

CHAPTER 4

An Overview of Meat Processing in Africa

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Introduction and Scope of Chapter

Relative to the literature on live animal production and trade, research on the meat processing sector in Africa is particularly sparse. This belies a sector that is increasingly dynamic, driven by changing demand patterns, evolving marketing channels, and population growth. This chapter aims to redress some of the research gaps by piecing together available data from countries south of the Sahara, combined with a series of case studies, to illustrate the rapid changes that are taking place within the sector. Our analysis focuses on meat as an end product only and does not consider other products derived from animals, notably dairy, where a significant literature exists (particularly in East Africa), and by-products such as hides and skins. We also highlight many of the important constraints affecting the sector to raise awareness of critical policy issues and draw attention to the integrated nature of animal end products alongside livestock production.

Overview of Production and Trade in Meat Products

Over the last two decades, meat production on the African continent has almost doubled, from 11.59 million metric tons in 2000 to 19.88 million metric tons in 2020 (Figure 4.1a). The continent now accounts for nearly 6 percent of global meat production, up from 4.5 percent in 2000 (Figure 4.1b). This change in global share is due in part to a reduction in the cattle herds of Oceania (mainly Australia), North America, and Europe (in Europe, this has been partly driven by a reduction in meat demand as well). Figure 4.1c disaggregates African meat production in 2020 by different livestock types. Poultry is the largest source of meat production in Africa, with 6.8 million metric tons produced in 2020. Beef and buffalo meat and sheep and goat meat are the second- and third-largest meat categories, with 6.2 million and 3.4 million metric tons produced, respectively.

Meat production and productivity vary widely across the continent (Figure 4.2). South Africa is the largest producer of beef and poultry, with 1 million and 1.9 million metric tons of production, respectively. It is the second-largest producer of pig meat, with 0.3 million metric tons of production. South Africa is also the most productive cattle producer, with a yield of 231 kilograms per animal; the most productive pig meat producer, with a yield of 86 kilograms

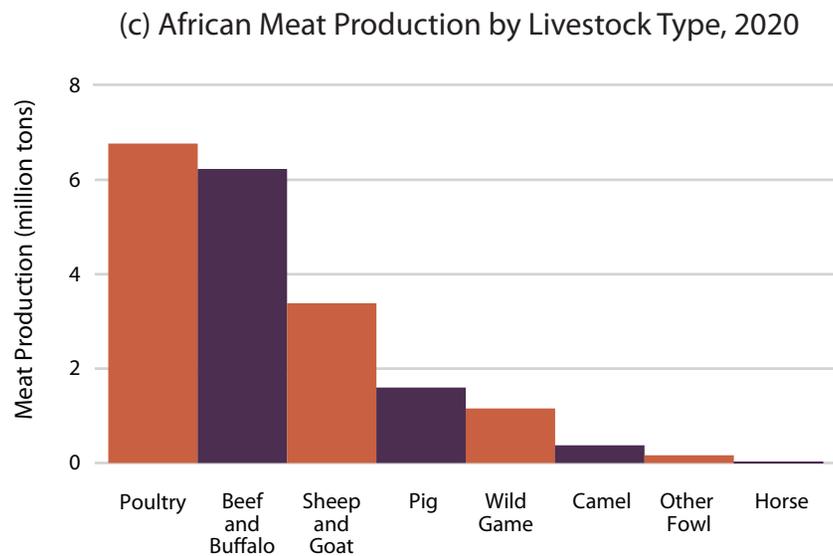
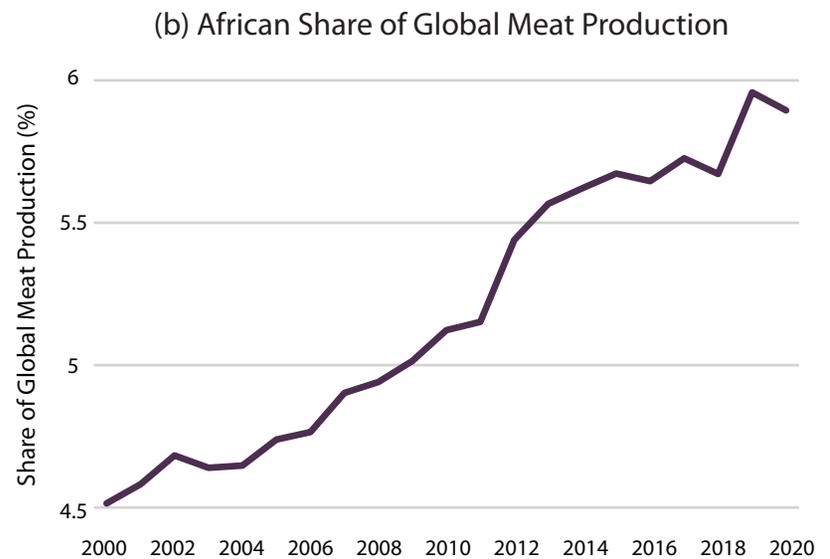
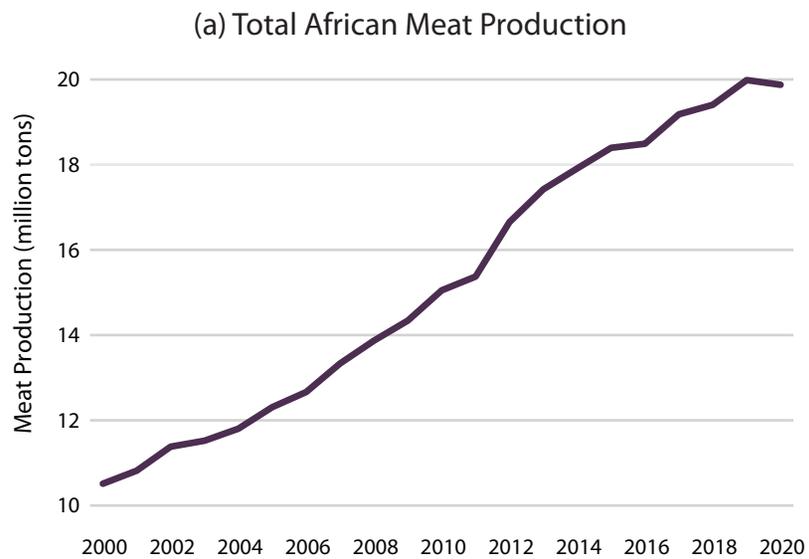
per animal; and one of the most productive poultry producers, with a yield of 1.94 kilograms per bird.

Outside South Africa, other top cattle producers include Egypt and Kenya, with around 0.5 million metric tons of production each and animal yields of 314.6 kilograms per animal and 108.5 kilograms per animal, respectively. Top poultry producers outside South Africa include Egypt, with 1.5 million metric tons of production and meat yields of 1.4 kilograms per bird, and Morocco, with 0.9 million metric tons of production and meat yields of 1.4 kilograms per bird. The two largest pig meat producers are Nigeria and South Africa, with about 0.3 million metric tons of production each. Within this sector, South Africa tends to compete at the intensive margin, with animal yields of 86 kilograms per head. Nigeria is less competitive at the intensive margin, with meat yields of only 45 kilograms per head, but dominates at the extensive margin, with a herd of 8 million animals.

Per capita meat consumption in Africa has risen from 15.65 kilograms per capita in 2000 to 19.01 kilograms per capita as of 2017. However, as of 2017, African meat consumption per capita is still less than half the global level of 43.22 kilograms per capita. On the African continent, meat consumption is highest in Gabon (59.2 kilograms per capita) and South Africa (60.0 kilograms per capita). Ethiopia and Nigeria have the lowest per capita meat consumption, at 5.4 kilograms per capita and 7.1 kilograms per capita, respectively.

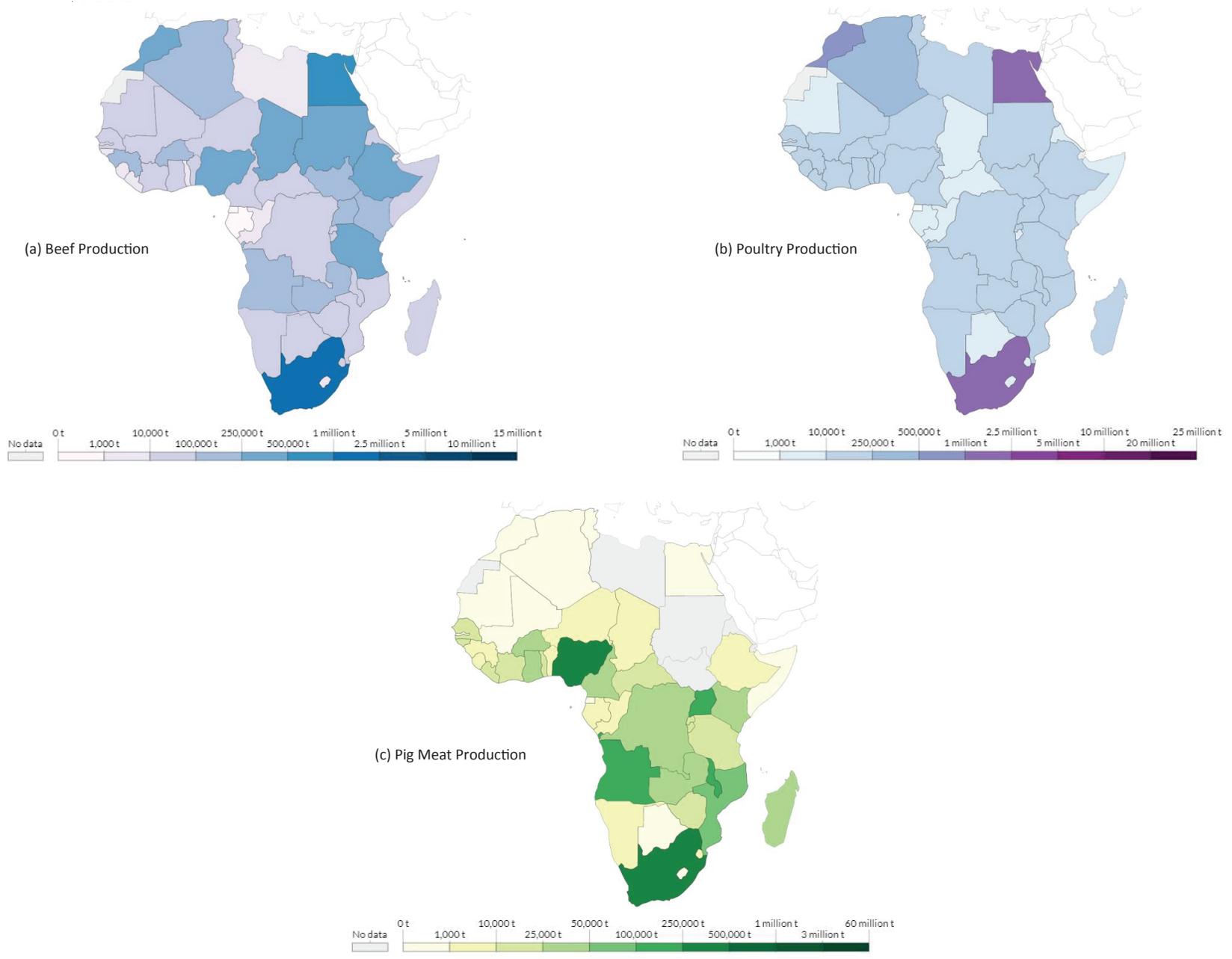
On the trade side, Africa is an increasingly important importer of meat products, particularly beef, from global markets but remains a relatively modest exporter; traditionally, exports have been in live animals, particularly cattle from across the Sahel to coastal West African markets (Rich and Wane 2021) and of sheep and goats from the Horn of Africa to the Middle East (Mtimet et al. 2020). Based on aggregate data from Enahoro and colleagues (2021), the only category of meat in which an African country is a major global exporter is sheep and goat meat, where Namibia ranks 10th globally. As noted in the first case study below, Botswana, Namibia, and Swaziland export modest amounts of beef to high-value markets in the European Union (EU), but most exports of meat tend to be minor regional exports and/or informal trade. However, Africa south of the Sahara is an important importer of both poultry and beef, with imports of nearly 1 million metric tons of beef and more than 2 million metric tons of poultry in 2019 (Enahoro et al. 2021).

FIGURE 4.1—EVOLUTION OF MEAT PRODUCTION ON THE AFRICAN CONTINENT, 2000–2020



Source: Ritchie and Roser (2017).

FIGURE 4.2—MEAT PRODUCTION BY COUNTRY, 2020



Source: Ritchie and Roser (2017).

Africa's relatively modest footprint in global meat production and trade can be explained by a variety of factors that are better illuminated in the case studies that follow. Nonetheless, briefly summarized, these constraints include (1) the use and maintenance of lower-yielding (though often more resilient) traditional breeds over more productive exotic breeds; (2) relatively low and inconsistent levels of offtakes (sales) from traditional systems that are less integrated with formal markets, based on the complex sociocultural and livelihood functions that livestock have in informal markets that obviate transactions on a consistent market basis; (3) the prevalence of a variety of endemic animal diseases that complicate investment, induce production-reducing mortality and morbidity, raise management and animal health costs, and thwart market access to high-value developed-country markets; (4) poor infrastructure, particularly downstream in roads and energy, which raises transaction and transport costs for both inputs (especially feed) and meat outputs, reduces throughput in processing, and prevents economies of scale in cold chains and other innovative technologies; (5) greater competition for grains that can be used for either food or feed purposes, thus raising costs in using more efficient feed sources; (6) a lack of an enabling environment on the policy side, in terms of regulations and tax laws that incentivize processing, and limited funding and support for veterinary services; (7) a general lack of grading systems for meat, resulting in meat being sold largely as an undifferentiated product, with carcass value not maximized on the basis of different cuts; and (8) despite their recent growth from a low base, modest per capita income levels, which have limited demand and consumption relative to other developing countries and hindered the ability of supply-side interventions to competitively capture and derive benefits from improvements and innovations.

Case Study #1:

Beef Exports from Botswana and Namibia—the Benefits and Costs of Investments in Animal Health and Traceability in the Meat Sector¹

Botswana and Namibia are two of the few countries in Africa that have been able to successfully export beef (and sheep and goat products) to high-value markets, predominantly to Europe. Each country maintains a cattle herd of approximately

2 million animals, though production is spatially bifurcated across the country into zones where foot-and-mouth disease (FMD) is either not present or is endemic. These zones are physically demarcated by a double ring fence, meaning that cattle producers (mainly small-scale ones) outside the FMD-free zone are generally unable to sell their animals out of their region (unless submitted to a rigorous quarantine period), and their meat cannot be exported to high-value markets. This system has maintained FMD-free areas, allowing market access to Europe—which insists that meat exports from either country be derived from animals that are FMD-free without the use of vaccination—but at significant financial and equity costs.

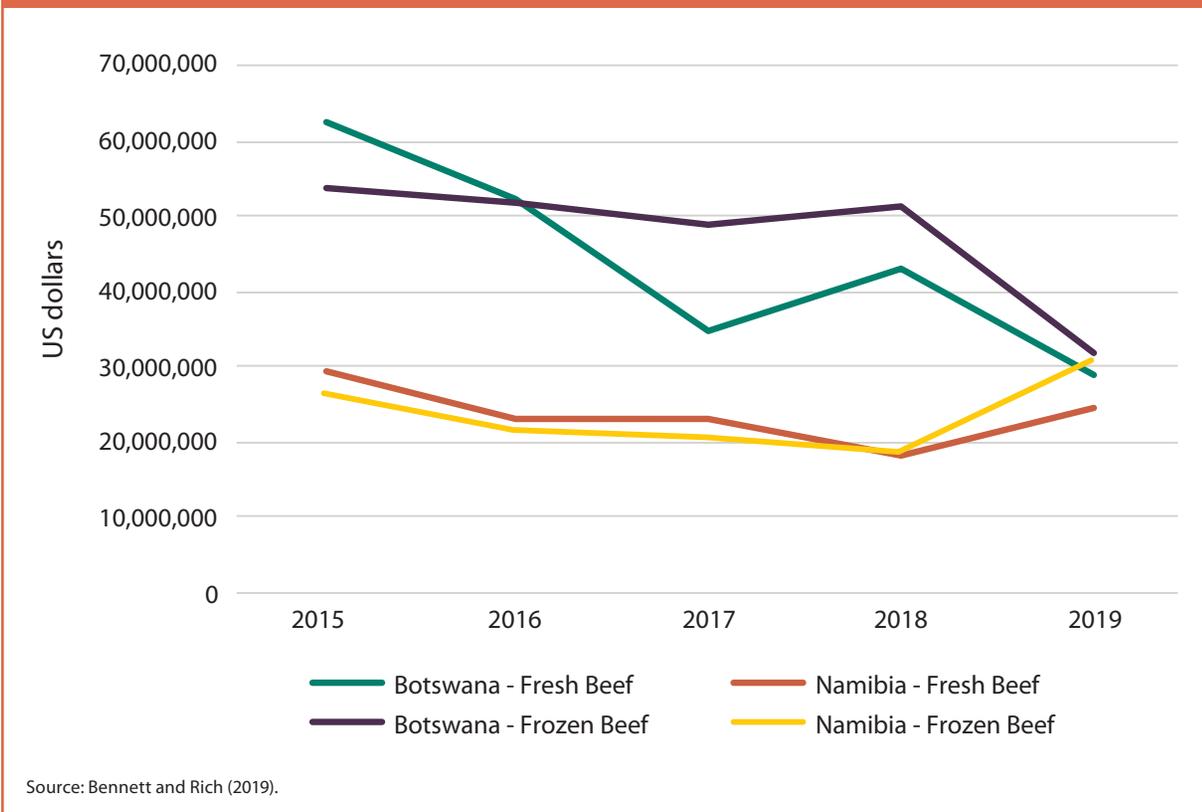
Exports by Botswana and Namibia have been fueled by preferential trade arrangements with the EU and Norway, which are the main destinations for higher-value fresh cuts; lower-value cuts are sold primarily to South Africa and regional markets in Africa. Trade with Norway is particularly lucrative, given the high levels of protection placed on domestic production and both countries' shared access to a duty-free quota of 2,700 metric tons that is a relic of Norway's earlier Generalized Scheme of Preferences. Norway also allocates an additional 500 metric tons to Southern African Customs Union countries. In 2021, Namibia was able to avail itself of the entire duty-free allocation to Norway by virtue of Botswana's inability to fill its share (Ngatjiheue 2022).

As shown in Figure 4.3, each country's total exports of both frozen and fresh beef are sizable, though exports from Botswana have been steadily declining in recent years, as Botswana has faced challenges with FMD outbreaks and difficulties with its parastatal, the Botswana Meat Commission (BMC), procuring animals in sufficient volumes for profitable exports. Both Botswana and Namibia rely on state-run organizations (MeatCo in the case of Namibia) for the export of beef, which has provided stability at the expense of innovation in the sector. However, particularly in the case of Namibia, trade links developed over the past decade with buyers in Europe have helped to improve logistics and add value through branding and other marketing efforts, including a greater focus on selling high-value, fresh cuts to the EU and Norwegian markets. Namibia has made recent inroads into the US market as well (*Africanews* 2020).

While the case of exports from Botswana and Namibia has been largely lauded as a success story and has raised food safety and animal health standards

¹ This case draws from Rich and Perry (2011); Naziri, Rich, and Bennett (2015); and Bennett and Rich (2019, 2020).

FIGURE 4.3—EXPORTS OF BEEF FROM BOTSWANA AND NAMIBIA, 2015–2019



Second, trade has been facilitated by preferential trade arrangements, particularly links with Norway, which have increased prices and production costs relative to other global competitors, especially those in South America. These higher prices have benefited farmers in Namibia. In Botswana, the BMC offers producers prices that are below export parity; this has reduced farmer incentives to sell animals for export, compromising throughput and the viability of the BMC, to the extent that the BMC is currently in the process of privatization (Reuters 2020). These trade arrangements have nevertheless bound these two countries to the European market, making it more difficult to diversify sales and maximize carcass value by selling other cuts at prices that are competitive with other suppliers. Given that EU market access is predicated on FMD-free status, any breakdown in the biosecurity regime of either country would have significant ramifications for the viability of that sector; periodic outbreaks of FMD in Botswana have undermined its ability to use its full share of the export quota, for instance.

Third, while innovation and added value have improved of late, particularly in terms of branding efforts in European markets, there may be limits

to international levels, several caveats underpin this narrative. First, from an equity standpoint, the use of physical barriers to separate parts of each country into FMD-free and FMD-endemic zones has created a dynamic that has benefited large-scale commercial operations (which represent 75 to 80 percent of national production), to the detriment of communal farms. Namibia has tried to redress this through its pricing mechanism, which provides the same price to farmers (for a given animal grade) countrywide, implicitly subsidizing production in communal areas. However, this has not adequately addressed low offtakes and throughput in communal area abattoirs.

to these gains, particularly in Norway, where local production is prized over imports for the highest-value products. Diversification of exports to the United States or China may be one way of overcoming these limits, as may further democratization and reforms of governance in the formal and communal sectors to allow greater voice and perspectives from a more diverse set of stakeholders, namely the communal sector, which has not as yet played a major role in decision-making.

Case Study #2:

Dynamics of the Beef Trade in West Africa²

West Africa is an important supplier of live animals in Africa, including cattle, sheep, and goats. Trade in West Africa is predominately regional, following pastoral patterns of animal movements across the Sahel and sales of animals from Sahelian markets (Burkina Faso, Mali, and Niger) to growing, dynamic coastal markets (particularly Côte d'Ivoire, Ghana, Nigeria, and Senegal). This trade follows well-defined transhumance routes that have existed for millennia and follow a sociocultural logic relating to the role livestock play in wealth generation and status in local societies. In the last few years, there has been a renewal of policy debates in Sahelian countries about ways to add value to live animal stocks by investing in abattoirs locally and exporting meat, rather than animals, to coastal West African markets.

Recent research by Rich and Wane (2021) explored the prospects of such trade through a case study on the potential of beef sales to Ghana from Burkina Faso. Along this trade corridor, Burkina Faso exports approximately 100,000 head of cattle to Ghana annually. Cattle from Burkina Faso account for roughly a third of Ghanaian consumption. Cattle processing in both countries is dominated (on a volume basis) by large slaughterhouses—some 57 percent of Burkinabe cattle are slaughtered in the main abattoir in Ouagadougou, while 40 percent of daily slaughter in Accra occurs at the main Accra slaughterhouse. These large operations exist in parallel with smaller, informal slaughter points that receive price signals from more formal players.

Much of the trade in beef to coastal West African countries is in the form of offal—nearly 77 percent of all beef imports in volume terms in 2018 were comprised of offal, with the remainder mainly lower-value cuts. This competes with local preferences for “hot-chain meat,” where animals are slaughtered with little in the way of product differentiation. An important component of any prospective trade involving exports from Sahelian countries to third countries will be competitiveness in offal and cuts and whether increased value can be generated for high-value cuts in order to make the price of offal more competitive with third-country suppliers.

² This case study draws from Rich and Wane (2021).

To assess this potential, Rich and Wane (2021) developed a simulation model of trade in cuts between Burkina Faso and Ghana. The model explored a range of scenarios associated with market segmentation, improved animal productivity, enhanced processing efficiency, and macroeconomic (exchange rate) movements to see whether Burkina Faso could compete with other meat suppliers in Ghana. Simulation results revealed that while Burkina Faso could compete relative to local production in Ghana, it could not offset the price advantages that other suppliers have in offal exports; it is also less clear whether such price differentiation by cut would be valued in local, informal markets. Moreover, such investments in the meat sector (in lieu of live animals) in Burkina Faso would produce only marginal improvements in GDP and employment, based on an assessment of multipliers from a Burkinabe social accounting matrix. The research highlights the logic of current trading patterns and suggests greater investments in the live animal sector to enhance this trade.

Case Study #3:

East Africa's Meat Production and Export Performance— Review of Policies and Practices in Ethiopia and Tanzania

Ethiopia and Tanzania are the two leading livestock-producing countries in Africa south of the Sahara. According to the Central Statistical Agency of Ethiopia (Ethiopia, CSA 2020), Ethiopia has the largest livestock population in Africa, with 70 million cattle, 42.9 million sheep, 52.5 million goats, 8 million camels, and 57 million poultry birds in the country. These estimates include the rural sedentary and pastoral areas of the country and exclude livestock populations in the nonsedentary (nomadic) areas of Afar and Somali regions. Tanzania is estimated to have a livestock population of more than 34 million beef cattle, 25 million goats, 8.9 million sheep, 3.3 million pigs, and 87.7 million poultry birds (Tanzania, NBS 2021). Despite both countries' large inventories of livestock, productivity and commercialization of the livestock sector remains low (Ethiopia, Livestock State Ministry 2014), with exports of meat and other slaughter by-products comprising only 2 percent of overall export commodities in Ethiopia (Eshetie et al. 2018) and less than 1 percent in Tanzania (Tanzania, NBS 2021).

According to the Food and Agriculture Organization of the United Nations (FAO 2018), between the years 2004 and 2014, the average meat yield (carcass weight) in Ethiopia was 0.8 kilograms for poultry, 10 kilograms for sheep, 8.5 kilograms for goats, 170 kilograms for camels, and about 109 kilograms for cattle. In Tanzania, between the years 2016 and 2017, beef meat accounted for 82 percent of total red meat production, goats for 14 percent, and mutton for 4 percent (FAO 2015). Meat production in both countries offers the opportunity to serve both regional export markets and domestic markets.

Although Ethiopia has the second-largest human population in Africa, its per capita meat consumption is below the average for countries in Africa south of the Sahara, at about 8 kilograms per year, of which beef consumption accounts for about 5.3 kilograms (Birhanu 2019). The low per capita meat consumption in Ethiopia is primarily due to low per capita income, high domestic meat prices, and the more than 200 religious fasting days per year observed by many in the country (Aleme and Lemma 2015; UNDP 2017). As for Tanzania, its per capita meat consumption is about 11 kilograms per year (FAO 2020) and is dependent on seasonality, urbanization, and agricultural growth (Kaminski, Christiaensen, and Gilbert 2016; Wenban-Smith, Faße, and Grote 2016).

In both countries, large, growing populations and rising incomes have increased domestic demand for animal-based food products, but domestic supply is relatively low due to structural and institutional constraints such as the availability and costs of inputs (feed, for example), equipment, and financial services. Livestock productivity growth is important in boosting market competitiveness in both domestic and foreign markets. However, prevailing factors such as critical shortages (and inadequate quality) of feed, widespread prevalence of pests and diseases, poor slaughtering and flaying processes, limited market linkages, and lack of standards and certifications need to be addressed to increase domestic production and consumption and to succeed in export markets.

With its established comparative advantage in live animals and its strategic geographic location, Ethiopia holds considerably greater potential for increased meat production and export than most African countries (FAO 2015; USAID 2010). Countries currently importing live animals from Ethiopia are Sudan (19.5 percent), Somalia (19.0 percent), Saudi Arabia (18.7 percent), and Djibouti (14.9 percent) (Ahmed 2019; Ethiopia, Ministry of Agriculture and ILRI 2013). Due to Ethiopia's comparative advantage in the Middle East's livestock and meat markets, its exports of chilled small ruminant meat from abattoirs are primarily

to the United Arab Emirates and Saudi Arabia, accounting for 60 percent and 38 percent of Ethiopia's exports, respectively (Eshetie et al. 2018).

Both Ethiopia and Tanzania are keen to enhance domestic production to close the projected total national meat production-consumption gap and increase exports of live animals and meat. Recognizing the potential of the livestock sector, governments in both countries have undertaken several strategic initiatives and policies over the years to facilitate and promote diverse incentive and investment interventions. These have included the initiation of Livestock Master Plans in each country to identify best-bet intervention and investment options from the public and private sectors (Shapiro et al. 2015; Michael et al. 2018). Such strategic government policies are poised to transform the meat production sector by boosting productivity and consumption and generating foreign exchange earnings through increased exports.

In Tanzania, market-led reforms introduced since 1986 include a new exchange rate regime, liberalization of trade, and price deregulation (Sharma et al. 2005). Policies to regulate the livestock sector in Tanzania include the Animal Diseases Act of 2003, the Tanzania Veterinary Act of 2003, the Tanzania Meat Industry Act of 2006, the National Livestock Policy of 2006, and the Grazing-Land and Animal Feed Resources Act of 2010. In addition, the Tanzania Livestock Modernization Initiative was established in 2015 to support the transformation of the traditional livestock sector into an economical, sustainable, and environmentally friendly sector (Tanzania, Ministry of Livestock and Fisheries Development 2015).

The Ethiopian government's second Growth and Transformation Program (the 2015–2020 GTP II) has helped to increase the productivity and competitiveness of the key livestock value chains for poultry, red meat, milk, and crossbred dairy cows through improved genetics, feed, and livestock health services (Ethiopia, National Planning Commission 2016). Policies related to livestock marketing and animal health in Ethiopia are also prioritized in the Ministry of Finance and Economic Development's Plan for Accelerated and Sustained Development to End Poverty (PASDEP), while specific programs related to livestock marketing and trade are prioritized in the Ethiopia Sanitary & Phytosanitary Standards and Livestock & Meat Marketing Program (SPS-LMM).

However, despite these reforms, challenges to effective policy implementation persist in both countries. Complementary policy support is required to help meet government-set targets in key livestock value chains (Shapiro et al.

2015). Examples of needed policy support include effective and affordable animal identification and traceability programs, monitoring programs for abattoirs for improved food safety and animal health, land availability for seed and forage production, investment in livestock market facilities and supporting infrastructure, quality-based pricing incentives to support domestic meat demand and supply, and policies that buffer domestic production against surges of imports. Provision of comprehensive veterinary services should also be a priority of public institutions. In addition, investment in high-potential fodder-production zones (Worqlul et al. 2022), in climate-induced risk management for the most vulnerable (Bogale and Temesgen 2021), and in creating an enabling environment to attract private sector investments in the meat value chain should be a policy priority for both countries.

Case Study #4:

Transitioning from Backyard Flocks to Semi-Commercialized and Commercialized Poultry Production—Review of Mozambique’s and Ghana’s Poultry Industry

While South Africa, Egypt, and Morocco are the largest poultry-producing countries, small-scale poultry production is prevalent across the African continent. In recent years, Mozambique has looked to improve and develop the domestic poultry value chain for its many small-scale producers (Mozambique, Bank of Mozambique 2015). However, imports from South Africa, Zambia, and Zimbabwe have proved to be competitors for Mozambican poultry producers. A ban on poultry imports in 2017 (mainly to prevent Brazilian imports) caused the price of poultry to increase, along with the price of inputs, which was not the intention of the ban (AfDB 2017). The government then loosened the ban to allow for some imports from South Africa and decided to focus more on developing the poultry value chain. Specifically, it sought to support hatcheries, grain producers and feed processors, abattoirs, and distributors (Mozambique, Bank of Mozambique 2015).

Poultry production in Mozambique can be divided into two broad categories: the small-scale village (or scavenging) system, which is the dominant system, and the intensive (or commercial) system. The two systems vary widely with respect to numbers, poultry breeds, biosecurity practices, and management.

According to the 2015 national Integrated Agricultural Survey, poultry has mainly been produced for producer consumption or limited sale to nearby local markets. Specifically, about 3.4 million chickens were sold alive (22.19 percent of total production), about 9 million were slaughtered for own consumption (59.44 percent of total production), and only 65,583 were slaughtered for sale (0.43 percent of total production). The majority of the marketed poultry meat comes from broiler chickens produced by cooperatives and large-scale private sector players. The largest producers include General Union of Agricultural and Livestock Cooperatives, Mozambique Farms, Astral Food, Mozambique National Poultry Association, Frangos de Manica, Empresa Avicola Abilio Antunes, Novos Horizontes, Frango King, and Pintainhos Stewart. In 2013, only six poultry slaughterhouses were officially registered (more operate but are not officially recognized) in Mozambique, supplying slaughtered and processed chickens to the main urban centers (FAO 2013).

It is impossible to discuss supply chain issues separately from infrastructure issues in most cases. Many supply chain issues are a result of a lack of infrastructure. Additionally, lack of infrastructure is at times due to existing supply chain issues or insufficient private or public investment that creates missing links in the supply chain. Both infrastructure and supply chain issues impact animal productivity, creating a highly intertwined and complex challenge.

As Mozambique looks to transition more toward semi-commercialized or commercialized production, the poultry value chain will need significant development and support—specifically, veterinary services, hatcheries, feed mills, processing, and storage (Bah and Gajigo 2019). Access to affordable feed remains a significant challenge for producers, given the absence of feed mills. Formal and highly structured hatcheries are necessary to ensure that poultry producers can have access to large quantities of chicks at similar ages to enable them to produce efficiently. Given the sparse population of many regions within Mozambique and the resulting long distances over poor road conditions to urban centers, the absence of processing services prevents access to significant parts of the market (Bah and Gajigo 2019). Access to financing has also proven to be a constraint to the development of the poultry industry, as only about 20 percent of the country’s working-age population has access to banking and financial services (McKague and Karnani 2014).

Ghana is similar to Mozambique in terms of the struggle to develop and maintain the poultry supply chain, as well as in how the country combats the

impact of trade on domestic production. From 2000 to 2017, poultry production in Ghana saw significant growth, with a steady increase from 50,895 metric tons in 2011 to 59,653 metric tons in 2017 (Ghana, Ministry of Food and Agriculture 2018). According to the Ghana Poultry Project, there are 29 large-scale commercial poultry farms currently in Ghana, and these farms represent about 20 percent of the total poultry sector. Medium- and small-scale producers comprise 80 percent of the poultry sector and rely on hatcheries for their day-old chicks and feed mills for their feed (Aning 2006). The medium- and small-scale operators practice minimal biosecurity, which exposes the producers to risk of disease outbreaks such as avian influenza (Aning 2006). While there are local hatcheries that produce day-old chicks, the quality is generally low, so most poultry farmers prefer to buy imported day-old chicks, especially day-old layer chicks. In 2018, Ghana imported 511,960 day-old broiler chicks and 7,130,999 day-old layer chicks (GPP 2022). Poultry feed accounts for about 70 percent of total animal feed produced in Ghana. Commercial feed millers supply poultry feed mostly to medium- and small-scale poultry producers, while large-scale poultry producers mostly provide their own feed through vertical integration (Andam et al. 2017). The poultry industry consumes nearly 30 percent of all maize produced in Ghana.

Ghana's poultry imports come mainly from Brazil, the EU, and the United States. To support the local poultry industry, in 2013 the government of Ghana removed customs duties on poultry inputs such as feed, additives, drugs, and vaccines and facilitated improved access to veterinary services. In 2014, the government launched the Broiler Revitalization Project to stimulate local broiler production. As part of the project, a new poultry and livestock import policy was designed to reduce the country's importation of chicken meat. The policy limits imports to 60 percent, meaning that importers must buy 40 percent of their produce from local sources. In 2019, a program titled Rearing for Food and Jobs was launched, aimed at "developing a competitive and more efficient livestock industry that will increase domestic production, reduce importation of livestock products, contribute to employment creation, and improve livelihoods of livestock value chain actors" (Netherlands Enterprise Agency 2019, 11). The focus of this program is on building the appropriate infrastructure to boost local production.

Much like the situation in Mozambique, general bottlenecks in the Ghanaian poultry sector include access to and quality of vaccines, a small hatchery sector,

and inadequate maize and soybean production for feed (Kusi et al. 2015). At the production level, the major challenges include inadequate biosecurity systems, low-quality day-old chicks due to poor-quality local hatcheries and lack of hatchery regulations, own on-farm feed production (leading to lower-quality feed), abuse of antibiotics, and poor linkages between input suppliers and marketers (Kusi et al. 2015). Limited processing, the high cost of local poultry production, and competition from imported poultry products are some of the challenges at the processing and marketing level (Kusi et al. 2015).

Conclusion: Key Opportunities and Challenges in the Sector

Demand for and production of meat products have been increasing, to varying degrees, across the African continent. This creates opportunities to expand processing capacity to meet this demand. Yet, the global footprint of Africa's meat production sector has remained modest, due in part to challenges along the value chain, as highlighted in the case studies. When considering meat and livestock products generated by the processing industry, the value chain leading up to the final product is highly complex. Primary inputs include land, feed, labor, intermediate livestock inputs (for example, chicks to poultry producers or feeder cattle to livestock feeding farms), transportation, and veterinary services.

As value chains evolve in a region, actors along that chain find opportunities and challenges. These include market access, costs of compliance, improvements in the availability and quality of feed and forage, animal disease, animal productivity and competitiveness, infrastructure, and other leverage points in the value chain, to name a few. Some of these issues were highlighted in the case studies above, but each region's meat value chain will face challenges and opportunities unique to that region. For example, a study of the red meat sector in South Africa identified infrastructure as the greatest challenge to growing meat production and processing in that country (Spies 2011).

Another challenge is animal losses, which can arise from predation, disease, parasites, and injury, among other causes. Large-scale animal losses threaten farm livelihoods, threaten food security and safety at the community level, and disrupt the ability of processors to meet client delivery expectations—domestically and internationally—at the market level. At the farm level, endemic diseases and parasites can depress annual production, reducing the overall availability of livestock to the processing industry. This is true of both formal and informal farm

types, although the criticality of particular animal health challenges may vary greatly by country and farm type.

Risk of disease outbreaks may vary between formal and informal farm types. Informal farm types may be at higher risk of a listed disease outbreak, since introductions to domestic herds and flocks may result from contact with wildlife carrying the disease (Souley Kouato et al. 2018). Some diseases also have a seasonal component. For example, FMD has been found to peak during March in Ethiopia (Aman et al. 2020). The incidence of animal disease also creates an economic burden of diseases on smallholder farms. For example, in Ethiopia, where FMD is endemic, it is estimated that cattle farmers with mixed crop-livestock farms lost an average US\$76 per herd, and pastoralists lost US\$174 per herd (Jemberu et al. 2014).

The World Organization for Animal Health recognizes 85 listed diseases of terrestrial species. These diseases can result in sanitary embargoes on exports from countries with outbreaks. In 2021, the largest number of individual listed disease outbreaks were for FMD (35 outbreaks in livestock), highly pathogenic avian influenza (26 outbreaks in livestock), Rift Valley fever (18 outbreaks in livestock), and African swine fever (17 outbreaks in livestock) (World Animal Health Information System 2022). Disease outbreaks can cluster geographically, with higher frequency in particular countries (Calkins and Scasta 2020). For example, from 1996 to 2018 the greatest geographic concentration of Rift Valley fever was in Kenya, Rwanda, and Tanzania, as well as Mauritania and South Africa (Calkins and Scasta 2020).

Rift Valley fever and highly pathogenic avian influenza are zoonotic diseases with the potential to cause adverse health effects in humans as well as animals. Rift Valley fever has the added complexity of being vector borne, namely, transmission can occur via mosquitos carrying contaminated blood from one person or animal to another. A study in Kenya found that the most common transmission routes, however, included the consumption of meat and milk from infected animals as well as contact with blood (Mutua et al. 2017). This disease poses risks not just to consumers but also to abattoir workers. Rift Valley fever further undermines both formal and informal trade in large and small ruminants, particularly in the area extending from the Horn of Africa to the Arabian Peninsula, and simulation analysis has shown that the trade disruption was accentuated by COVID-related shocks (Mtimet et al. 2021).

From a policy standpoint, a number of additional issues emerge from the analysis, many of which are addressed by interventions highlighted in the Livestock Master Plans that have been developed for Ethiopia (Shapiro et al. 2015), Rwanda (Shapiro et al. 2017), and Tanzania (Michael et al. 2018).

First, policies that improve the productivity, safety, health, and resilience of the live animal sector will naturally have positive spillover effects on the meat sector, and in turn can yield incentives for greater investment in formal downstream meat processing activities. Such investment would improve competition in the sector, which is often highly bifurcated between atomistic informal facilities and quasi-parastatal formal-sector abattoirs.

At the same time, it is less clear whether such investments would have significant enough impacts on competitiveness to enable the products of such facilities to compete with imported supplies. While reduced production in certain exporting countries (particularly in Europe) and rising demand from China and other East Asian markets may boost world prices in the future, identifying mechanisms and infrastructure that can reduce costs in processing, distribution, and retail will be essential.

Further to this point, and following the study by Rich and Wane (2021), are the prospective conflicts between animal trading and recipient markets over capturing added value from meat production. In West Africa, increased local production of meat by traditional animal exporters could have knock-on effects on employment in coastal markets that might engender trade conflicts in erstwhile free trade zones. Identifying ways to share the benefits of increased value addition across borders will be critical.

Finally, the question of scaling up semi-commercial production to enable more farmers to engage in formal markets, particularly in poultry, in ways that benefit current smallholder farmers will be an important area for policy engagement. While sectors such as poultry can provide benefits to smallholders, sustainable engagement requires achieving a certain level of scale that may be difficult without investments in, among other things, feed, training, and management. Addressing these challenges will be essential to realize livestock's—and meat's—potential to serve as a true pathway out of poverty.