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Animal Source Foods Production and Marketing Brief

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Sustainably intensifying smallholder livestock systems to improve human nutrition, health, and incomes

1. Introduction

Livestock provide a livelihood for 65% of the Ethiopian population (Solomon, 2003). This sector is the source of animal protein, power for crop cultivation, means of transportation, export commodities, manure for farmland and household energy, security in times of crop failure, and means of wealth accumulation. With regard to altitude, Ethiopia is divided into a highland (>1,500 m above sea level) and a lowland (<1,500 m above sea level), which includes pastoral and agro-pastoral areas. The highland comprises 39% of the land areas of the country, 88% of human population, and 74% of the tropical livestock units, while the remainder is in the lowlands (Hussen et al., 2008; Coppock, 1994). According to the estimates of the Central Statistical Agency of Ethiopia (CSA, 2015a), there are 56.71 million cattle, 29.33 million sheep, 29.11 million goats, 1.16 million camels, and 56.87 million poultry in the country. These estimates exclude livestock populations in the nonsedentary (nomadic) areas of Afar and Somali regions. In 2014/2015 fiscal year, 3.07 billion liters of cow milk, 233.85 million liters of camel milk, and 106.57 million eggs were produced (CSA, 2015b). The livestock management system is predominated by extensive production systems, where indigenous breeds are kept under low-input/low-output husbandry practices. Green pasture (56.23%) and crop residues (30.06%) are the main feed types available in the country (CSA, 2015b).

The productivity of this sector is constrained by several factors, including poor genetics that result in low production and low reproductive performance, poor quality and varying seasonal availability of feed, high disease incidence and parasite challenges, low accessibility of services and inputs, and lack of a well-organized marketing system, which is dominated by informal marketing. However, the Ethiopian government's second Growth and Transformation Program (GTP II) has envisaged to increase by 2020 the productivity and total production of the key livestock value chains for poultry, red meat/milk, and crossbred dairy cows through improving genetics, feed, and livestock health services (MOA, 2015).

2. Production

Management practices

The Ethiopian livestock population is almost entirely composed of indigenous animals. Recent estimates show that 98.66%, 1.19%, and 0.14% of cattle are indigenous, hybrid, and exotic breeds, respectively; the respective estimates for sheep are 99.78%, 0.17%, and 0.05%, and for poultry are 95.86%, 2.79%, and 1.35%. Nearly all goats (99.99%) are indigenous breeds (CSA, 2015a).

There are three predominant management systems in the country: intensive management, mixed crop-livestock, and pastoral/agro-pastoral. The intensive management system is practiced on the recently booming market-oriented dairy and poultry farms in urban and peri-urban areas. In the intensive management system, exotic breeds or crossbred animals are mainly kept for their high performance (Tegegne et al., 2013). The mixed crop-livestock farming system is the dominant livestock production system in the Ethiopian highlands. In this system, crops and livestock play interdependent roles, with livestock providing draught power and manure for the crop agriculture while crop residues provide feed sources for the livestock (Yisehak, 2008). The pastoral and agro-pastoral production system is practiced in southern and eastern parts of the country in Afar, Somali, Southern Oromia (Borana), Kereyou in East Shoa and South Omo in the Southern Nations Nationalities and Peoples' Region (SNNPR). In the pastoral system, there is no crop production, while agro-pastoralism is characterized by dominance of livestock husbandry and limited crop production (Tegegne et al., 2013). The latter two production systems can be categorized as extensive livestock management systems with low-input/low-output.

The use of animals depends on the production system and the ethnic group(s); for instance, sheep are kept primarily for cash income in the mixed farming system, such as in North Shoa of Amhara region; but

milk production is the prime purpose for sheep in Afar region (Getachew, 2010). Small ruminants are main sources of cash income for rural women (Biffa et al., 2006).

Intensive Management System

The intensive management system is practiced by urban dairy farms in cities or towns. In this system, milk production is market oriented, the cow breed is predominantly high yielding and improved (exotic breeds or crossbreeds from local cows), and there are relatively high inputs and technology usage. The produced fluid milk is channeled to urban dwellers, restaurants and cafes, or milk processing plants. The main feeds available for urban dairying are crop residues, hay, and industrial by-products. Some farms have lands to produce improved forage. In most cases, free grazing is limited due to lack of land, and thus stall feeding is the main feeding method in this management system. Shortages of feed and extremely high feed prices, disease incidence, lack of land/space, shortage of genetically improved heifers for expansion, and limited market outlets for milk are factors that limit the development of urban dairying in Ethiopia (Tegegne et al., 2013; Welearegay et al., 2012).

Mixed Crop-Livestock System

In the mixed farming system, livestock come after crops as the means of household livelihood (Tegegne et al., 2013). For instance, in the Sinana district (Bale Zone) of southeastern Ethiopia (Abate, 2012) and the Diga district of western Ethiopia (Duressa et al., 2014), livestock contribute respectively 25-41% and 33-36% of household's livelihood; and in Dandi of central Ethiopia, only 2.6% of a survey's respondents considered livestock as their primary means of making a living (Duguma et al., 2012). Cattle are the most important livestock species in this system because they are used for ploughing and compacting of farm lands, threshing crops, and providing manure. Sheep, goats, equines, and poultry are also important sources of income, meat, draft power, and manure. In some places, a few farmers keep one or more improved cows for milk production (Abate, 2012; Duressa et al., 2014). Due to increased activity of crop cultivation, the number of livestock kept per household in mixed farming areas is low. In Central Ethiopia's Dandi district, for example, the following average numbers of livestock are kept per household: cattle (4.5), sheep (1.1), goats (0.5), equines (0.8), and poultry (3.0). (Duguma et al., 2012). Different livestock species are often kept in a separate place, such as an open barn for cattle and equines and a small barn for small ruminants and young calves; sharing of the living space with the household at night is not uncommon (Abate, 2012, Duguma et al.; 2012, Duressa et al., 2014). The mean number of household members in the mixed crop-livestock farming system is around six people (Tegegne et al., 2013; Duguma et al., 2012). Studies in Dandi district and Jimma zone have indicated that children are involved in herding and watering of livestock; women are responsible for collecting water, milking, milk processing, selling the milk products, and cleaning barn or animal shed; and men are mainly responsible for feeding the livestock with hay and crop residues. Decision making about breeding and marketing of animals, feeding oxen, and taking animals to the veterinary clinic is the responsibility of men, while looking after calves and sick animals and feeding cows are roles of women (Duguma et al., 2012; Yisehak, 2008).

Livestock production in the mixed farming system is limited by several factors: declining availability of grazing lands due to increasing human population and encroachment for crop cultivation (Abate, 2012); poor production and reproductive performance (Duguma et al., 2012); and lack of or inadequate access to technologies (Duressa et al., 2014). The average farm land per household is 1.4 ha in Lemo district (Hadiya zone), one of the densely populated areas in SNNPR (Geleti et al., 2014b) and 4.5 ha in Bale, a less densely populated area in Oromia (Abate, 2012). A very small part of each family plot is generally allocated for forage production (0.05 ha in Lemo). The summary of livestock species in the mixed crop-livestock system, purposes of livestock keeping, and major constraints are depicted in Table 1.

Table 1. Livestock species, purposes of livestock keeping, and major constraints in the mixed crop-livestock system, Ethiopia

Livestock Species	Purposes of Livestock Keeping	Major Constraints for All Types of Livestock	References
Cattle	Draft power, manure, meat, milk, cash	1. Shortage of feed both in quantity and quality	Abate (2012), Duguma et al. (2012), Duressa et al. (2014), Geleti et al. (2014b), Feyissa et al. (2014),
Sheep	Cash, meat, manure, wool/fiber	2. Insufficient and inefficient artificial insemination (AI) service	
Goats	Cash, meat, manure	3. Diseases and parasites	
Equine	Draft power, transportation	4. Lack of veterinary clinics or shortage of facilities and drugs	
Poultry	Meat, eggs, cash	5. Unsatisfactory credit service	
		6. Lack of awareness about available technologies	

Pastoral and Agro-Pastoral System

Pastoral and agro-pastoral livestock production is the second dominant system in Ethiopia. In southern pastoral and agro-pastoral areas of Ethiopia (Borana zone of Oromia and Liban zone of Somali), cattle are the most numerous species, followed by goats, camels, and sheep, with means of 21.1, 13.8, 9.8, and 9.5 animals per household, respectively. Livestock is a means of livelihood for 90% and 93% of households in Borana and Liban, followed by crop production (60% and 36.7%), and trade (10% and 3.3% respectively). Sale of animals, animal products, crops, and trade contributed 75%, 60%, 5%, and 10% of household income in Borana and 80%, 36.7%, 10%, and 13.3% of household income in Liban, respectively (Tolera and Abebe, 2007).

Poultry Production

Poultry production is one of the most important agricultural subsectors for rural communities, with 58% households raising chickens and each having an average of five birds (Catley et al., 2014). On the other hand, large commercial poultry farms are mainly found around big cities or towns. In terms of the proportion of households that keep poultry, Tigray region is the highest with 66% of households having chickens, followed by Afar (60%), Somali (54%), and Benishangul (54%). The involvement of women in poultry keeping is higher than their male counterparts, and the income from poultry and poultry products is predominantly controlled by women (Yisehak, 2008; Sambo et al., 2015; Getu A. and Birhan, 2014).

Main forages, feeds and their production

The available feed resources in the mixed crop-livestock production areas are natural pastures, crop residues, and to a lesser extent, improved forage, concentrates, and nonconventional feeds. Natural pasture is the primary feed source for livestock, and is abundant during rainy season. In some areas, it is harvested during wet season and conserved for dry season (Abate, 2012; Duressa et al., 2014; Feyissa et al., 2014; Geleti et al., 2014b). Crop residues are the second most abundant feed sources in the country and include straw or stover of teff (*Eragrostis teff*), barley, wheat, sorghum, and maize (Duguma et al., 2012; Duressa et al., 2014; Tegegne et al., 2013), and legume residues such as fava bean and field pea (Abate, 2012). Animals are fed on crop stubble during harvesting seasons. In some places, improved forage is cultivated and fed to dairy cows to increase milk production, but this practice is not widespread (Abate, 2012). Nonconventional feeds, such as weeds and brewers grains, a by-product of local tella (beer) production, are also fed to livestock (Feyissa et al., 2014). Agro-industrial by-products such wheat

bran, oil cake, and molasses are available only to farmers close to urban areas, but are unaffordable to most of them for frequent purchase (Geleti et al., 2014b; Yami, 2012). Available feed types and major constraints in three mixed crop-livestock production areas are presented in Table 2. The main feed types available for urban dairies are crop residue, hay, and agro-industrial by-products (Tegegne et al., 2013).

Free grazing is the most common feeding system in mixed crop-livestock farming areas, while stall-feeding is dominant in urban dairying. Animals graze on pasture land, along roads and rivers and around homesteads in mixed farming areas (Abate, 2012, Duressa et al., 2014; Feyissa et al., 2014; Tegegne et al., 2013), and animals range free in the lowlands. Stall feeding is common in some places in the mixed farming system, and crop residues, forage, and weeds are given to the animals (Duguma et al., 2012; Geleti et al., 2014b). In some places, like the Mieso district of Oromia, animals are tethered during crop cultivation but freely graze after harvesting season (Hussen et al., 2008). Some farmers mix crop residue with oil cake and wheat bran to increase its palatability, and some farmers provide improved forage and hay to dairy cows and oxen (Abate, 2012; Duguma et al., 2012). Seasonal purchase of concentrates for fattening animals and dairy cows is also common in some places (Feyissa et al., 2014). Salt supplementation is very common, but urea supplementation to increase the intake and nutritional value of crop residues is rare (Duressa et al., 2014).

Table 2. Available feed types and major constraints in three mixed crop-livestock production areas, Ethiopia

Districts	**Major Feed**	**Major Constraints**	**References**
Sinana district (Bale), Oromia region, southeastern Ethiopia	1. Crop residues (cereal straws of wheat, barley, and emmer wheat, and legume residues of fava bean and field pea) 2. Natural pasture 3. Cultivated fodder crops (maize and fodder oats) 4. Stubble grazing or aftermath 5. Weeds during rainy season 6. Linseed cake and wheat brans	1. Lack of knowledge in crop residue management and feeding 2. Lack forage seed and poor Extension services 3.Grazing land scarcity and low nutritional value of available feeds specially during dry season 4. High price of concentrates 6. Cash shortage 7. Inadequate clean water	Abate (2012)
Dandi district, Oromia region, central Ethiopia	1. Natural pasture 2. Crop residues (straw of teff, wheat; maize stover) 3. Conserved hay 4. Stubble grazing or aftermath 5. Non-conventional feeds (brewers grains)	1. Land scarcity and lack of awareness about how to grow improved forage crops 2. Wet season feed shortage caused by water logging of grazing pasture and intensive cropping	Duguma et al. (2012)

		3. Unaffordable price of concentrates, e.g., oil extract cake	
Lemo district (Hadiya), SNNPR, southern Ethiopia	1. Natural pasture 2. Crop residues (*Ensete* by-product; straw of wheat, barley, teff) 3. Roadside grazing and collected fodder (improved forage and grasses) 4. Concentrates (wheat bran and oil extract cake)	1. Shortage of land 2. Financial shortage and volatile price of concentrates 3.Transportation of concentrates	Geleti et al. (2014b)

The feeding system in pastoral areas is grazing. Milking cows, calves, and sick animals are kept around the homesteads, while other animals freely graze in rangeland far from home (Tolera & Abebe, 2007). The main feed resources available in pastoral and agro-pastoral areas, such as Borana and Liban zones, are natural pastures—herbaceous vegetation composed mainly of grasses and forbs, and browses such as shrubs, tree leaves, and pods—and *Acacia* species for browsing. However, the availability and quality of the pasture markedly vary based on the variability and distribution of annual rainfall. Adequate feed is available during the rainy season, but the pasture is depleted during dry seasons; thus pastoralists consider feeding leaves and branches of trees to their animals during this season. Haymaking during feed surplus season is not common, but some part of the range land is often fenced and reserved for dry seasons. The major constraints of feed availability in such areas are shortage of rain and frequently recurring drought, rangeland encroachment by undesirable plant species such as *Acacia drepanolobium*, expansion of cropping and land conversion to cultivation and private enclosures, and ethnic conflicts (Tolera & Abebe, 2007). In addition, climate change has forced the pastoralists to shift the species of livestock from grazers (cattle and sheep) to browsers (camels and goats) (Amsalu et al., 2013).

Support services and use of new technologies and practices

The government has deployed agricultural development agents in rural areas to render extension service to the rural communities, and four livestock development packages have been formulated to be adopted by farmers. These packages include technologies that support dairy for milk production, fattening of animals for meat, poultry for egg production, and honey and wax development. However, the recent national agricultural sample survey has revealed that less than 1% of households have adopted at least one of these packages (CSA, 2015a). Tegegne et al. (2013) has mentioned low accessibility of extension services and inadequacy of practical demonstrations as the causes of poor performance of the livestock extension service among small dairy holders. A study conducted in Jimma zone of Oromia indicates that men have easier access to extension service, training, and other technologies than women (Yisehak, 2008). The position of men as heads of households, men's greater access to off-farm mobility, and cultural and social limitations for women were discussed as main reasons for men's easier access, but the case of women-headed households was not discussed in the study (Yisehak, 2008).

Use of manure and waste

Use and disposal of manure and waste varies according to production system. Livestock manure is piled and used to enrich farm lands, and cow dung is made into cakes and used as a fuel or used for house plastering. Animal waste is not a problem under the mixed crop-livestock system, because it is used as a fertilizer and a source of income (Tesfay, 2014). A study in Ada'a district of Oromia in central Ethiopia shows that 93% of survey respondents collected manure for household fuel and 24% of them sold it to get additional income; in 99% of the cases manure is sold by women (Minase, 2013). However, there is lack of integrated waste management in intensive commercial dairy and beef farms (Belete, 2015). The extent of this problem depends on the number of animals raised property size, and location of the farm (e.g., the manure, slurry, and feed leftovers from urban farms can cause a nuisance to the neighbors and become source of pollution to the environment). For instance, a study done in central zone of Tigray in northern Ethiopia revealed that 36.25% of urban dairy farms experience waste disposal problems compared to only 13.75% of peri-urban dairy farms (Tesfay, 2014). In the Shashemene-Dilla milkshed in southern Ethiopia, 47% of urban dairy producers spent additional money to dispose cow dung from their farms (Tegegne et al., 2013). In a positive recent trend, the use of animal waste for biogas production has been increasing in the country (NBP, 2007; Gedefaw, 2015).

Production constraints

Livestock development in Ethiopia are mainly limited by technical and institutional factors. The technical constraints include poor genetic makeup of the animals, insufficient and low quality feed sources, unavailability and prohibitive prices of improved breeds, and widespread disease. Limiting institutional factors include poor linkages between technology sources such as research centers and end users, and limited extension and financial services (MOA, 2013). According to recent estimates (CSA, 2015a), 98.66% of cattle, 99.78% of sheep, 95.86% poultry, and almost all goats (99.99%) in the country are indigenous breeds that have poor production and reproductive performance. The average daily milk production and lactation length for a local cow are 1.35 liters and six months; production and lactation are relatively better for camels at 4 liters and nine months. The mean annual egg production is 48 eggs per hen. The mean age at first calving and the calving interval are around 50 and 22 months, respectively (Duguma et al., 2012). Unavailability and high prices of better-performing, genetically improved heifers and chickens is the key bottleneck (Yisehak, 2008). Improved bulls are unavailable and artificial insemination (AI) service is insufficient and inefficient, despite high demand for it (Tegegne et al., 2013; Yami, 2012). Furthermore, there is a large gap between feed supply and demand, which becomes worse during drought years (MOA, 2015). The major proportion of available feed resources is roughage with low nutritional value and poor management; improved feed accounts only 0.3% of the total feed available in the country (CSA, 2015a) and the price of feed concentrates is high. Feed availability is seasonal and knowledge of conserving extra feed during the wet season for the dry season is lacking (Duressa et al., 2014). In addition, feed production is affected by unavailability of land. Additionally, increased cropping and urbanization result in encroaching on grazing lands, which is more pronounced in the highland mixed farming areas than in the lowland areas. A study conducted in northwestern Ethiopia indicates that grazing land declined by 30.52% from 1986 to 2013 (Amsalu & Addisu, 2014). Credit services for livestock development are not satisfactory because the amount provided is small, the procedures to get the credit are complex, and producers lack awareness of the importance of credit (Duressa et al., 2014; Tegegne et al., 2013; Yami, 2012). Women have less access and are considered less creditworthy than their male counterparts for various reasons (Yisehak, 2008). Moreover, the livestock mortality rate is very high; the death estimates for 2014/2015 fiscal year were 3.23 million cattle, 4.37 million sheep, 4.90 million goats, 18,231 camels, and 41,195 chickens (CSA, 2015a). These estimates do not include the nonsedentary (nomadic) areas of the country.

3. Marketing and Exports

Dairy products

Marketing System

In Ethiopia, fresh milk, butter, fermented or soured whole milk (ergo), cottage cheese (ayib), and buttermilk (arera) are both formally and informally marketed. The informal milk marketing system is dominant, accounting for 95% of marketing in the country, and producers directly sell their products to consumers or to unlicensed traders or retailers through price negotiation. There is no license to operate and no check of quality in the informal system (Yilma et al., 2011). The formal marketing system prevails in peri-urban and urban areas; milk is collected from producers by cooperatives and private collecting and processing plants, which channel the products to consumers, caterers, supermarkets, and retailers (Tegegne et al., 2013; Anteneh et al., 2010). Under the formal system, the quality of the milk is tested on delivery (Yilma et al., 2011). In some urban areas where milk collecting cooperatives or milk processing plants are absent, such as Bako and Nekemte towns of Oromia in western Ethiopia, the marketing system is informal (Geleti et al., 2014a). In pastoral and agro-pastoral areas of eastern Ethiopia, milk from both cows and camels is sold in raw form through the informal marketing system (Demissie et al., 2014). In this area, cow milk is processed to butter, and sale of soured milk and butter account for around 10% of the total milk market, while camel milk processing to other dairy products is less common. Besides raw milk, soured milk is also marketed in pastoralist areas like Borana in Oromia. Milk and other dairy products generally are marketed in towns and market places. Season and distance from the main towns affect the price, with the price being higher during dry season and closer to towns where demand is high. Milk is transported from the local market places to the nearby towns by donkeys and light truck (Tolera & Abebe, 2007).

Actors in the milk marketing system are producers, cooperatives, local assemblers, wholesalers, retailers, and consumers. The type of actors and market channels between producers and final consumers vary from place to place and also depend on the type of livestock production systems. In urban areas, producers may sell their products directly to consumers or cooperatives or caterers (e.g., cafés, restaurants). In rural areas, producers may sell their products to cooperatives or assemblers who then market to wholesalers, who sell to retailers that bring the dairy products to the end users (Anteneh et al., 2010; Geleti et al., 2014a; Tegegne et al., 2013). The type of actors are similar in eastern pastoral areas (Demissie et al., 2014), although the existence of cooperatives was not reported from either the southern or the eastern pastoral areas.

Market information

Sources of market information are government, dairy cooperatives and unions, and traders (Yilma et al., 2011). The market information from dairy cooperatives and unions, however, is only distributed to their members.

Role of government

In Ethiopia, dairy development is controlled and guided by the Ministry of Livestock and Fisheries (formerly part of the Ministry of Agriculture). The ministry provides extension services to smallholder dairy producers on available improved livestock technologies, builds the technical capacity of producers, promotes collective action (e.g., formation of cooperatives and unions), and facilitates linkages with other national, regional, and international organizations engaged in dairy research and innovation development (Yilma et al., 2011). The Ethiopian Meat and Dairy Industry Development Institute (EMDIDI) under the Ministry of Industry provides all-around support for investors engaged in the production, supply, processing, and marketing of dairy products, as well as monitoring quality of dairy products.

Major markets

In Ethiopia, almost all milk and milk products are domestically marketed and there is no substantial export market. Indeed, dairy products are imported from abroad, and in the years 2005 to 2009, import values increased from about US$5.6 to 10.3 million (Yilma et al., 2011). Imported dairy products were

powdered milk, ghee (clarified butter), and different varieties of cheeses. In addition to formal imports, there is minor, predominantly informal, cross-border trade at the Metema-Sudan route, Dire Dawa-Djibouti route, and Jigjiga-Togochalle-Somaliland route (AGP-LMD, 2013b).

Key bottlenecks

- ***Factors of culture and religion*** – In some communities, selling fluid milk is a taboo, while marketing of butter, local cheese, and whey is acceptable. In the Ethiopian highlands, there is a general perception of milk as a baby food (AGP-LMD, 2013b). The demand for dairy products decreases during fasting seasons, particularly in the Orthodox Christian dominated highlands (Anteneh et al., 2010; Tegegne et al., 2013). There are 250 fasting days per year, during which observant Christians abstain from consumption of any sort of animal-origin food (Ayenew et al., 2009; Yilma et al., 2011).
- ***Inaccessibility of markets and lack of transport*** – The demand for milk is high in urban areas; however, given the short shelf life of raw milk and the lack and/or unaffordable price of transportation, accessibility of the markets difficult for many rural milk producers. This problem is more pronounced in pastoral areas (Tolera & Abebe, 2007). In Mieso, a district dominated by the pastoral production system, women travel 1 to12 km (mean = 5.89 km) to reach market places or nearby towns (Hussen et al., 2008).
- ***Other factors*** – Shortage of adequate market information, lack of cold storage facilities, adulteration of dairy products, and frequent interruptions of electric power also affect the milk market (Geleti et al., 2014a). Although 81.5% of households in Gursum and Babille reported having market information prior selling their milk, the information system was unorganized and inaccurate because the sources of information are traders, personal observations, and friends (Demissie et al., 2014). Additionally, the price for milk is too high for many Ethiopians to frequently buy it (AGP-LMD, 2013b).

Meat and live animals

Marketing System

As in the case of milk, meat and live animals are channeled through both formal and informal marketing systems, where the latter system is dominant. There are three channels in the domestic market: consumers buy live animals from a market and slaughter themselves, or consumers purchase meat from a market, or butcher shops (Alemayehu, 2011). The actors in the live animal trade are producers, local traders, middle or larger scale traders, butchers, and consumers (Alemayehu, 2011). The main animal collection points for most export abattoirs and live animal exporters are purchasing agents assigned in major marketing areas, small and large scale traders, and livestock trading cooperatives (Asegede et al., 2015; Getachew et al., 2008).

Market information

The Ethiopian Livestock Market Information System (LMIS) provides regular livestock prices and volume information to producers, middle men, and traders in most of the major livestock markets in the country. Information from LMIS is available on request via text messaging, email, and on the Internet.

Role of government

The Ethiopian Meat and Dairy Industry Development Institute (EMDIDI) provides all-around support for investors engaged in the production, supply, processing, and marketing of meat, as well as monitoring quality of meat products.

Major markets

Beef, mutton, goat, and camel meat are sold in market places and butcher shops. The domestic demand for meat increases during traditional and religious festivities. On the other hand, demand sharply declines during the fasting seasons of Orthodox Christianity, particularly in the 55 days before Easter festivities. Meat and live animals are exported to the Middle East and some African countries. Exports have dramatically increased in the last decade, and currently there are about 11 meat export abattoirs in the country (Elias Walelign, personal communication). Chilled/frozen beef, goat meat, mutton, chilled veal, chilled camel meat, and red offal are mainly exported to the United Arab Emirates (UAE), Saudi Arabia, Angola, Egypt, Bahrain, Turkey, and Kuwait. One hundred percent of the exported meat is sold through formal channels, due to regulations of the importing countries. Live animals are exported to Somalia, Kenya, Sudan, Djibouti, Egypt, UAE, Saudi Arabia, and Yemen. Informal cross-border trade mostly consists of live animals (AGP-LMD, 2013a; AGP-LMD, 2013b; Alemayehu, 2011).

Key bottlenecks

The livestock marketing system is limited by myriad problems, and many of these constraints are common for both domestic and export markets, while some of them are specific to the latter.

- ***Long market chain*** – The live animal market chain is long. There are four major marketing levels: farm level, primary markets, secondary markets, and tertiary/terminal markets. At the farm level, trade is carried out between producers and local traders. The subsequent markets involve the smaller rural traders, larger traders, butchers, and consumers (Alemayehu, 2011). The presence of these complex marketing channels similarly affects meat and live animal exports. The participating actors are producers, middlemen, livestock trading cooperatives, traders, and meat or live animal exporters (Getachew et al., 2008).
- ***Lack of market-oriented production*** – The absence of a market-oriented production system results in an inconsistent and uneven supply of animals to markets. Large ruminants mostly are sold when they are old, culled, or unproductive, or when cash is required for unforeseen expenses. Producers of beef animals and small ruminants often target their production to cultural or religious festivities (Anteneh et al., 2010; ESGPIP, 2011).
- ***Lack of market information and poor market infrastructures*** – Producers lack market information. Producers also fail to respond to price changes (Anteneh et al., 2010; Alemayehu, 2011). A study in Tigray region pointed out that the information barrier creates a mismatch between the demand of the export abattoirs and the production of suppliers (Asegede et al., 2015). Furthermore, poor market infrastructure limits the efficiency of livestock marketing. In Ethiopia, about 120 market centers are recognized by the government, but these centers are not well organized to provide watering, feeding, resting, and quarantine facilities; the situation is worse in pastoral areas (Anteneh et al., 2010).
- ***Informal cross-border trade*** – There is informal marketing of beef animals, sheep, goats, and camels at border areas with Somalia, Kenya, Sudan, and Djibouti (Solomon, 2003). The informal marketing, in general, accounts for 80-90% of the county's export of live animals (AGP-LMD, 2013a), and the Ethiopian government losses about US$300 million per annum from such illegal marketing.
- ***Inadequate supply of the required quality live animals*** – Inadequate supply of good quality live animals happens because of illegal cross-border trade, poor livestock market linkages, and lack of infrastructure (Asegede et al., 2015; Ayalew, 2006; Filip, 2006). The informal cross-border trade results in an inadequate supply of the required quality animals for meat processing plants or abattoirs, which cause below potential performance (Alemayehu, 2011).
- ***Other factors*** – There is poor linkage between abattoirs and animal fattening enterprises (Asegede et al., 2015). About 95% animals destined for meat or live animal export originate from the lowlands; however, recurring drought and ethnic conflicts in these areas affect the livestock

marketing system (Getachew et al., 2008). Livestock trade is also limited by lack of transporting capabilities. Animals are trekked on foot to market centers and slaughterhouses, which leads to considerable loss of weight and exposure to physical injuries and illness (Anteneh et al., 2010). In addition, infectious diseases, poor veterinary support services, and inadequate application of hazard analysis and critical control points (HACCP) food safety protocols in export markets and abattoirs negatively affect the meat and livestock market, particularly the export market (ESGPIP, 2011).

4. Processing

Milk processing

In Ethiopia, 47.33% of milk production is processed to butter, local cheeses, and other products (AGP-LMD, 2013b). Milk is traditionally processed into fermented soured whole milk (ergo), butter (kibe), cottage cheese (ayib), buttermilk (arera), whey (aguat), and ghee (nitir kibe). Soured milk is churned to produce butter and buttermilk, and the latter is further processed to cottage cheese and whey. Traditional milk processing generally is time consuming and undermines the realization of full value-added milk production (Ayenew et al., 2009). In the last decade (since about 2005), the number of milk processing plants has been increasing; these facilities pasteurize milk and produce yoghurt, cheese, and other products for the domestic market (MOA, 2013).

Meat processing

Live animals are traditionally slaughtered around the homestead and the meat is consumed or meat is purchased from markets and/or butcher shops. Abattoirs are found in major cities where they render slaughter services for residents and butchers, yet many of them have a shortage of necessary facilities such as water systems, laboratories, transport services, and adequate staffing.

In the last decade (since about 2005), abattoirs and plants that engage in slaughtering and packing meat for export have been increasing in number. They are mainly found around big cities, such as Addis Ababa, Bishoftu, Modjo, Adama, Dire Dawa, Jigjiga, Bahir Dar, and Mekele. Meat processing in these plants is stymied by many of the problems listed in the previous section, among which the shortage of required quality live animals is prime (AGP-LMD, 2013a, Asegede et al., 2015; Anteneh et al., 2010).

5. Consumption

Dairy products

Domestic trends and preferences

According to the Annual Agricultural Sample Survey for 2014/2015 of livestock product utilization, 46.36% of the total annual milk production is consumed in the household; 47.33% is processed to butter (35.49% of which is sold) local cheeses (15.22% of which is sold), and other products; and only 5.98% is sold as fluid milk(CSA, 2015a). In Ethiopia, the total milk production is increasing; however, the per capita milk consumption has decreased from 26 kg per year in 1980 to 22 kg in 1993, 19 kg in 2000, and 16 kg in 2009. During this time, the growth rate in national milk production has been less than the growth rate in human population. The decreased consumption is attributed to the higher growth rate of the human population compared to the increase in milk production. The annual average per capita consumption of milk in Ethiopia is the lowest in the world (i.e., 17 kg); the averages for Africa and the world are 25 kg and 100 kg, respectively. Liquid milk is not part of the daily diet of most households, particularly in the highlands, because, among other reasons, it is perceived as food for babies (AGP-LMD, 2013b). Milk is used to make tea and coffee and to feed infants or the elderly or infirm, whereas other dairy products, such as butter, cottage cheese, and soured milk, are regularly consumed (Hussen et al., 2008; Yilma et al., 2011).

There is variation in preference for different dairy products between highlanders and lowlanders and between family members. In the mixed farming system, soured milk is mainly given to male members of the family, while in the pastoral regions, fresh milk is preferred. Buttermilk is considered a food for children and women in rural areas, but it is also provided to elderly (Yilma et al., 2011). In some places, goat milk is mainly given to children, believing that it makes them grow well and healthy (Hussen et al., 2008).

Meat and live animals

Domestic trends and preferences

According to the Agricultural Sample Survey carried out by the Central Statistical Agency (2015a) 52.93% of beef and 90.04% of mutton/goat meat are consumed in the household, and 33.18% and 3.42% are sold, respectively. With the fast growth of both the Ethiopian economy and the population, the domestic demand for meat is increasing; however, the average per capita consumption of meat is 9 kg per year, below the average for developing countries (i.e., 25 kg) (Alemayehu, 2011). This is due to low per capita income, prohibitive domestic meat prices, and the many fasting days of the Orthodox Christian calendar (Yilma et al., 2011; AGP-LMD, 2013a; AGP-LMD, 2013b; Ayenew et al., 2009).

Traditionally, meat is purchased from butcher shops for fresh cuts, while live animals are purchased and slaughtered for religious holidays. Meat from high-fat female and castrated male sheep and goats, highland cattle, and young Boran bulls is preferred by most Ethiopians (AGP-LMD, 2013a).

Export trends and preferences

The required age and live-weight categories for animals vary depending on the requirements of the countries to which the exports flow. Black head Somali and Afar sheep breeds and Borana/Somali and Afar goat breeds are preferred lambs/kids for Middle East markets. Meat and live animal exporters prefer local breeds from the lowlands as well-fed, young male lambs/kids aged one to two years with a live weight between 13-24 kg (Asegede et al., 2015; Getachew et al., 2008). For the export cattle markets, Boran bulls are highly preferred, followed by cattle from Bale areas, and cattle younger than five years are preferred (AGP-LMD, 2013a). In the past decade (since 2005), the export of meat and live animals has been increasing (AGP-LMD, 2013a, ESGPIP, 2011).

Additional Issues

- ***Gender*** – The Ethiopian government has a gender mainstreaming program where equality of men and women is promoted in all developmental activities in general, and women's participation in the agricultural sector is encouraged at all levels in particular. In livestock related activities, participation of at least 30% women is obligatory. The gender mainstreaming actions of the Ministry of Agriculture also include human resources (staff) gender balance at all levels (MOA, 2011).

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