Global poultry production: current state and future outlook and challenges

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Abstract

The paper presents the current situation of the global poultry sector and the future trends, and discusses the challenges the sector is facing, with particular emphasis on food security, poverty alleviation and equity, animal and human health, and natural resources and climate change.

Poultry is the fastest growing agricultural sub-sectors, especially in developing countries. Poultry makes a substantial contribution to food security and nutrition, providing energy, protein, and essential micro-nutrients to humans, with short production cycles and the ability to convert a wide range of agri-food by-products and wastes into meat and eggs edible by humans. Poultry also contribute to poverty alleviation. Poultry birds are a major asset-representing capital and in many cases, a source of income. They can be sold in times of crisis and act as household insurance.

The global poultry sector is expected to continue to grow, as demand for poultry meat and eggs is driven by growing population, rising incomes and urbanization. In this context, the sector is facing unprecedented challenges.

Particularly for small holders and poor people, both in rural and urban areas, poultry is key to poverty alleviation, providing income and market participation. While its role in nutrition is recognized, it also represents a threat to human health, especially as a vector of infectious diseases and because of its role in antimicrobial resistance.

Poultry has a significant impact on the environment and uses large amounts of natural resources. While the sector is usually seen as quite efficient in converting natural resources into edible products, it uses large amounts of land, water and nutrients for the production of feed materials. It also contributes to climate change, mainly through feed production.

Keywords: poultry; production systems; trends; projections; natural resource use; efficiency

Introduction

The world has over 23 billion poultry birds-about three per person on the planet (FAOSTAT, 2016), and about 5 times more than 50 years ago. They are kept and raised in a wide range of production systems, and provide mainly meat, eggs and manure for crop fertilization.

Poultry meat and eggs are among the most common animal source food consumed at global level, through a wide diversity of cultures, traditions and religions, making them key to food security and nutrition. Within the livestock sector, poultry emerges as the most efficient sub-sector in its use of natural resources and in providing protein to supply a global growing demand.

Poultry is at the same time particularly important for small holders and poor rural and urban population and a commodity produced in large scale and intensive operations, making it one of the fastest growing agricultural sub-sectors. While most of the sector’s growth has been driven by private investments, public concerns about the sector’s impact on the environment and human health, its contribution to climate change and local and global economy is triggering governments’ response and the development of public policies.

Current state of global poultry production and production systems

Poultry production is very diverse. Factors to consider to characterize this diversity include the feed base, breeds, the orientation and the type of housing. At global level, 3 main types of poultry production systems can be considered: broilers, layers and backyard (Table 1).
Table 1. Poultry production systems (Gerber et al., 2013)

<table>
<thead>
<tr>
<th>System</th>
<th>Housing</th>
<th>Characteristics</th>
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<tbody>
<tr>
<td>Broilers</td>
<td>Broilers assumed to be primarily loosely housed on litter, with automatic feed and water provision</td>
<td>Fully market-oriented; high capital input requirements (including Infrastructure, buildings, equipment); high level of overall flock productivity; purchased non-local feed or on farm intensively produced feed</td>
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<tr>
<td>Layers</td>
<td>Layers housed in a variety of cage, barn and free range systems, with automatic feed and water provision</td>
<td>Fully market-oriented; high capital input requirements (including infrastructure, buildings and equipment); high level of overall flock productivity; purchased non-local feed or on farm intensively produced feed</td>
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<tr>
<td>Backyard</td>
<td>Simple housing using local wood, bamboo, clay, leaf material and handmade construction resources for supports (columns, rafters, roof frame) plus scrap wire netting walls and scrap iron for roof. When cages are used, these are made of local material or scrap wire</td>
<td>Animals producing meat and eggs for the owner and local market, living freely. Diet consists of swill and scavenging (20 to 40 percent) and locally-produced feeds (60 to 80 percent)</td>
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Global production of eggs reaches 73 million tons and global production of poultry meat is close to 100 million tons (GLEAM 2, 2016). Backyard systems contribute to 8% of global eggs production and 2% of global poultry meat production. The majority (92%) of poultry meat production comes from specialized broiler systems and layers only contribute to 6% of the total. But these global figures hide significant regional differences. Backyard systems make significant contribution to eggs and poultry meat production in Eastern Europe, South Asia, Sub-Saharan Africa and to a lesser extent in East Asia and Latin America and the Caribbean (Figure 1).

Poultry is one of the fastest growing agricultural sub-sector. Demand for animal source food is increasing because of population growth, rising income and urbanization, and poultry meat has shown the fastest trend in the last decades. The average annual growth rate over the last 5 decades was 5% while it was only 1.5% for beef, 3.1% for pork and 1.7% for small ruminants’ meat (Alexandratos & Bruisma, 2012). Global per capita consumption of eggs increased from 4.55 kg to 8.92 kg between 1961 and 2010, while global per capita consumption of poultry meat increased from 2.88 kg to 14.13 kg (FAOSTAT, 2016). Production has been particularly dynamic in developing countries, especially in East and South East Asia (Figure 2), with an annual growth rate in poultry meat production of 7.4%. The biggest poultry meat producers are the United States, with almost 20 million tons a year, followed by China, with 18 million tons, the EU and Brazil with about 13 million tons.

Figure 1. Eggs and poultry meat production by production systems and regions (GLEAM 2, 2016)

Technological changes in production practices were one of the main drivers of the sector’s growth. The move from free-ranging to confined poultry operations dramatically increased the number of birds per farmer, facilitated the substitution of capital for labor, and led to a significant increase in labor pro-
ductivity (Narrod et al., 2012). For example, the same authors have shown that between 1985 and 1996, the share of poultry farms with more than 10,000 heads grew from 42% to 78% in the region Center West of Brazil. Advances in breeding to improve animal size, fecundity, growth rate and uniformity, have also contributed to increase outputs.

![Figure 2. Global eggs production by region](image)

**Future trends**

The growth of the global livestock sector is expected to continue. Global human population is estimated to reach 9.6 billion in 2050, with about 70% living in urban areas, while incomes could increase by 2% a year. In this context, Alexandratos and Bruisma (2012) projected that the demand for animal source food could grow by 70% between 2005 and 2050. While beef and pork demand could increase by 66% and 43% respectively, poultry meat is expected to have the highest growth, with 121%. Demand for eggs will increase by 65%. Global demand for eggs is also expected to keep on growing.

Still the fastest growing subsector, poultry meat production would however increase at a slower rate than in the past decades. By 2050, its annual growth rate is estimated to reach 1.8% at global level, and 2.4% in developing countries. This growth will be the result of strong regional differences.

Most of the growth will be driven by Asia. Average per capita consumption of poultry meat is still relatively low in Asia, with less than 10 kg per year, twice as less as in Western Europe and 5 times less than in Northern America, for example. OECD/FAO (2016) estimate that, in East and South Asia, meat production will expand by 1.8 Mt annually by 2025, with pork and poultry accounting for the bulk of this expansion.

In Sub-Saharan Africa, poultry consumption has expanded faster than any other meat and with domestic supply unable to match demand, almost 40% of the additional consumption was imported. For the period 2015-2025, OECD/FAO (2016) estimate that imports will supply 66% of the growth in poultry meat demand in the region, while this share will only be 16% for beef and veal, 2% for sheep and 45% for pork.

The same authors forecast a decrease in global meat prices in real terms due to a decrease in feed prices. Due to its short production cycles and high feed use efficiency, poultry is expected to experience an annual decrease in prices of nearly 1% between 2016 and 2025.

Globally 10% of meat output will be traded in 2025, up from 9% in 2015, with most of the increase coming from poultry meat.

**Challenges**

*Food security*

Using the same approach as Gerber et al. (2015), we can consider five main drivers of poultry’s contribution to food security.

First, the feed ration of the animals, and whether the materials included in the ration are used or pro-
duced in concurrence with human edible food. This is for example the case of grains and fodder crop cultivated on arable land. On the contrary, crop residues, food by-products and swill produced on non-arable lands are not directly comestible by humans, although they could contribute to food production through fertilization and energy production. Figure 3 shows the estimated composition of the global feed ration of poultry. 58% of the global dry matter (DM) intake is from cereal grains, which represent a total of 348 million tones, or 14% of global cereal production. When adding cassava, soybeans and, pulses, rapeseed and soy oil, human edible feed material represent 64% of total feed intake.

Second, the efficiency with which the animal convert feed into edible products (kg of feed per kg of meat or eggs). This efficiency is driven by (i) the quality of the feed, (ii) the animal performances (e.g. growth rates, influenced by genetics and health conditions). Though more significant for ruminants, two more factors influence feed use efficiency: (iii) the proportion of meat supply from layers, since maintenance energy is diluted over the two products meat and eggs and (iv) the proportion of breeding stock in the herd (these animals need to be fed but do not contribute directly to the edible product output). Efficiency in poultry production systems is generally higher than in ruminant production. Layers and broilers require between 18.5 and 28.0 kg of DM feed to produce 1kg of protein, while backyard systems, which are less productive and use lower quality feed, require 81.4 kg in non OECD countries and 64.2 in OECD countries (Table 2). At global level, ruminants need an average of 134.8 kg per kg of protein. However, when only edible material are considered, layers and broilers systems appear less efficient than backyard systems or ruminants.

![Figure 3. Global poultry feed ration (source: GLEAM 2, 2016)](image)

| Table 2. Feed conversion ratios by regions and production system (Mottet et al., 2016) |
|-----------------|-----------------|-----------------|-------------------|
|                 | Kg DM feed      | Kg DM human-edible* feed |
|                 | / kg protein product | / kg protein product |
| Backyard        | 81.4            | 2.6             |
| Non OECD        |                 |                 |
| Layers          | 21.1            | 17.3            |
| Broilers        | 27.3            | 26.2            |
| Backyard        | 64.2            | 0.1             |
| OECD            |                 |                 |
| Layers          | 18.5            | 16.4            |
| Broilers        | 28.0            | 25.5            |
| Ruminants       | 134.8           | 2.9             |

DM = dry matter
* Only from grains, pulses, roots & tuber
The global poultry sector has made significant gains in productivity. The average carcass weight increased by 30%, from 1.3 kg in 1961 to 1.66 kg in 2013 (FAOSTAT, 2016). The highest gains were made in South America (75%), Northern America (57%), Western Europe (33%) and Eastern Asia (32%). The highest gains in eggs production were made in East Asia (108%), Africa (75%), and Western Europe (59%).

Third, the contribution poultry makes to agricultural productivity through manure used in crop production. For example, in Europe, the share of animal manure input in total Nitrogen inputs was estimated at 38% and reaches 61% in the Netherlands (European Commission, 2012).

Fourth, the availability and affordability of other sources of foods and in particular protein and micro nutrients, and thus the exclusive or optional nature of eggs and poultry meat contribution to nutrition.

And fifth, the income generated by poultry production at household and national level. Today, an estimated 12% of total poultry meat and 4% of total eggs production are exported, with a few countries only (US, Brazil, EU and Thailand) generating substantial revenues (more than 85% of global exports). These share are still relatively low compared to other animal source food, such as beef (17%) or milk powder (over 50%). In parallel, least developed countries find themselves increasingly dependent on imports of poultry products: the share of imports in consumption increased from 2% in 1961 to over 28% in 2013. In 2013, least developed countries were net importers of nearly 1 million tons of fresh poultry meat (FAO, 2015). While poultry is key to poverty alleviation for small holders, least developed countries are becoming every year more dependent on imports to supply their increasing demand in poultry products.

Poverty alleviation and equity

There are 900 million poor people worldwide, living on less than US$1.9/day (World Bank, 2015). About half of them depend directly on livestock for their livelihoods. To poor people, farm animals are a major asset-representing both capital and, in many cases, a source of income. Livestock, which can be sold in times of crisis, act as household insurance. On the farm, poultry provide fertilization in addition to meat and eggs. Because of their short production cycle and their ability to convert swill and household wastes into edible products, poultry animals have a particularly important role to play for small holders (FAO-AGAL, 2016). They can contribute to three major pathways out of poverty by: (1) increasing resilience (2) improving smallholder productivity and (3) increasing market participation (ILRI, 2008).

Some two thirds of poor livestock keepers-290 million-are estimated to be women. They are largely involved in caring for small ruminants, poultry and dairy cows. But labor statistics may underestimate their role. That is because women are less likely than men to define their activities as work and less likely to report themselves as engaged in livestock management-while working, on average, longer hours than men. Despite women’s major role in animal production and marketing, especially with poultry, however, they have less access to resources, land, and capital in particular. In order to help achieve gender equality in agricultural populations, priority should be given to improving the conditions of women working in the livestock sector (FAO-AGAL, 2016).

Animal and human health

Animal-source foods are important to nutrition and health, especially for children and pregnant women and for the elderly. They can help reduce mortality among children and the newborn. Animal source foods provide a wide range of micronutrients-such as vitamin A, vitamin B-12, riboflavin, calcium, iron and zinc-which are difficult to obtain in adequate quantities from plants source alone (Murphy & Allen, 2003). But livestock can also represent a threat to human health, and poultry has a significant role in this threat, given the intensity and frequency of contacts between humans and birds. A majority of recent pandemics such as H5N1, or “avian influenza”, since 1997, are of animal origin. Of the known animal diseases, 61% are zoonotic, meaning that they can also infect humans (IFAH, 2012). Disease transmission between animals and humans occurs daily around the globe, both through agricultural practices and everyday activities. Again, as the main consumer of antibiotics (mostly used to speed growth), the livestock sector is a major contributor to global Antimicrobial Resistance (AMR)-a rapidly emerging threat to human health. Nonetheless anti-microbial consumption is expected to rise by almost 70% by 2030. Farm animals are also among the sources of some of the most severe but neglected tropical diseases
while, in economic terms, livestock diseases cause huge losses every year.

Animal welfare is also a significant challenge for the global poultry sector. For example, it is estimated that 61% of egg production come from industrial systems (Steinfeld et al., 2006) and around 60% of hens are kept in cages in the EU, with high frequency of beak trimmings.

Increasing international trade results in growing concerns about food safety. They in turn can translate into requirements to comply with standards and regulations (Narrod et al., 2012), which can represent a challenge for small producers and slow down market integration.

In order to increase livestock’s positive contribution to human health, and reduce their negative impact, animal health should be made a priority in public policies, and a One Health approach, recognizing that the health of humans is connected to the health of animals and the environment, should be adopted (FAO-AGAL, 2016).

**Natural resources and climate change**

Feed production is the main activity through which poultry use land and water resources (Steinfeld et al., 2006). Land requirements per unit of edible product varies significantly between regions and production systems. Poultry production is the sub-sector that requires the most land for cereal production with an estimated 93 million ha in 2010 (Mottet et al., 2016), including 74 million in non-OECD countries and 19 million ha in OECD countries. This represent 44% of the total cereal area required by the global livestock sector. The area necessary to produce oil seed cakes fed to poultry represent 16 million ha, when land is allocated to the different co-products of the crops (oil and cakes).

Mekonnen & Hoekstra (2012) estimated that poultry needed an average of 4325 m3 of water per ton of meat and 3265 m3 per ton of eggs, which account for 11% and 7% of the total water footprint of animal production. The water footprint of broilers and layers are the lowest average among animal products. These estimations of the water footprint include different categories of water-blue water (diverted from surface and groundwater), green water (rainwater evaporated from soil and plants) and grey water (needed to assimilate the load of pollutants).

Nitrogen use efficiency, i.e. the percentage of nitrogen input retained in products, is relatively higher in poultry production that in ruminants. It is however very different between production systems and regions, and show some differences even within systems and regions. It ranges from 5% in backyard production in some countries in East Asia and Sub-Saharan Africa to 50% in certain broiler systems in Western Europe. None retained nitrogen is excreted as urine or faeces. Part of this manure recycled as it fertilizes pastures and crops but a large share is lost to the environment, as gaseous emissions and leaching, and contributes to air and water pollution and climate change.

Poultry contributes to climate change by emitting greenhouse gases (GHG) either directly (e.g. from manure management) or indirectly (e.g. from feed-production activities, conversion of forest into crop-lands). Based on a Life-Cycle Assessment approach (GLEAM 2.0), it is estimated that poultry supply chains emits about 836 million tons of CO₂ equivalent, about 11% of the total GHG emissions from livestock supply chains. Poultry is the smallest contributor to the global livestock sector’s emissions.
When emissions are expressed on a per protein basis, poultry is the commodity with the lowest emission intensity (amount of GHGs emitted per unit of output produced), with an average of 40 kg CO$_2$-eq per kg of protein. Different agro-ecological conditions, farming practices and supply chain management explain the heterogeneity observed both within and across production systems, though the range of emission intensity is also smaller than for other species.

Manure management, energy used on farm and emissions from post farm processing and transport account for 38% of total poultry emissions. The rest of emissions result from feed production, including field work, fertilizer and manure application and land-use change for soybean and palm oil production, which account for 17% of total poultry emissions.

Poultry production uses an important area of land for the production of feed. This modifies many habitats. For example, the destruction of undisturbed habitats, as the conversion of the Amazonian rainforest to feed crops (soybean in particular) leads to important biodiversity losses. Increasing productivity and feed use efficiency in poultry production can contribute to reduce its negative impact on biodiversity by sparing land. Climate change, nutrient and pesticides pollution, to which poultry production contributes, are also important drivers of biodiversity losses.

**Discussion and conclusion**

The poultry sector needs to respond to the growing demand for meat and eggs and enhance its contribution to food security and nutrition. However, to be sustainable, it needs to consider its roles beyond just providing food. It needs to produce more with less, while benefiting all. It has a key role in providing secure livelihoods and economic opportunities for hundreds of millions of smallholder farmers. Enhancing this role requires a specific attention to market access. It needs to use natural resources efficiently, mitigate and adapt to climate change and reduce other environmental impacts. Finally it is necessary that the sector enhances human, animal, and environmental health and welfare.

Consequently, policies need to be designed in a holistic manner to best reconcile the various demands concerning productivity, sustainability and societal values. They should be tailored to regional/national specificities. They should not only consider the goods and services provided by the different production systems, their contribution to the economy and their environmental impacts but also producers’ capacity to react and invest, the cost associated with reaching out to producers and monitoring change and the different entry points for public policies in the different production systems. Given the complexity of the challenges and the diversity of actors involved, multi-stakeholder initiatives have a key role to play in this process.

**References**


