



Food and Agriculture  
Organization of the  
United Nations

AFRICA  
SUSTAINABLE  
LIVESTOCK  
2050

*Livestock and livelihoods spotlight*

# KENYA

Cattle and  
poultry sectors



Republic of Kenya



**USAID**  
FROM THE AMERICAN PEOPLE

Financial support provided by the United States  
Agency for International Development (USAID)

**ASL  
2050**

# Livestock and Livelihoods Spotlight

## Cattle and Poultry in Kenya

### 1. Introduction

Livestock contributes to people's livelihoods through numerous channels such as income, food, employment, draft power, hauling services, manure, social status, savings, insurance and so on. Quantifying these outputs and services as well as their value is challenging, both because of insufficient data and lack of standard methodologies. However, appreciating the role livestock play in the household economy it is critical to understand how future growth and transformation of the livestock sector will impact societal welfare.

In this brief the contribution of cattle and poultry to household livelihoods has been summarised, based on available information, including government and research reports and papers. The fact that cattle and poultry contribute differently to household livelihoods in the different production systems has been differentiated. The production systems were selected and characterized by stakeholders, including the Ministry of Agriculture, Livestock and Fisheries, the Ministry of Environment and Natural Resources and the Ministry of Health, as part of the implementation of a One-Health approach assessing the current and long-term impact of livestock production systems on the economy and people's livelihoods, on public health and on the environment. The production systems include intensive, semi-intensive and extensive dairy production systems (table 1); pastoralism, agro-pastoralism, ranching and feedlots for beef production (table 5); and free-range, semi-intensive and intensive poultry meat production systems (table 7).

Data on the contribution of dairy production systems to households' livelihoods are discussed and presented first, while the following two sections focus on the beef and poultry production systems, respectively. Conclusions are drawn at the end of this brief.

### 2. Dairy production systems and livelihoods

Kenya has a vibrant dairy sector, estimated to be the second largest contributor to livestock value added. The country produced over 4.48 billion litres of milk in 2014, valued at KES 243 billion. Dairy cows contributed with 76 percent of the total milk production, with the remaining coming from camels and goats (FAOSTAT, 2017). Smallholders in all production systems contribute with about 90 percent to the national milk supply (Nassuima and Nyoike, 2014). Per capita milk consumption averages 117 litres per year, one of the highest in Africa (FAOSTAT, 2017; SDP, 2004; GoK, 2010). The sector is fast-growing: milk production, processing capacity and per capita consumption growth rates average 5.3, 7 and 5.8 per year, respectively (GoK, 2010; GoK, 2015).

**Table 1.** Kenya dairy production systems

<b>Animal population: 4.5 million dairy cows</b>	
<b>Intensive (zero grazing) dairy system</b>	In intensive dairy systems, farmers keep stall fed exotic cattle and sell most of the milk produced to the market. While the average herd size varies, in most cases farmers keep few dairy animals and also a few acres of land, which allow a close livestock-crop (mainly maize) integration. Intensive dairy farms are concentrated in the mid- and high-altitude agro-ecological zones, where cereal and cash crops are grown. The farms are particularly predominant in Mount Kenya and central Rift Valley regions, and present in many urban and peri-urban zones in humid and sub-humid areas of the country.

<b>Semi-intensive (semi-grazing)</b>	This is the most popular dairy system. Farmers let the animal graze during daytime and provide feeding at night, including supplements during milking. Farmers keep crosses of the dairy breed of cattle, and dairy animals are part of a larger herd, including other animals such as chicken, sheep, goats, donkeys and, occasionally, pigs. Semi-intensive dairy systems are concentrated in Mount Kenya, the central and north Rift Valley and in the coastal regions, but presently in all areas where crop farming is practiced, such as the western and Nyanza regions.
<b>Extensive (controlled and uncontrolled)</b>	This is a pasture/based production system and practiced in large farms (controlled grazing with large herds) and in marginal and communal grazing lands (uncontrolled grazing smaller herds). Animals are both exotic and improved. Under controlled grazing, animals are placed on natural and improved pastures using paddocks or strip grazing and supplemented with high quality fodder, mineral licks and commercial concentrates. Uncontrolled grazing is characterized by free grazing in natural pastures. This system is found in North and South Rift Valley, Eastern and Coast Regions.

Source: ASL2050, FAO, 2017

## 2.1. Population depending on dairy cattle

The Kenya dairy sector plays a critical role in the livelihood of many Kenyans. About 1.3 million households are estimated to keep dairy cattle, a figure arrived at by combining expert opinions with livestock population data (FAO, 2017; GoK, 2016). Small-scale farmers represent 95 percent of all households keeping dairy animals but keep about 6 percent of the dairy population with an average herd size of 3 cows (Table 2). The 2 percent of farmers that raise animals in intensive or extensive (controlled) systems keep about 40 percent of the national dairy herd, with an average of 20 cattle per herd (GoK, 2015; Bebe *et al.*, 2016).

**Table 2.** Households keeping dairy cattle

Production system	Number of dairy cattle per production system <sup>1</sup>	Herd sizes <sup>2</sup>	Number of dairy cattle keeping households <sup>3</sup>	Share %
Intensive (zero grazing) small scale	1 555 354	3	518 451	40
Intensive (zero grazing) large scale	303 116	20	15 156	1
Semi Intensive (semi-grazing)	2 141 791	3	713 930	55
Extensive (controlled)	266 650	20	13 332	1
Extensive (uncontrolled)	238 823	5	47 765	4
<b>Total</b>	<b>4 505 733</b>		<b>1 308 634</b>	

Note: (1, 2) Source: ASL2050 FAO (2017) and GoK (2016); (3) No. dairy cattle / herd size

## 2.2. Household income

Dairy cattle contribute to household cash income through milk consumption and sale of liquid milk or processed products, such as cheese. They are also a source of meat (culled cows and fattened bull calves), though animals are largely kept for producing milk.

Table 3 and figure 1 show the different income sources for households keeping dairy cows in the different dairy production systems. These include livestock and crop income, off-farm self-employment, wage employment (salaries) and transfers (including public and private, international and domestic). Livestock income includes revenues from raising all types of animals; self-employment refers to off and non-farm businesses, such as petty craft and trade. Livestock income is estimated as cash income (revenues from sale of live animals and livestock products), plus the value of self-consumed livestock products, minus operating costs such as feed, water and

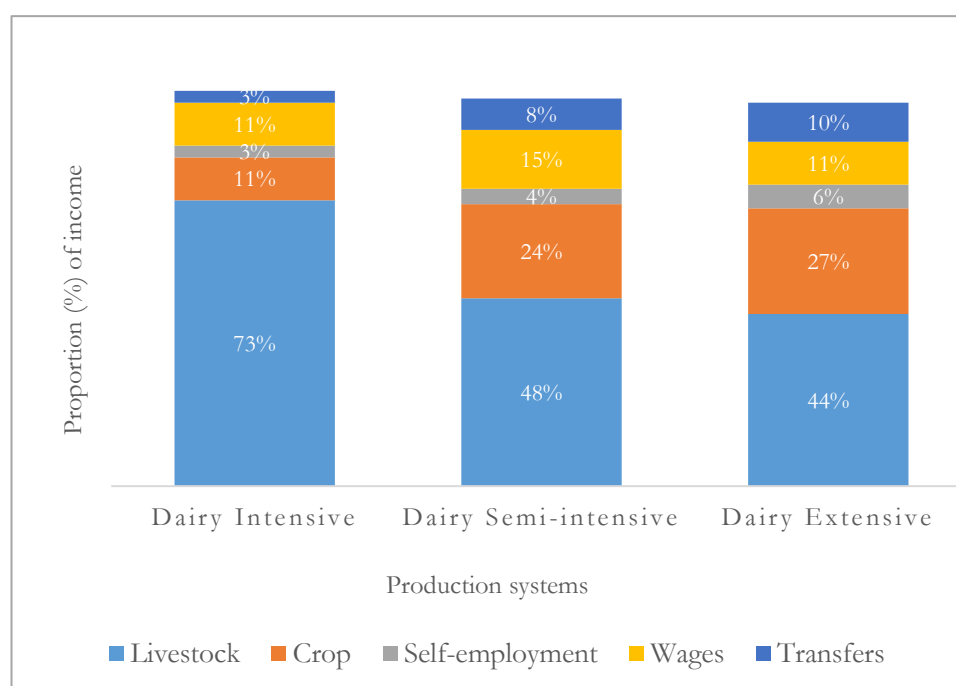
veterinary expenses. The value of non-tradable, such as the provision of hauling services and insurance, is not estimated due to lack of data.

In all three dairy production systems, livestock is the biggest income contributor to household income, supporting household livelihoods more than crop agriculture, self-employment wages and transfers. In intensive dairy systems, livestock contribute 73 percent to total household income, and 48 and 44 percent in semi-intensive and extensive systems. This is suggestive that, for many households, dairy animals represent a major source of livelihoods.

**Table 3.** Income sources (%) for cow-keeping households by dairy production system

	Livestock	Crop	Self-employment	Wages	Transfers
Dairy Intensive	73%	11%	3%	11%	3%
Dairy Semi-intensive	48%	24%	4%	15%	8%
Dairy Extensive	44%	27%	6%	11%	10%

Sources: Income from other activities calculated from Rural Livelihoods Information System (RuLIS) (FAO, forthcoming). Livestock income calculated using the Kenya Integrated Household Budget Survey 2005-06 (GoK, 2014).



**Figure 1.** Income sources (%) for cattle-keeping households by dairy production system

### 2.3. Employment

Dairy farming is labour intensive. In Kenya, according to a Food and Agriculture Organization of the United Nations (FAO) Report (FAO, 2011) for every 1 000 litres of milk produced daily about 90 jobs are created: 50 persons are employed on farms full time; 13 are permanently employed by milk processors; 23 are self-employed along the value chain; and 3 are casual labourers. This means, considering the national milk output of 4.9 billion litres in 2014 (FAOSTAT, 2017), that about 1.07 million people are employed in the dairy sector (table 4).

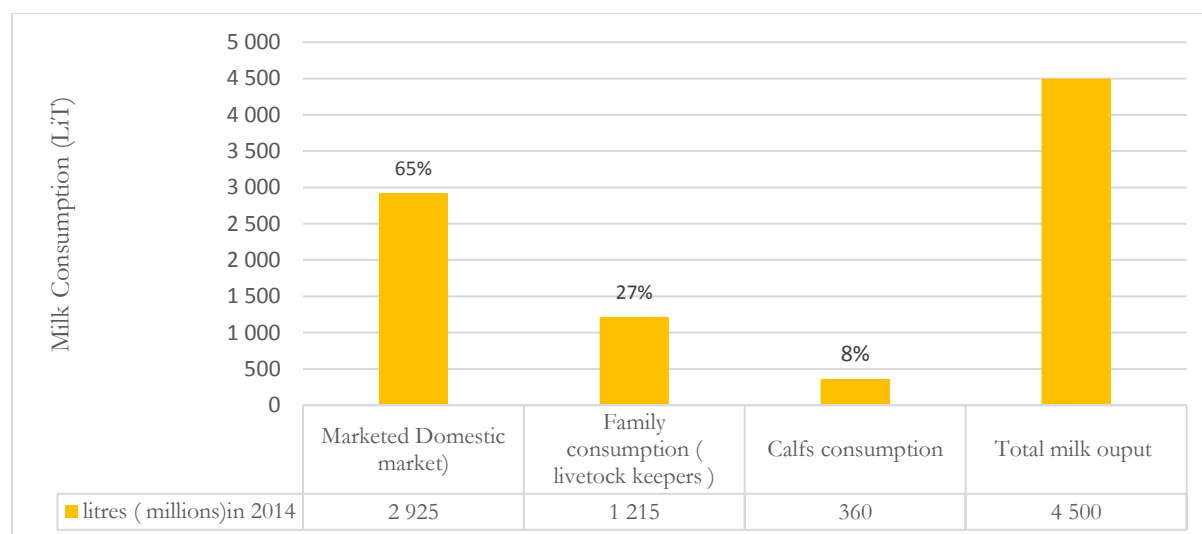
**Table 4.** Employment in the dairy sector

	Milk output (litres)	Category of employment			
		Self- employed	Full time on farm jobs	Casual laborers	Full time jobs in processing
Milk production (2014)	4 900 000 000				
Milk processed	1 470 000 000				
Jobs created per 1 000 litres/day		23	50	3	13
Jobs		308 767	671 233	40 274	52 356
<b>Total no. of jobs</b>					<b>1 072 630</b>

Source: Authors' calculation based on FAO (2011)

## 2.4. Nutrition

Milk and dairy products are nutrient-dense foods supplying energy and significant amounts of protein and micronutrients including calcium, magnesium, selenium, riboflavin, vitamins B5 and B12, which are essential to reduce hunger and malnutrition particularly amongst the most vulnerable (e.g. pregnant women and children). In Kenya, out of the 4.5 billion litres of milk produced in 2010, 65 percent was marketed, 27 percent self-consumed with the remaining 8 percent given to calves (Figure 2). This indicates that a large share of the Kenyan population consumes milk, and that milk represents a major source of nutrients for households keeping dairy cows, even when they have limited access to market and/or purchasing power.

**Figure 2.** Proportion of milk marketed, consumed at home and fed to calves.

Source: GoK (2010)

## 3. Beef production systems and livelihoods

The beef industry is the largest contributor to livestock value added (Kosgey *et al.*, 2011; Otieno *et al.*, 2012) as well as a major contributor to income and employment (Alarcon *et al.*, 2017). Its contribution to societal welfare is particularly relevant in arid and semi-arid lands (ASALs), where beef production is the main economic activity (Kahi *et al.*, 2006; Kinyamario and Ekeya, 2001). The four major beef production systems in Kenya are pastoralism, ranching, agro-pastoralism systems, and feedlots (FAO, 2017).

**Table 5.** Kenya beef production systems

<b>Animal population: 14 million beef cattle</b>	
<b>Pastoralism (extensive system)</b>	Pastoralism is a low-input low-output subsistence system, with indigenous cattle relying entirely on communal grazing areas and water sources. Pastoralism, including transhumance and nomadic pastoralism, is practiced in arid and semi-arid areas. Livestock density in pastoral areas is low, at about 11 Tropical Livestock Unit.
<b>Ranching (extensive)</b>	Ranches are made up of large land areas and have large herds, including local, crossed and exotic breeds. Most ranches have infrastructure for disease control, feeding and water storage. It is a highly commercial system targeting prime local niche markets and export markets and, as such, contributes to the Kenya export revenue.
<b>Agro pastoralism (semi-intensive)</b>	Agro-pastoralists keep a mixed herd, including beef cattle, and feed animals with crop residues and other products. They make use of animal manure and draft power to increase crop productivity. Agro-pastoralism is a low input low output system, subsistence oriented, and mainly practiced in semi-arid areas. Animal densities range from 20 tropical livestock unit per km <sup>2</sup> in the lowlands to 50 in the highlands.
<b>Feed lot (intensive)</b>	This is a commercially-oriented system in which animals are kept for a short period (about 3 months) during which they are fattened and sold to niche/prime beef markets. It is both a capital and labour-intensive system, with significant investments in feeding and animal health. There are two different feed lot systems – one focusing on fattening dairy culls and dairy bull calves, the other fattening beef breeds.

Source: ASL2050, FAO (2017)

### 3.1. Population depending on beef cattle

There are no accurate statistics on the Kenyan population who depend partly or fully on beef cattle for their livelihoods. However, beef is largely produced in arid and semi-arid areas, where about 13 million people or about 36 percent of the Kenyan population live (GoK, 2009). About 64 percent of these are pastoralists and 16 percent agro-pastoralists (Oxfam, 2008).

Overall, one can conclude that about 8 million people in Kenya directly depend on beef cattle for their livelihoods.

### 3.2. Household income

There are no statistics available to estimate the benefits households keeping beef cattle derive from their animals. However, using livestock population data from GoK (2016) and African Sustainable Livestock 2050 (ASL2050) FAO (2017) one can estimate the value of beef production for the different production systems, which can then be used as proxy to assess the contribution of beef to household livelihoods. The total value of beef production in Kenya, estimated by using standard parameters for offtake, dressing weight, and offal proportion, can be estimated to over 106 billion KES (table 6).

**Table 6.** Estimated beef output by production system

<b>Production system</b>	<b>Cattle population</b>	<b>Off take %</b>	<b>Live weight (kg)</b>	<b>Price per Kg</b>	<b>Revenue from animal sale</b>	<b>Revenue per head</b>
Pastoral	8 085 053	15	200	180	43 659 284 047	36 000
Agro-pastoral	5 420 342	15	250	180	36 587 311 653	45 000
Dairy systems (culls, fattened bulls)	4 505 733	7.9	300	150	16 017 879 344	45 000
Ranching	762 544	15	400	200	9 150 523 804	80 000
Feedlots	42 990	25	300	200	644 847 000	60 000
<b>Total</b>	<b>18 816 661</b>				<b>106 059 845 848</b>	<b>42 307</b>

*Sources: Gross output calculated using estimated proportions of herd number in the different production systems (FAO, 2017) based on KNBS livestock figures (GoK, 2016) and offtake percentages (USAID, 2012) and prices provided by experts from State Department of Livestock.*

Pastoralism is the largest contributor to beef output, accounting for about 46.3 percent of all production value. Agro-pastoralism follows, with 31 percent of all production value. Culls and fattened bulls from dairy systems, ranching systems and feedlot contribute to about 14, 8 and 1 percent of all the beef production value.

As 36 percent of the Kenyan population live in pastoral and agro-pastoral areas that jointly account for 76 percent of all beef production value, it implies that beef systems play a major role in supporting the livelihoods of people living in arid and semi-arid areas. However, the revenue per head of cattle is lower in pastoral and agro-pastoral systems than in ranching and feedlots systems, suggesting that households, on average, derive only marginal benefits from their cattle (Kahi *et al*, 2006).

#### 4. Poultry production systems and livelihoods

Poultry contributes 8 percent to agricultural value added, with the country producing over 25 000 tons of poultry meat and 1.3 billion eggs per year, jointly valued at KES 28.5 billion (FAOSTAT, 2017). Per capita consumption is approximately 0.56 kg of poultry meat and 45 eggs per year (FAOSTAT, 2017). The sector is highly heterogeneous, comprising of a large number of small scale free-range and backyard indigenous chicken producers; a good number of small scale commercial layers and broiler farms; and few industrial integrated layer and broiler farms. Chickens constitute about 98 percent of the total poultry raised in Kenya and 65 percent of Kenyan households are estimated to keep at least one bird. The three major poultry production systems in Kenya are free range, semi-intensive and intensive systems. Table 7 presents a succinct description of major chicken production systems, excluding layer farms.

**Table 7.** Kenya chicken production systems

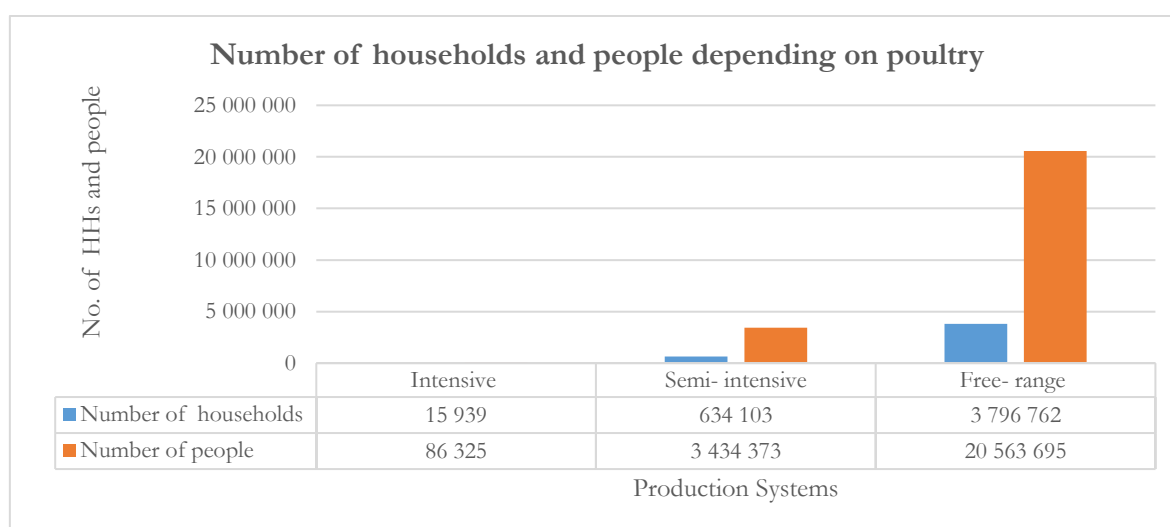
<b>Bird population: 39 million meat or dual purpose chickens</b>	
<b>Intensive production system (broiler farming)</b>	Broiler farming in Kenya is practised in urban and peri-urban areas, such as around Nairobi, Mombasa, Nakuru and Kisumu. This system requires little space and exotic birds – mainly sourced locally or imported from Uganda – kept in large hangars and fed compounded feed. This system is market-oriented. It is estimated that over 3 million broiler chickens are raised in Kenya, in small, medium and large farms. Flock sizes per cycle vary from 50–500 (small scale) through 500-10 000 (medium) to over 10 000 (large and integrated farms). The system is market-oriented.
<b>Semi-intensive production system</b>	Farmers keep flocks of 30 to 100 birds confined in simple structures. The birds are both indigenous and exotic, and provided with feed supplements. Farmers sell most of the birds, though some are self-consumed. Semi-intensive production system is a practiced throughout the country, the exact number of semi-intensive farms is not known, though experts estimate they likely keep up to a third of all chickens in the country.
<b>Extensive system (free-range)</b>	This is a low input low output system where birds are left to freely roam for feed. Farmers keep flock ranging from 5 to 30 local birds, often managed by women and children. It is a subsistence-oriented system, with little and opportunistic informal marketing. Although popular throughout the country free ranging is predominant in western Kenya regions, some parts of lower eastern, north Rift areas and coastal areas.

*Source: ASL2050, FAO (2017)*

#### 4.1. Population depending on poultry

Most households across the 47 counties in Kenya keep poultry, including the poor and the landless. For instance, FAO (2007) reports that about 75 percent of rural households keep poultry in rural areas, as well as a good share of households in Nairobi, Muranga, Nyeri, Nakuru, Thika, Mombasa, Kisumu and Eldoret. In Nyanza and Western Kenya, over 96 percent of the rural households are estimated to keep indigenous chicken in extensive or semi semi-intensive systems (Okitoi *et al.*, 2000b; Njenga, 2005). Combining bird population data with expert consultation suggests that there are about 20.6 million people living in households that keep at least one scavenging bird; 3.4 million people living in households who practices semi-intensive poultry farming; and less than 100 000 people in households with broiler farms.

**Figure 3.** Number of households and number of people depending on poultry



Source: ASL 2050, FAO (2017) and expert knowledge on flock sizes and human household (HH) sizes. Chicken calculated by number of chicken per production system divided by flock size as reported by experts from the state department of Livestock. The total number of chicken keepers is derived at multiplying the no. of chicken keeping farms/HHs per production system by the average house size of 5 persons.

#### 4.2. Household income

Poultry significantly contribute to household income. They provide a regular source of protein (eggs), and hence support food security and nutrition; birds can be sold to the market and represent a source of insurance, an asset that can be cashed in time of need.

Table 8 and figure 4 show the different income sources for households keeping birds in the different poultry production systems. The systems include livestock and crop income, off-farm self-employment, wage employment (salaries) and transfers (including public and private, international and domestic). Livestock income includes revenues from raising all types of animals; self-employment refers to off and non-farm businesses, such as petty craft and trade. Livestock income is estimated as cash income (revenues from sale of live animals and livestock products), plus the value of self-consumed livestock products, minus operating costs such as feed, water and veterinary expenses. The value of non-tradable, such as the role of birds as insurance and for food security, is not estimated because of lack of data.

Farmers in intensive poultry systems derive about 63 percent of their income from livestock, with this proportion being 44 and 36 percent for farmers keeping birds in semi-intensive and extensive



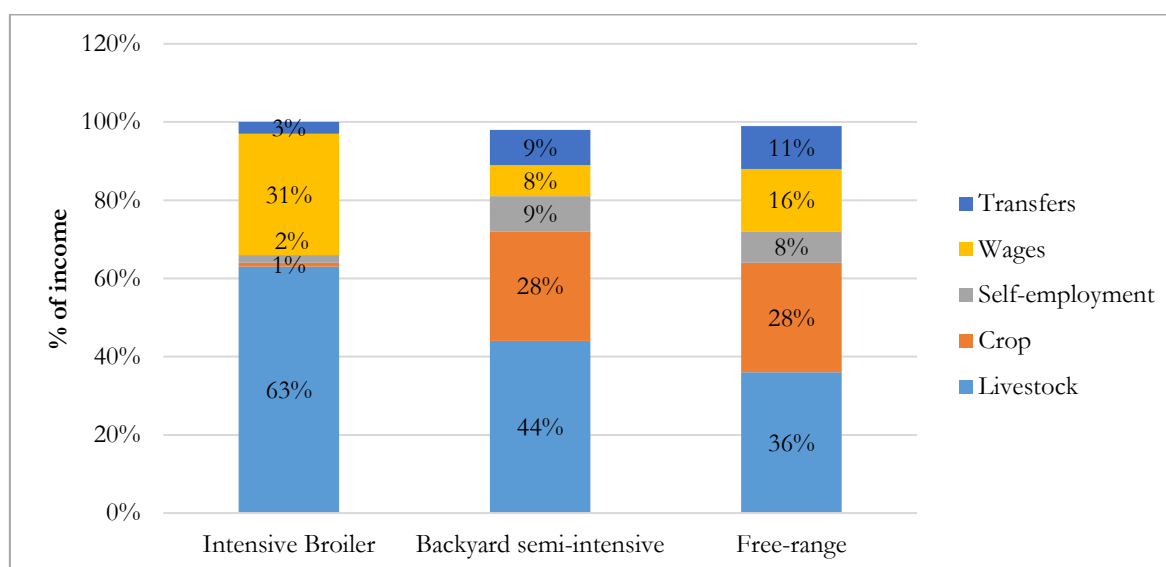
systems. These statistics, though including all types of animals, clearly suggest that the more farmers intensify the more poultry become an important source of livelihoods.

**Table 8.** Income sources (%) for poultry-keeping households by poultry production system

	Livestock	Crop	Self-employment	Wages	Transfers
Intensive (Broiler)	63%	1%	2%	31%	3%
Semi-intensive	44%	28%	9%	8%	9%
Extensive	36%	28%	8%	16%	11%

Source: Livestock income calculated using the Kenya Integrated Household Budget Survey 2005-06 (GoK, 2014). Income from other activities calculated by Rural Livelihoods Information System (RuLIS) (FAO, forthcoming).

**Figure 4.** Income sources (%) for poultry-keeping households by poultry production system



Source: GoK (2014), FAO (forthcoming)

### 4.3. Other benefits from poultry

Poultry contribute to nutrition by directly providing animal protein, both eggs and meat from the slaughtered birds. Amongst the animal source foods, which are a major source of proteins and micronutrients, poultry meat and eggs provide more proteins than swine, cow milk, beef and lamb per unit of intake. Thus, greater availability and affordability of poultry meat and eggs contribute to enhanced household nutrition and improved food security.

Birds can easily be sold and represent an immediate source of cash, thereby assisting households to cope with minor shocks or unexpected expenses, such as paying for doctor's fees or medicines (Magothe *et al.*, 2015). Poultry manure can be used as a supplement in dairy cattle feeding, although farmers are not always aware of the hazards associated with this practice (Lanyasunya *et al.*, 2006). Finally, poultry have important social and cultural roles in the lives of rural people, not least in building social capital and facilitating relations with other rural dwellers, such as during social, cultural and spiritual activities (Njenga, 2005).

## 5. Conclusion

Livestock are a popular asset in Kenya and a major contributor to household livelihoods, both in terms of income as well as food. However, there is heterogeneity between households in the different production systems. It was described in this brief how cattle and poultry contribute and contribute differently to the livelihoods of households in dairy, beef and poultry production systems. In all cattle and poultry production systems, livestock – including all animals – contribute with between 36 and 73 percent to total household income. As expected there are large differences between and within systems, with large ruminants contributing more to total household income than poultry on average. Households in all systems also benefit from consuming animal source foods, including milk, beef and poultry meat.

When creating policies to support livestock sector growth it is necessary to take into consideration that any transformation of the livestock sector will have direct implications on the livelihoods of a large part of the Kenyan population. Decision-makers should not only use production and productivity as the metrics to assess the impact of their livestock sector policies, but also examine their impact on household income, consumption of animal source foods, and poverty and food security overall.

*January 2018.* This brief was written by Stephen Gikonyo (FAO) and Ana Felis (FAO) under the guidance of the Members of the Africa Sustainable Livestock 2050 (ASL2050) Kenya Steering Committee. ASL2050 is a USAID-funded policy initiative implemented under the umbrella of the FAO Emerging Pandemic Threat Program.

## 6. References

- Alarcon, P., Fèvre, E. M., Murungi, M. K., Muinde, P., Akoko, J., Dominguez-Salas, P., ... & Rushton, J.** 2017. *Mapping of beef, sheep and goat food systems in Nairobi—A framework for policy making and the identification of structural vulnerabilities and deficiencies.* *Agricultural Systems*, 152, 1-17
- Bebe, B.O., Rademaker, C., Van De Lee, V., Kilelu, C. & Tonui, C.** 2016. *Sustainable growth of the Kenyan dairy sector - A quick scan of robustness, reliability and resilience.* <http://edepot.wur.nl/413390>
- FAO.** 2007. *Poultry sector review in Kenya.* Rome: Food and Agriculture Organization of the United Nations.
- FAO.** 2011. *Dairy development in Kenya.* Rome: Food and Agriculture Organization of the United Nations.
- FAO.** 2017. *ASL2050 Livestock production systems spotlight: Kenya. Cattle and poultry sectors.* African Sustainable Livestock 2050. FAO, Nairobi, Kenya.
- FAO.** Forthcoming. *RuLIS - Rural Livelihoods Information System, Forthcoming.* Rome.
- FAOSTAT.** 2017. *Livestock Primary* (data for 2014) <http://www.fao.org/faostat/en/#data/QL>
- GoK.** 2009. *Population and housing census 2009.* Kenya National Bureau of Statistics (KNBS), Ministry of Planning and National Development, Nairobi. Government of Kenya.
- GoK.** 2010. *Kenya National Dairy Master Plan. A situational analysis of the dairy sub-sector. Volume I.* Nairobi: Ministry of Agriculture, Livestock and Fisheries (MoALF), Government of Kenya.

- GoK.** 2014. *Kenya integrated household and budget survey 2005/06*. Kenya National Bureau of statistics (KNBS). Ministry of Devolution and Planning, Nairobi. Government of Kenya.
- GoK.** 2015. *Kenya Dairy Board Annual Report and Financial Statements for the year ended 30 June 2014*. Kenya Dairy Board (KDB). <http://kdb.co.ke/press/publications/reports/21-kdb-2014-annual-report/file>.
- GoK,** 2016. *County summaries for livestock products for year 2016*. Kenya National Bureau of statistics (KNBS). Ministry of Devolution and Planning, Nairobi. Government of Kenya
- Kahi, A. K., Wasike, C. B. & Rewe, T. O.** 2006. *Beef production in the arid and semi-arid lands of Kenya: constraints and prospects for research and development*. Outlook on Agriculture, 35(3), 217-225.
- Kinyamario, J. I. & Ekeya, W. N.** 2001. *Mechanisms of drought management by African pastoralists*. In Proceedings of animal production society of Kenya symposium (pp. 117-122).
- Kosgey, I. S., Mbuku, S. M., Okeyo, A. M., Amimo, J., Philipsson, J. & Ojango, J. M.** 2011. *Institutional and organizational frameworks for dairy and beef cattle recording in Kenya: a review and opportunities for improvement*. Animal Genetic Resources/Resources génétiques animales/Recursos genéticos animales, 48, 1-11.
- Lanyasunya, T.P., Rong, W. H., Abdulrazak, S.A., Kaburu, P.K., Makori, J.O., Onyango, T.A. & Mwangi D.M.** 2006. *Factors Limiting Use of Poultry Manure as Protein Supplement for Dairy Cattle on Smallholder Farms in Kenya*. International Journal of Poultry Science 5 (1): 75-80, 2006. ISSN 1682-8356 © Asian Network for Scientific Information, 2006
- Magothe, T.M., Okeno, T.O., Muhuyi, W.B. & Kahi, A.K.** 2015. *Indigenous chicken production in Kenya: Current status*. World's Poultry Science Journal · March 2012. DOI: 10.1017/S0043933912000128
- Nassuima, D. & Nyoike N.** 2014. *Milk production and marketing in Kenya: a Preliminary survey report* 2013.
- Njenga, S.K.** 2005. *Production and socio-cultural aspects of local poultry phenotypes in coastal Kenya*. MSc Thesis, Danish Institute of Agricultural Sciences, Tjele, Denmark.
- Okitoi, L.O., Ondwasy, H.O., Obali, M., Linyonyi, A., Mulamula, H., Otieno, K., Murekefu, F., Soita, J., Ndege, J., Kahai, R., Rotich, D. & Wekesa, A.** 2000. *An appraisal of local poultry production in western Kenya*, in: De Jong, R. & Mukisira, E.A. (Eds) *Testing of Livestock technologies on smallholder mixed farms in Kenya*, pp. 157-178 (Nairobi, Kenya Agricultural Research Institute).
- Otieno, D. J., Hubbard, L. & Ruto, E.** 2012. *Determinants of technical efficiency in beef cattle production in Kenya*. In Selected Paper prepared for presentation at the International Association of Agricultural Economists (IAAE) Triennial Conference (pp. 18-24).
- Oxfarm international.** 2008. *Climate Wrongs and Human Rights Putting people at the heart of climate-change policy*. Oxfarm briefing paper. <https://www.oxfam.org/sites/www.oxfam.org/files/bp117-climate-wrongs-and-human-rights-0809.pdf>.
- SDP.** 2004. *The Demand for Dairy Products in Kenya. Small-holder Dairy Project*. Retrieved <http://cgspace.cgiar.org/handle/10568/1915>.
- USAID.** 2012. *End market analysis of Kenyan livestock and meat: A desk study*. [https://microlinks.org/sites/microlinks/files/resource/files/Kenya\\_Livestock\\_End\\_Market\\_Study.pdf](https://microlinks.org/sites/microlinks/files/resource/files/Kenya_Livestock_End_Market_Study.pdf)

