues concerning animal welfare in their decision strategies. Though Kenya and Zambia have concerns about housing of livestock, for example, they provide no clear regulatory framework for implementing strategies to ensure that animal welfare is integrated in production systems. Furthermore, Zambia's animal welfare strategies mainly focus on pastoral systems, with little regards to more intensive systems.

Despite the regional policy guidelines which recommend the integration of animal welfare in country livestock policies, governments have been slow to address the issue on the ground. The COMESA Regional Livestock Policy Framework, for example, clearly emphasizes the need to integrate livestock welfare concerns in policy design and recommends that animal rights be protected following the international standards. More needs to be understood as to the underlying reasons that explain the neglect of animal welfare in country policies, but a tentative answer could be that governments may have more wicked problems to address and animal welfare does not appear to be among the top

priorities at this time. With limited resources, investments are geared towards more pressing issues (from the countries' perspective).

Because poor animal welfare is a result of market failures (Harvey & Hubbard, 2013), policies have been proposed to address the neglect of animal welfare in intensive production systems. From an economic perspective, a Pigouvian tax, which forces farmers to reflect the social cost of production in the prices of ASF (i.e. meat or milk) can create incentives for taking the right measures in production practices. Issue of animal welfare could also be addressed through the introduction of digital tools (Buller, Blokhuis, Lokhorst, Silberberg, & Veissier, 2020). As Buller et al. (2020) put it, Precision Livestock Farming (PLF) offers significant opportunities for a holistic, evidence-based approach to the monitoring and surveillance of farmed animal welfare (p1).

5.6. Livestock intensification and land governance challenges

Livestock activities are based on the exploitation of natural resources and the land they are tied to. In this sense, land tenure constitutes one of the major constraints to sustainable livestock farming. In sub-Saharan Africa in particular, land tenure insecurity is linked to inefficient resource management and conflicts (Basupi, Quinn, & Dougill, 2017; Kalabamu, 2019). With the on-going livestock revolution, problems related to land are likely to worsen. To respond to the growing demand for animal products, the transformation taking place in terms of land use and land use changes runs the risk of exacerbating land-related conflicts and land tenure insecurity. In the presence of ineffective land policies, livestock sector development may be hampered, leading to adverse environmental and socio-economic outcomes. Ineffective land tenure could indeed lead to increasing livestock numbers beyond the carrying capacity of the land (Pica-Ciamarra, Otte, & Chilonda, 2007), with implications for land competition and conflicts.

Livestock policies are geared towards the intensification of the livestock sector. Nevertheless, the success of intensification policies is tied to the land tenure regime within the various livestock systems operate (Basupi et al., 2017; Senda et al., 2020). The intensification of livestock production under private property rights is not adapted to the mobility patterns in pastoral systems (Basupi et al., 2017; Behnke, 2018) and is detrimental to the subsistence of pastoralists (Senda et al., 2020), especially where privatization translates into land fragmentation (Senda et al., 2020). This situation creates strong disincentives to manage rangelands efficiently (Senda et al., 2020), as it makes pastoralists less secure about use of natural resources. The exclusion of pastoralists in this land tenure systems, thus constitute an important socio-economic trade-off in the intensification of production.

By pushing in for intensification, livestock policies under private land transformations are likely to push a category of herders out of the activity, depriving them of their main source of livelihoods. Some countries even encourage pastoralists to sedentarise. While such approach may encourage intensive practices and better productivity, countries may be trading off economic benefits for social well-being and stability, leading to constant conflicts and turmoil.

5.7. The promise of integrated policy approaches

It is increasingly evident that policy makers must contend with multiple variables to assess and accommodate negative trade-offs in livestock production. The multiplicity of livestock's positive and negative contributions therefore calls for a more integrated approach to policy design and implementation. Essentially, this complexity of livestock production and associated negative trade-offs poses financial, institutional and methodological challenges. To address these challenges, a number of emerging methodologies and institutional arrangements are worthy of note.

Methodologically, approaches to increase the coherence between policies that influence or are influenced by environmental outcomes of livestock production are equally challenging. Ashley (2019) for example adopt the Policy Coherence for Sustainable Development Framework to examine a range of policies across three African countries for their coherence in addressing livestock sector adaptation and mitigation. The study finds that policies from Kenya and Ethiopia have strong coherence for livestock adaptation and mitigation strategies, therefore highlighting key areas for policy action in the two countries. Kantor et al (2015) present a suitably flexible framework that conceptualises the multiple interrelations at play in food systems in an effort to inform policymakers as to how agriculture and food policy could improve outcomes such as nutrition and public health in low- and middle-income countries. The framework is tailored for policymakers seeking to examine the potential direct and indirect impacts of agriculture and food system policies but may be strengthened by integrating clear intervention points for improving outcomes through livestock production (Nicholson et al, 2020). The ex-ante and ex-post evaluation of livestock policies may further benefit from integrated data collection approaches that complement the knowledge and experience of multiple stakeholders. Such approaches may be in the form of social network analysis using tools such as Netmap to identify challenges encountered during the policymaking process, direct livestock policy interventions or participatory impact evaluations, such as Participatory Impact Diagrams which can be used to capture both the positive and negative outcomes of policy measures on livestock producers and other actors along the livestock value chain (Kariuki et al, 2015).

Regarding approaches to financing, the Livestock Sector Investment and Policy Toolkit is another promising methodology that has been adopted successfully to develop country and sector-level livestock master plans (Alary et al., 2014). The innovative approach is designed to engage a diversity of stakeholders from the livestock sector to jointly develop a vision guided by a five-year plan for key sub-sectors. Current versions deliberately integrate interactions in different markets between subsectors (e.g. competition for feed), as well as impacts of GHG emissions (Sere, 2020). The approach which offers a rigorous assessment of interventions with respect to livestock's overall contribution to human development, is expected to help avoid the setbacks of narrowly conceived livestock interventions that have historically yielded limited impacts (such as vaccination campaigns and artificial insemination schemes).[7] Based on experiences of livestock master plan development from east Africa (Ethiopia, Tanzania and Rwanda), there is increasing interest in the potential of the tool to integrate the numerous trade-offs associated with livestock production as a means for governments and international financial institutions to design national development plans and programmes for financial services such as loans (Sere, 2020).

For sustainable intensive livestock farming, our results stress the importance of implementing inclusive policies that consider animal and human health needs. In this regard, a "One Health" approach to addressing zoonotic diseases (Bardosh et al., 2017; Wilcox & Steele, 2021) is increasingly being promoted. The one health approach advocates for an integrated strategy that will result in stronger and longer-lasting political support for the prevention of major public health and animal-related illnesses at the human–animal interface. There are increasing calls in livestock policy arena to take an intersectoral collaboration approach, based on exchanges between health services and veterinary services, to adequately identify the related risks and detect the emerging diseases (Marcotty et al., 2013; Pieracci et al., 2016). In addition to addressing the human-animal interface, considerable attention is also given to the relationship of livestock development with the environment and the implications for diseases outbreaks and pandemics. To mitigate the trade-offs between livestock sector intensification and livestock and human health, policy makers would have to strengthen the livestock institutional structure, while facilitating collaboration between research, extension and related ministries of health and environment.

Regarding institutional and implementation challenges, there is a recognised need to design or enhance mechanisms that balance the costs and benefits of sustainable livestock intensification, at scale. Payments for ecosystem services (PES) are often identified as a promising approach whereby adoption of practices compatible with sustainable livestock management are financially compensated. Such schemes may take the form of CO_2-

[7] For Ethiopia see, (Shapiro et al., 2015), Tanzania (Michael et al., 2018), Rwanda (Shapiro et al., 2017).

emissions trading in the form of REDD+ (Sere, 2020; Silvestri et al, 2012). Although none of the livestock policies make provisions for such schemes, results of successes on the continent have been mixed at best. In Kenya for example, a number of existing schemes have received considerable positive attention as the country hosts a range of land-based carbon projects and biogas development programs of relevance for the livestock sector (Nyangena, et al., 2017) including the continents first project to issue carbon credits for sequestering carbon in soil, the Kenya Agriculture Carbon project (Atela, 2013). However, the projects do not operate at scale and emerging evidence indicates a number of limitations. Received payments are used to purchase more animals which may be herded outside of the project area, contributing considerably to negative environmental spill over effects, or that payments may not be commensurate to activities conducted (Kariuki et al, 2021; Chomba et al, 2016; Kariuki and Birner, 2015). Therefore, strategies to reduce herd sizes to retain productive and efficient animals may be ideal, but run the risk of being at odds with the socioeconomic functions that are supported by larger herd sizes regardless of animal productivity (Hristov et al., 2013a, b, c; Knapp et al., 2014; FAO, 2018b; Adesogan et al, 2020).

6. Conclusion

This study sought to explore the extent to which flagship livestock policies from Kenya, Zambia and Burkina Faso incorporate measures to address trade-offs in livestock development. The policy measures identified are sufficiently represented along the livestock value chain. Aspects concerning improved access to services and inputs, marketing and trade and consumption all receive considerable and adequate attention. The policies, through the mentioned measures, promote commercialisation and intensification of agriculture to improve food security and livelihoods. However, several trade-offs identified by the study receive minimal attention in the reviewed policies and require further attention. These include trade-offs between increased livestock production and adverse environmental impacts, uneven distribution of benefits between men and women, negative animal and human nutritional outcomes. To address these challenges, the report calls for more integrated approaches in policy making processes, and suggests potential strategies that could engage a wider set of stakeholders and compensate for any policy 'blindness' in the design and implementation of livestock policies.

7. Appendix 1: Similarities in policies: an overview

Services: Animal health care

Livestock disease incidence is recognised across all country documents as undermining livestock productivity and causing negative economic impacts on local and cross border trade. Overall, the Kenya policy is considerably targeted and focusses explicitly on animal disease reporting, pests and vector control and cross border disease management. The Burkina Faso policy emphasises measures for eradicating zoonotic diseases in extensive systems, whereas the Zambia policy provides a modest package of disease control and prevention measures. The documents refer to various drivers of increased disease incidence including climate change and increased livestock-wildlife interactions. In light of these challenges, all policy documents introduce measures that accommodate for improved quality and frequency of vaccine delivery. The Zambia policy states the need to improve primary animal health care provisions and delivery (animal clinics; wheel baths and foot baths), the Burkina Faso policy seeks to improve overall access to veterinary services and facilitate the emergence of local agri-businesses, while the Kenya policy places concrete emphasis on maintaining strategic stocks of vaccines for diseases 'of critical concern' as well as seed stock for vaccines 'not currently occurring' but with potential for significant risk of reintroduction and spread. The control of animal disease is prioritised in all countries whose policy documents outline measures for improved surveillance and management practices. Unique to the Zambia policy is the emphasis on "deliberate measures to promote the application of IKP in the management of animal diseases". Unique to the Kenya policy are measures to combat Antimicrobial resistance (AMR) which "threatens the effectiveness, prevention and treatment of an ever-increasing range of infections caused by bacteria, fungi, parasites and viruses".

Other than strengthening technical approaches in the control and prevention of animal disease, the Kenya and Zambia policies recognise the importance of a well-coordinated and regulated institutional collaborations for successful disease management. In particular, the Zambian policy refers to 'strengthening institutional collaboration' for the delivery of primary health care', whereas the Kenya document focusses on developing and strengthening intra and intergovernmental coordination and collaborative disease reporting mechanisms, not only with county veterinary services, but also with other stakeholders, including the public education sector to enhance disease reporting.

Services: Animal genetic resources (AnGR)

The management and conservation of animal genetic resources (AnGR) is an area of focus in all the reviewed policies. According to the documents, there is either minimal to no

inventory of indigenous AnGR in Kenya and Zambia respectively. In Kenya the policy states sub-optimal performance of AnGR due to limited breed improvement, while in Zambia and Burkina Faso, there is a limited ability to characterise particularly, the indigenous livestock breeds. The neglected potential of local breeds is attributed to the slow process of breed improvement in the Burkina Faso. As a consequence, Kenya and Zambia policies express concern that some livestock breeds or strains may face extinction or undergo a 'continuous genetic dilution', which therefore threatens the biodiversity and conservation of the indigenous genetic pool, as stated in the Zambia policy document. Additionally, the sub-optimal performance of livestock in Burkina Faso is linked to the absence of a legal and regulatory framework to facilitate the introduction of exotic breeds.

To address these challenges, the documents present a number of similar measures. In particular, the need to create and maintain a database to manage existing AnGR and to promote a genetic management resource system. The Kenya policy further states characterisation, inventory and monitoring as key approaches achievable through a livestock census (collecting information on breed diversity, population sizes, trends and distribution) to form the basis of a 'web-based' national AnGR database. Data collection is prioritised as part of Kenya's policy strategy with proposed activities including periodic surveys to monitor performance and to strengthen the 'Livestock Recording Centre (LRC) to manage all data. In contrast, the Burkina Faso policy document emphasises the need to import animals of various breeds and species to test their adaptability and ensure their multiplication.

Given concerns about breed extinction, all three countries illustrate the need to prioritise conservation of livestock genetics, particularly the conservation of local or indigenous breeds and strains. The measures stipulated in the Zambia document are rudimentary, perhaps due to the basic level of development of AnGR the country. In comparison, the Kenya and Burkina Faso strategies present a comprehensive set of measures including the establishment of a gene bank for conservation of germplasm from locally adopted breeds. The Kenya policy also places strong focus on developing new and strengthening existing national breeding programs for locally adopted breeds, while the Burkina Faso policy promotes on-farm testing to identify all subjects with specific characteristics.

Furthermore, the approach of Zambia and Burkina Faso purposes to promote artificial insemination to promote sustainable livestock production and productivity. All policies nonetheless share the need for developing mechanisms for evaluating the genetic potential of livestock breeds. As such, the Zambia policy refers to the development of programmes for the evaluation of indigenous livestock breeds, the Kenya policy focuses on developing and providing a national infrastructure to support animal identification, performance

recording and genetic evaluation while the Burkina Faso policy proposes to promote public breeding stations and the development of partnership with research institutions (national and international) for the characterization of local breeds. Kenya-specific approaches to managing AnGR also include measures to facilitate the development of human capacity (develop and strengthen various types of capacities), livestock breeder incentives (awards programmes for breeders who show exemplary success in supporting conservation efforts), infrastructure development and institutional frameworks to support objectives of the conservation and sustainable use of AnGR and an explicit focus to promote the sustainable utilisation of AnGR.

Services: Livestock extension and service delivery

All countries place emphasis on strengthening what is acknowledged as poorly performing extension services for livestock development. In Kenya, for example, the situation analysis states that the "current technical-staff to farmer ratio is 1:700 for intensive mixed farming systems, 1:640 for agro-pastoral system, and 1:1000 for pastoral systems". The Burkina Faso document acknowledges the insufficient training of extension agents. As such, the Burkina Faso document, in elaborating livestock policy has put emphasis on building the capacity of extension service agents through intensive and tailored trainings. Nevertheless, it fails to clearly specify the type of trainings and knowledge sets that would be transferred to extension agents towards meeting these outcomes. The Zambia document purposes to strengthen advisory services in livestock development in an effort to promote sustainable livestock production and productivity, to strengthen livestock research – extension linkages and to support and strengthen extension service delivery to promote good grazing.

Inputs: Livestock nutrition, feeds and feeding

Measures to accelerate the pace of change in the feed industry are necessary to accompany the expanding livestock sector. Livestock nutrition is particularly important in the three country policies, however the depth and variety of measures presented varies considerably. The Zambia policy purposes to strengthen the adoption of good animal nutrition practices as a preventative measure for achieving animal health (through supplementary feeding and improved access to forage sources). Comparatively, the Kenya policy document presents a set of measures that address a diversity of challenges affecting different feed types (namely roughage, concentrate and rangeland feed resources), agroecological zones and value chain actors (from farmers, feed retailers and consumers).

The measures reflect efforts to enhance both the quantity of feed resources (through facilitating optimum productivity of roughage feed sources per unit area of land in various agro-ecological zones; promoting the expansion of the fodder value chain through fodder

and pasture commercialisation; promoting utilisation of crop residues and by products in animal feeds as well as encouraging the establishment of feed mills by cooperatives, farmer-based groups and the private sector) as well as the quality of feed resources (establishment of a robust regulatory framework, development of an institutional framework and mechanisms to maintain and enforce required standards of production, establishment of a regulatory inspectorate agency and development of tools for monitoring compliance). The Kenya policy can further be differentiated based on the strong research and lab-oriented approach. For example, measures for research into disease resistant and high yielding forages and alternative feed sources are clearly accommodated for. Lab-based research is also among the measures to ensure environmental integrity will not be undermined as a result of increased fodder production (promote sustainable soil).

Livestock Production Overview

Across different systems, access to resources such as land and water are crucial for livestock rearing at the production level. As rangelands account for between 20 – 50 million ha of land in Kenya and Zambia respectively, challenges facing the quality, distribution and management of grazing/pasture and water resources feature prominently in their policy documents. In keeping with these challenges, the Zambia policy dedicates the specific objective of improving “the management of rangelands and livestock water resources”; while the Kenya policy presents measures to improve rangeland feed resources specifically, and rangeland resources more generally. Similarly, the National livestock policy in Burkina Faso stipulates the need to “secure animal feed throughout the year through increasing the availability of quality fodder and feed concentrates”. This strategy relies on better use of available resources (natural fodder and agricultural residues); the promotion of forage production of cultivated fodder; and the revitalization/strengthening of concentrates. The feed policy in Burkina Faso also includes aspects related to preparedness in the event of forage crisis. Overall, the Zambia policy leans more towards inclusive rangeland management approaches with the support of extension services and the promotion of suitable technologies for forage conservation and utilisation. Whereas the measures stated in the Kenya policy reflect key components of a risk management approach with a combination of measures to ensure drought preparedness, mitigation and sound range management practices.

Of particular focus in the rangelands is the communal or customary land tenure arrangements. Both Kenyan and Zambian documents attribute threats to these arrangements from land degradation due to encroachment by and competition with other land uses. Both policy documents emphasise that land degradation is exacerbated by the ‘fragility’ of the range environment and the ‘seasonal decline in the quantity and quality of

forage'. To protect the environment and support sustainable livestock development, the two policy documents promote a community-oriented approach to rangeland management. The policy in Zambia specifies promoting 'communal grazing management systems' and in Kenya, 'range and pasture rehabilitation programmes.' While both approaches are people-centred, there are important differences in emphasis. For example, the Zambia policy gives weight to accommodating different forms of knowledge, in promoting Indigenous Knowledge and Practices (IKP) in rangeland management. Whereas, the Kenya policy gives weight to formalising community participation, namely by 'institutionalizing' the involvement of communities in planning, and development of range and pasture rehabilitation programmes.

Climate change is acknowledged as a dominant factor limiting access to and availability of water for livestock production, however only in the Kenya document is specific policy direction offered to manage this challenge. Measures range from institutional (legislation relating to action plans) and technical approaches (strengthening risk management mechanisms like early warning systems), to more localised approaches (promoting public awareness and capacity building while supporting the adoption of climate change technologies). The policy document in Burkina Faso does not allocate a specific objective to climate change, however adopts a similar approach as in the Kenya policy. The policy highlights the need to raise livestock stakeholders' awareness on environmental challenges, the adverse effects of climate change and presents a commitment to build capacity for the adaptation and the mitigation of vulnerability to climate change, while integrating issues related to adaptations to climate change during the preparation and implementation of development plans, programs and projects. Low adoption and high cost of water technologies as well as inadequate management practices are also highlighted in Kenya and Zambia policy documents. To address these challenges, Policy Objective 7 (Zambia) promotes the community-led establishment of livestock watering points and the strengthened 'collaboration in the development and maintenance of reliable water sources for livestock'. In contrast, the Kenya policy states that in collaboration with stakeholders, the government will support investment in enabling livestock infrastructure. To address the negative impacts of water shortages for livestock production, the Kenya policy document presents a forward-thinking strategy that promotes the 'selection and development of appropriate breeds and forage varieties', as well as promoting the 'keeping of animals of higher productivity'. The Kenyan policy also includes an approach to 'promote climate financing and broaden mechanisms to attract investments in climate-smart agricultural practices along the commodity product value chains.'

Processing and Trade

Promoting trade of livestock and livestock products is a central strategy for developing the livestock sectors across all countries. However, the policy priorities indicate that countries are at considerably different stages of market development. While all countries state similar barriers with respect to trade and value addition, the Zambia and Burkina Faso policy refers to the lack of commercialisation of livestock production in a more general sense (in the Kenya document, this applies only for some livestock species and products) while the Kenya policy pinpoints more specific barriers to trade that hinder efficient aggregation and transportation, such as poor infrastructure, including cold chains and collection centres.

Therefore, the Zambia policy document presents measures to promote commercialisation of livestock production, marketing and agribusiness development. Likewise, the Burkina Faso policy document emphasises the capacity development of stakeholders in agribusiness and the development of training centres for professionals of agribusiness. In contrast, the Kenya document emphasises infrastructural and institutional measures that enhance trade in livestock and livestock products. Infrastructure in the Kenya document is expected to support aggregation and transportation of livestock through the development, improvement, rehabilitation and maintenance of marketing infrastructure at ports of entry and the improvement of distribution networks. Institutional strategies include the development and implementation of legal and regulatory measures to encourage value addition and agribusiness and the development and enactment of legislation to protect and enable economic utilisation of livestock infrastructure (holding grounds, outspans and livestock stock routes), which also compliments the strategy of enacting legislations for mechanisms to 'plough back' revenues for marketing facilities towards the development and maintenance of sustainable management structures.

The three country documents stress the importance of capacity-building either through strengthening producer organisations (Zambia) or producers and marketing groups in production and storage of livestock products (Kenya and Burkina Faso). Both country documents further state the need to apply value addition technologies and state the importance of skills transfer to promote the application of such technologies. Developing mechanisms for the establishment and growth of value adding enterprises in the Kenya policy document is further distinguished between large scale and cottage industry enterprises. Only in the Kenya document was there mention of measures to strengthen security and deter dumping while promoting competitiveness of local products to cushion producers.

Processing of livestock products is acknowledged in the Kenya and Zambia policy documents, but with substantially different focus areas. The Zambia policy focusses on measures to invest in processing facilities and promote livestock processing organisations

in an overall effort to establish standards and quality of livestock, livestock products and by-products. Whereas the Kenya policy focusses on enhancing the access and uptake of processing technologies (especially for the youth), strengthening processing capacities of producers and marketing groups and also building capacities of processors to produce diverse value-added products, including those from non-conventional livestock.

Consumption and food safety

To ensure that consumers are protected, all three countries have integrated policies on food safety across the livestock value chain. Zambia allocates a specific stand-alone objective (Specific Objective 2) to 'promote established standards and quality of livestock, livestock products and by-products'. Kenya allocates policy measures on Safety and Quality of Livestock and Livestock Products and Livestock Products Consumption both under the marketing of livestock and livestock products. Burkina Faso elaborates a strategy to "improve the specification and quality of animal products in order to strengthen their competitiveness both on the national and sub-regional and international markets". To different degrees, all country policies state the need to promote established standards and quality of livestock, livestock products and by products. The policies acknowledge the potential of developing and implementing livestock traceability systems to strengthen animal identification (Zambia) and ensure safety and quality of livestock, livestock and livestock products (Kenya and Burkina Faso). A detailed range of approaches is presented in the Kenya and Burkina Faso document compared to the Zambia document. In the latter promoting 'good' agricultural and manufacturing practices is highlighted as well as the promotion and application of grading systems for live animals and livestock products at processing facilities. Whereas the Kenya policy aims to ensure availability of quality livestock and livestock products as well as developing the relevant institutions to carry out effective safety and quality control measures. The set of institutional approaches presented in Kenya's policy are regulatory and include the enforcement of 'Sanitary Standards', the development and implementation of food safety regulations and the strengthening of quality control and safety measures. Likewise, the policy document from Burkina Faso aims to develop and implement a communication strategy and ensure regular monitoring of the application of standards. In addition, the Burkinabe policy emphasises the importance to support production units in the certification of products intended for export.

All three countries' documents recognise the importance of promoting livestock value chain actors, with the Kenya document emphasising capacity-building of producers and value chain actors to enhance the quality of products and Zambia policy emphasising the promotion of livestock processors organisations. Only Kenya has an explicit focus on the consumer in the livestock value chain. Specifically, the policy document states that

mechanisms will be put in place to promote the consumption of livestock products as well as to support consumer rights to information and quality livestock products. Such measures were not included in Burkina Faso and Zambia policy.

The Kenya policy makes explicit reference to the importance of safety standards for trade in domestic and international trading markets. The policy document states that inadequate capacity/number of inspecting officers and slaughter facilities is a major challenge in meeting national and international safety standards. The policy also has a strong emphasis on securing international trade by meeting the mandatory requirements of CODEX and Sanitary Standards set under the relevant WTO sanitary and phyto-sanitary statute. Like Kenya, Burkina Faso aims to meet the international standards of food safety, by following international norms, including SPS, CODEX standards, OIE standards, ISO standards, and national regulations. Furthermore, Kenya and Zambia policy highlights poor agricultural and manufacturing practices, particularly by smallholder farmers for whom compliance to quality and standards of livestock products and by-products is undermined by low levels of awareness about Standard Operating Procedures and good manufacturing practices.

Cross cutting issue: Climate change

Climate change remains a major challenge for livestock development in sub-Saharan Africa. For countries like Burkina Faso, Kenya and Zambia, the effects of climate change for rural population who rely strongly on livestock husbandry can have adverse consequences on their livelihoods and may exacerbate poverty levels. In an effort to integrate climate change in livestock policies, all three countries have acknowledged the need to raise livestock keeper's awareness on the issue (Burkina Faso and Kenya) is increasingly constraining livestock husbandry through the keeper's activity by reducing the availability of resources for livestock feeding *No focus on recycling or disposal, waste anywhere in the policies.

Cross cutting issue: Gender

While many of the policy pathways converge between the selected countries, some differences were also observed, with some countries integrating other components to their policy priorities. Kenya and Burkina Faso livestock policy pathways converge with regards to gender and social inclusion. Both countries mention gender equity as an important concern to address in livestock policy implementation. Nevertheless, Kenya is more concise in defining gender related livestock policy and highlights the action plan to achieve this outcome.

Cross cutting issue: Animal welfare

Both Kenya and Zambia face similar challenges with respect to animal welfare and acknowledge its strong relationship with animal health and livestock productivity. Common

challenges include low awareness of animal welfare issues, inadequate housing facilities and poor feeding and watering practices. The Zambia policy cites limited application of indigenous knowledge and practices and a weak animal health delivery services as additional challenges, while the Kenya document adds that transportation and certain cultural sports further constrain animal welfare. To address these challenges, both country documents recognise the need to engage government bodies in the regulation and enforcement / compliance of animal welfare standards (at the national and county level in Kenya) and strengthen institutional cooperation (for example, through the Kenya Veterinary Board in Kenya) and improve public awareness on animal welfare.

Cross cutting issue: Livestock research and development

Livestock research and technology development are key for enhancing productivity and competitiveness in the livestock industry. All three countries face the constraint of inadequate government and private sector investment which is stated as having different opportunities and constraints in the two countries. According to the Kenya policy document increased government expenditure could enable a better prioritisation of national research needs especially because most research has concentrated on addressing technical production problems (feeding, breeding, health and husbandry), while overlooking key socio-economic parameters (gender, culture and indigenous technical knowledge that equally affect the livestock sector). Whereas, the Zambia policy document states that lack of research and development has stagnated livestock productivity for many decades. Both countries therefore point to the limitations in institutional capacity to conduct research. The Burkina Faso document highlights the importance of research institutions into enhancing the livestock sector and mentions the poor as one of the institutional constraints to achieve better livestock productivity outcomes.

The Zambia policy includes an explicit policy objective to ‘strengthen livestock research policy and development’. Under this specific objective are a combination of institutional measures (strengthen collaboration and institutional capacity for livestock research and development) topical research priority areas (forage production and pasture management, rangeland utilisation and management, livestock products and by-products, research-extension linkages) and funding / investment in the research sector. Whereas in Kenya, the policy measures (3.5 Livestock Research) are a combination of funding commitments (allocation of 2% of national budget towards agricultural research of which 50% will be dedicated to livestock; establish a fund for livestock research and commercialisation of potential technologies); generic support functions (support public research institutions to commercialise technologies developed, diversify and enhance the funding base for livestock research); topical (in collaboration with stakeholders take measures to mainstream

socio-economic factors in research; strengthen and coordinate livestock research agenda and improve dissemination and uptake of research findings). Research also features across the various policy measures in the Kenya policy (Livestock Nutrition feeds and feeding; Animal diseases and pests; Marketing of livestock and livestock products).

Biotechnology in livestock development

The Kenya policy document was the only one that referred to the role of biotechnology in livestock development. The document reads ‘In the face of increasing population and the subsequent demand for safer and nutritious food, livestock production can leverage on all available technologies including genetic modification, to increase animal production and productivity while safeguarding human and animal health, and the environment… Adoption of biotechnology in livestock production could contribute to improved breeding efficiency, enhanced feed value, production of pest and drought tolerant feed crops, therapeutics, disease diagnostic agents, and animal disease management agents (vaccines).’ There are several governing and regulatory authorities on biotechnology development in the country through which the Kenya livestock policy states that there will be measures to ‘enhance the capacity for general supervision and control over the transfer, handling and use of livestock-related genetically modified organisms with a view to ensuring the safety of human and animal health; and the provision of an adequate level of protection of the environment’. Whereas, the county governments will ‘facilitate the National Biosafety Authority to provide the general supervision of GMO introductions in Kenya’.

8. Appendix 2: Policy documents in Kenya, Zambia, Burkina Faso

COUNTRY	NAME	YEAR	TYPE OF DOCUMENT
Kenya	Meat Control Act 2012	2012	Act
	Food and Nutrition Act	2020	Act
	Animal Health Act	2010	Act
	National Drought Management Authority Act No.12 of 2020	2020	Bill
	The Livestock and Livestock Products Marketing Board Bill 2019	2019	Bill
	The Livestock and Livestock Products Marketing Board Bill 2019	2019	Bill
	The Agriculture, Livestock, Fisheries and Food Authority Bill, 2012	2012	Bill
	The Agriculture, Livestock, Fisheries and Food Authority Bill, 2012	2012	Bill
	National Drought Management Authority Act No.12 of 2020	2020	Bill
	Livestock Breeding Bill 2015 - Draft	2015	Draft Bill
	Draft National Livestock Policy 2019	2019	Draft Policy
	Kenya Veterinary Policy 2015 - Draft	2015	Draft Policy
	Nairobi City County Urban and Peri-Urban Agriculture, Livestock and Fisheries Policy	2015	Draft Policy
	Draft Livestock Development Policy Zambia (See MMP_2020 doc)	2012	Draft policy
	Kenya Climate Smart Agriculture Implementation Framework 2018 - 2027	2018	Framework
	Food and Nutrition Security Policy Implementation Framework (2017-2022)	2017	Framework
	COMESA Regional Livestock Policy Framework	2015	Framework
	AU Policy Framework for Pastoralism in Africa (2010)	2010	Framework
	State Department for Livestock Strategic Plan (2013-2015)	2015	Plan
	African Union Agenda 2063 (2015)	2015	Plan
	Malabo Declaration Goal (2014)	2014	Plan
	ECOWAS Strategic action plan for development and Transformation of livestock sector 2011 - 2020	2011	Plan
	Vision 2030	2008	Plan
	CAADP (AU / NEPAD) 2003 (limited livestock, AU IBAR came in)	2003	Plan
	National Livestock Policy Implementation Plan October 2020 - 2024	2020	Plan
	Ministry of Fisheries and Livestock Devolution Plan	2016	Plan
	Second National Agricultural Policy Implementation Plan 2016-2020	2016	Plan
	SADC Regional Agricultural Policy (2013)	2013	Policy
	National Food and Nutrition Security Policy 2011	2011	Policy
	National Livestock Development Policy	2020	Policy
	National Agriculture Policy 2012-2030	2011	Policy
	Dairy Industry (Dairy Produce Safety) Regulations 2020	2020	Regulations
	Dairy Industry (Import and Export) Regulation 2020	2020	Regulations

	Dairy Industry (Pricing of Dairy Produce) Regulation 2020	2020	Regulations
	Dairy Industry (Milk Sale Contract) Regulations 2020	2020	Regulations
	Dairy Industry (Produce Traceability and Recall) Regulations 2020	2020	Regulations
	Dairy Industry (Compliance Officer) Regulations 2020	2020	Regulations
	Dairy Industry (Returns Reports Estimates) Regulations 2020	2020	Regulations
	Dairy Industry (Registration Licencing Cess and Levy) Regulations 2020	2020	Regulations
Zambia	National Livestock Development Policy	2020	Policy
	Sessional Paper No. 08 of 2012 on National Policy for the Sustainable Development of Northern Kenya and other Arid Lands	2012	Sessional Paper
	National Livestock Policy 2008 Sessional Paper no. 2	2008	Sessional Paper
	Agriculture Sector Transformation and Growth Strategy 2019-2029	2019	Strategy
	State Department for Livestock Strategic Plan (2018-2022)	2018	Strategy
	Livestock Development Strategy for Africa (2015)	2015	Strategy
	Vision 2030 Development Strategy for Northern Kenya and other Arid Lands	2012	Strategy
	EAC Agriculture and Rural Development Strategy (2005 - 2030)	2005	Strategy
	Ministry of Fisheries and Livestock Strategic Plan 2020-2021	2020	Strategy
	Vision 2030	2006	Strategy
Burkina Faso	Politique Nationale De Developpement Durable De L'elevage (PNDEL)	2010	Policy
	Plan D'actions Et Programme D'investissements Du Sous- Secteur De L'elevage (PAPISE)	2010	Framework
	Stratégie Nationale D'amélioration Génétique Des Animaux Au Burkina Faso	2012	Strategy
	Programme National De Developpement De L'elevage Pastoral	2013	Framework
	Loi N° 070-2015/Cnt Portant Loi D'orientation Agro-Sylvo-Pastorale, Halieutique Et Faunique Au Burkina Faso	2015	Bill
	Loi 034 portant Regime Foncier rual et Decrets	2009	Bill
	Décision A/Dec.5/10/98 Relative A La Règlementation De La Transhumance Entre Les Etats Membres De La CEDEAO	1998	Plan
	DECRET N°2011-306/PRES promulguant la loi n°003-2011/AN du 05 avril 2011 portant Code de forestier au Burkina Faso	2011	Act
	Loi N°006-2013/An Portant Code De L'environnement Au Burkina Faso	2013	Bill
	Loi N° 037-2012/An Portant Règlementation De L'amélioration Génétique Du Cheptel Au Burkina Faso	2012	Bill

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