

agribusiness
handbook



**Poultry
Meat
& Eggs**





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This handbook is part of a series of agribusiness manuals prepared by the FAO Investment Centre Division, in collaboration with FAO's Rural Infrastructure and Agro-Industries Division. It was prepared for the EBRD Agribusiness team, under the FAO/EBRD programme of cooperation. The production of the manuals was financed by FAO and by the EBRD multidonor Early Transition Countries Fund and the Western Balkans Fund. The purpose of this handbook is to help agribusiness bankers and potential investors in the Early Transition countries (ETCs) and the Western Balkan countries (WBCs) to acquire basic knowledge about the technical features of poultry meat processing and to become acquainted with recent economic trends in the sector around the world, with a special focus on the ETCs and the WBCs. This volume was prepared by Inna Punda, FAO Agribusiness Expert, and reviewed by Dmitry Prikhodko, Economist, FAO Investment Centre Division, as well as by members of the EBRD Agribusiness team. Electronic copies can be downloaded from www.eastagri.org, where a database of agribusiness companies, including poultry meat processing companies that operate in the ETCs and the WBCs, is also available. Please send comments and suggestions for a future edition of the manual to TCI-Eastagri@fao.org.

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ACRONYMS AND ABBREVIATIONS

Abbreviation	Meaning
ABEF	Brazilian Association of Poultry Exporters
CAGR	Compound Annual Growth Rate
CIS	Commonwealth of Independent States
DOC	Day-old Chick
EBRD	European Bank for Reconstruction and Development
ETC	Early Transition countries
EU	European Union
FAO	Food and agriculture organization
FCE	Feed conversion efficiency
FCR	Feed conversion ratio
FYR Macedonia	Former Yugoslav Republic of Macedonia
HPAI	Highly pathogenic avian influenza
HS	Harmonized (Commodity Description and Coding) System
MOA	Ministry of Agriculture
OECD	Organisation for Economic Co-operation and Development
WBC	Western Balkan countries
WTO	World Trade Organization

I. INTRODUCTION

Pigeons, ducks, and geese were bred in China more than 3,000 years ago. Chickens, developed from Asian jungle fowl, were domesticated probably about the same time. In the sixteenth century, chickens were introduced into America from Europe and turkeys were introduced into Europe from America.

Although poultry eggs were artificially incubated in ancient China and Egypt, this method of hatching poultry was not used on a commercial scale until the 1870s. The modern poultry industry emerged in the late nineteenth century in Europe and America as breeders focused on improving meat and egg production. Research and technical innovations in poultry housing, feeding, and breeding have led to the rapid development of the industry since the 1930s.

Production and consumption of poultry products increased significantly during World War II when beef and pork were in limited supply. Since 1945, improved methods of storing and distributing poultry meat and eggs have helped stimulate consumption of these foods. Specialization in raising broilers has been important to the expansion of the poultry industry.

The current integrated poultry production system evolved from the many small, independent farms and companies that existed around the 1940s as hatcheries, feed mills and processing plants and then over the ensuing years integrated under a single ownership. In North America, the integration process was nearly completed by 1970.

I.1 Characteristics of poultry meat

Poultry, or domestic birds, are raised for their meat and eggs and are an important source of edible animal protein. Poultry meat accounts for 30% of global meat consumption. The worldwide average per capita consumption of poultry meat has nearly quadrupled since the 1960s (11 kg in 2003 compared with 3 kg in 1963¹).

Poultry meat and eggs are highly nutritious. The meat is rich in proteins and is a good source of phosphorus and other minerals, and of B-complex vitamins. Poultry meat contains less fat than most cuts of beef and pork. Poultry liver is especially rich in vitamin A. It has a higher proportion of unsaturated fatty acids than saturated fatty acids. This fatty acid ratio suggests that poultry may be a more healthful alternative to red meat.²

¹ FAOSTAT. © FAO Statistics Division 2009.

² *Encyclopedia Britannica*.

The following five factors are believed to have contributed to the increasing popularity of chicken meat:

- value/price compared with other foods;
- good nutritional profile/low in fat;
- convenience/ease of preparation;
- versatility; and
- well suited for quick-service and casual dining menus.

1.2 Different varieties of poultry meat

Poultry meat represents about 33% of global meat production: in 2007, some 269 million tons of meat were produced globally, of which 88 million tons were poultry meat.

Chickens and turkeys are the most common sources of poultry meat (87% and 6.7% of total poultry production, respectively). However, other commercially available poultry meats include meat from ducks (4% of total poultry production) and from geese, pigeons, quails, pheasants, ostriches and emus (combined about 2.7% of total poultry production). In the United States and Canada, turkey meat is the second most important poultry meat consumed after chicken meat; however, in other countries turkey meat is less important.

Chicken accounts for about 86% of all poultry raised worldwide. In the European Union (EU), chicken meat accounted for only 79% of all poultry meat produced in 2007, while turkey, duck, pigeon, geese and quail meat accounted for 15%. Hen eggs represent 92% of the global primary production of eggs.

Table 1: Types of poultry raised in the main producing countries, 2007 (thousand tons)

Country	Chicken meat	Turkey meat	Duck meat	Goose and guinea fowl meat	Total poultry meat	% of poultry in total meat product	Total meat
■ 1 United States	16,211	3,397	83	n/a	19,691	47	42,020
■ 2 China	10,617	4	2,329	2,092	15,042	21	70,464
■ 3 Brazil	8,988	230	7	n/a	9,225	49	18,898
■ 4 Mexico	2,542	22	21	n/a	2,585	47	5,548
■ 5 India	2,240	n/a	73	n/a	2,313	36	6,508

Source: FAOSTAT. © FAO Statistics Division 2009

Broilers are the main type of chicken produced by modern integrated poultry raising facilities due to their high feed-meat conversion ratio. This handbook will, therefore, focus on broilers for meat production and laying hens for egg production.

The genetic line of broilers is Cornish cross (Cornish x White Rock) and the genetic lines of layers are Leghorn (white eggs) and Rhode Island Red and New Hampshire (brown eggs). The colour of the eggshell is directly influenced by the breed of the hen. Approximately 50% of the eggs produced in the world are brown and 50% are white.

2. BROILERS FOR MEAT PRODUCTION

A broiler is a type of chicken specially bred for meat production because it grows much faster than an egg breed of chicken.

2.1 Classification of birds

Broilers are generally grown for a specific number of days and until they reach a specific weight. In North America, seven-week-old chickens are classified as *broilers* or *fryers* and fourteen-week-old chickens are classified as *roasters*³.

2.2 Production process in the broiler industry

In the modern poultry industry, producers usually do not own the primary breeding stock (i.e. the parent lines supplying their operation). They purchase birds from primary breeders. Specialized firms and institutes obtain chicks from hybrid lines selected for specific characteristics such as resistance to diseases, growth curve and adaptation to certain types of feed.

The average growth cycle is about six weeks for a broiler. The length of the cycle is influenced by the degree to which the feeding diet is balanced and considers the cost of feed per 1 kg of meat produced, the feed-to-meat conversion ratio and the sale price of boiler meat. Feed quality, heat regulation, veterinary/sanitary control and animal density within breeding houses (on average 10 animals/m²) are the most important factors affecting growth.

After six weeks, broilers reach an average weight of 2.5 kg. They are then gathered into cages and sold to processors for slaughtering. In broiler meat production, cages are used only for transportation purposes and not for containing broilers during their growth.

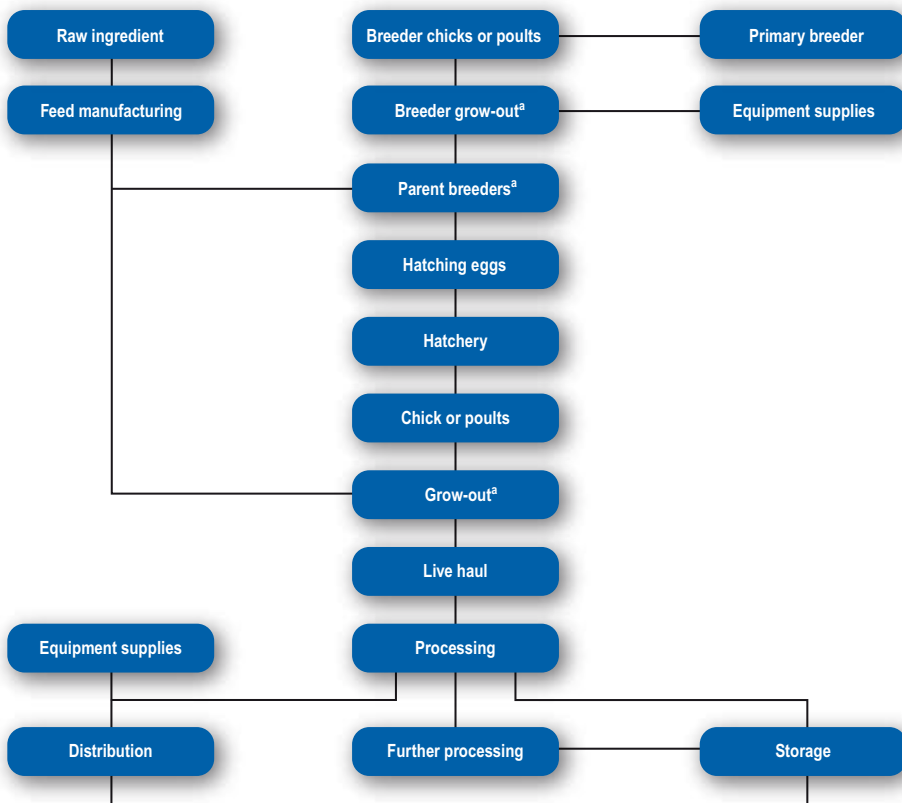
Figure 1 depicts the following major elements of a modern broiler production chain:

- the **hatching** – the egg farm provides fertile eggs to the hatchery;
- the **hatchery** where fertile eggs incubate and day-old chicks (DOCs) hatch from the eggs. All healthy DOCs are sent to broiler grow-out facilities. The DOCs are raised for about 42 days, and after that time they are ready for slaughter or to be sold live; and
- the **processing plant** where birds are slaughtered and either prepared as ready-to-cook whole chicken or cut-up chicken parts, or further processed into deboned chicken, polony and viennas.

³ *Encyclopedia Britannica.*

There are various arrangements for the raising of broilers, depending on the level of integration of the companies in the broiler industry. In some countries (the United States, Canada, the United Kingdom), integrated companies own and control the hatcheries, feed mills, processing plants and distribution facilities but contract up to 90% of the broiler grow-out with private farms. In the Russian Federation and Ukraine, where contract farming is not developed, all major broiler meat producers also own and control the broiler grow-out facilities.

Figure 1: A typical integrated broiler operation



Note: ^(a) Normally produced under contract arrangement with grower.

Source: College of Agriculture and Life Sciences of North Carolina State University

The advantages of farming broilers over other animals are:

- broilers have a growth cycle of six to seven weeks, which allows for repeated production throughout the year;
- more broilers than layers can be placed in a shed;
- broilers have high feed conversion efficiency (FCE)⁴ in comparison with other birds or livestock. FCE of broilers is 2, of turkeys is 2.5 and of ducks is 2.5–3. FCE depends on many factors, including the age of birds, feed quality, duration of lighting, etc. Cattle need more than 8 kg of feed per head to put on 1 kg of live weight per head, a ruminant will convert about 7 kg of feed to 1 kg of meat and a pig will convert about 3.5 kg of feed to 1 kg of meat;
- return from the investment in broilers is fast. Different growth cycles have a direct impact on net cash flow. For example, eight generations of birds can be raised per year compared with from two to two-and-one-half generations of pigs and less than one generation (0.8) of cattle; and
- high consumer demand and preference for broilers.

Today's poultry industry is characterized by vertical integration whereby a single company owns the facilities and controls the breeding, hatching and/or processing of broilers but contracts with private poultry farmers for the raising of the chicks (up to 90% of grow-out may take place on private farms). Although an integrated company (e.g. Pilgrim's Pride Corp. or Tyson Foods, Inc.), referred to as an integrator, owns the birds and provides feed, medication and other supplies, the grower owns the chicken house and provides litter, labour and utilities.

2.3 Breeding and feeding

Until the 1950s, all poultry was raised outdoors and sunlight provided a natural source of vitamin D. In the 1950s, producers turned to indoor confinement of poultry for the protection of chicks from predators, tighter control of operations, greater labour efficiency and disease control. The advent of synthetic vitamin D permitted total indoor production.

There are two systems of poultry raising: extensive and intensive production.

⁴ Feed conversion ratio (FCR), feed conversion rate or feed conversion efficiency (FCE) is a measure of an animal's efficiency in converting feed mass into increased body mass, i.e. least amount of feed that is required for unit body weight gain. Animals that have a low FCR are considered efficient users of feed.

2.3.1 The extensive (or pasture-based) production system

From a production standpoint, birds are pastured to obtain nutrients from the pasture, improve land fertility and improve bird health. Poultry obtain nutrients from young, vegetative forage plants but because they cannot digest cellulose as ruminants do, they do not make use of the vast energy stored in the plant fibre. In addition to foraging for plants, poultry in pasture also forage for seeds and live protein such as worms and insects. Extensive breeding is largely practiced in developing countries where natural native genetic lines are used.

Small farmers raise poultry in “free-range” or pasture-based systems that are part of a diversified farm.

There is a niche market for “free-range” poultry, which is rare in the modern industry. Most producers would rather not expose birds to predators and wildlife to avoid diseases. However, some farmers manage this type of production successfully and obtain premium prices for their poultry (for instance, in France, up to 30% of poultry is produced on range under the Label Rouge certification programme). However, the price premium for “free-range” chickens in the EU, North America and other developed markets should be viewed against consumer disposable income and willingness to pay for this type of product.

2.3.2 The intensive (or cereal-oilseed protein-based) production system

Under the intensive system, all the nutrients required by the birds must be provided in the feed, usually in the form of a balanced and mixed feed.

The following main features distinguish an intensive poultry production system from an extensive poultry production system:

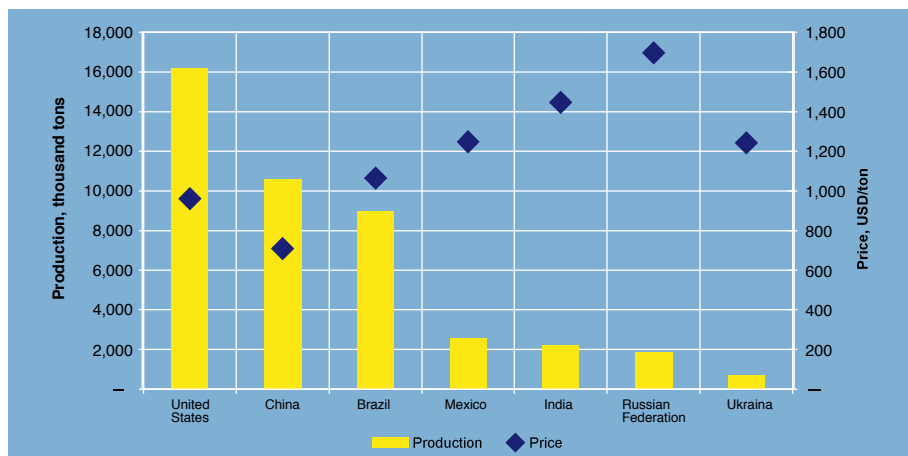
- Intensive range poultry production can be a stand-alone enterprise and requires only a small amount of land. However, careful manure management is needed to prevent environmental damage.
- Extensive range poultry production requires much more land and is usually part of a diversified operation with ruminants. Mixed husbandry can be very important in range poultry production.

2.4 Sale prices of live broilers

Poultry prices may vary significantly, influenced by seasonal patterns, input costs and relative costs of competing meats.

Production costs are very volatile. They greatly depend on the desired characteristics of the final product (whether chicken of a brand name or of low quality) and also on feed prices (mainly grain prices), climatic conditions and the genetic lines used. Therefore, they vary considerably from one region to another region.

Figure 2: Producer prices of chicken meat in selected countries (USD/ton of live weight)



Note: 2007 data.

Source: FAOSTAT. © FAO Statistics Division 2009

2.5 Average margins of producers

Margins for producers of broilers largely depend on final product characteristics (quality, brand, brand name). Indeed, high quality meat usually requires a longer growing period, which means higher production costs because more feed is used, as well as slightly increased costs of other miscellaneous variables. The choice of final product characteristics is largely determined by how much consumers are prepared to pay for high quality broilers.

An approximate average gross margin calculation for broilers is provided in Table 2.

Table 2: Broiler contribution margin for 100,000 birds in British Columbia, Canada (target weight 1.92 kg/bird)

Income	Yield	Price USD	Unit	Income USD
Broiler sales	1,920	1.365	kg	2,621
Condemnations	(13.5)	1.365	kg	(18.43)
Total income				2,602

Direct expenses	Quantity	Price USD	Unit	Expense USD
Feed	3,456	0.398	kg	1,375
Chicks (vaccinated)	1,053	0.560	kg	593
Levies	1,920	0.010	kg	19
Medications				30
Catching				40
Litter				24
Waste removal (litter & dead birds)				30
Energy and water				77
Maintenance and repairs				17
Total direct expenses				2,206
Contribution margin				397
Contribution margin/broiler				0.40
Contribution margin/kg				0.21

Source: British Columbia Ministry of Agriculture, Fisheries and Food

One of the important by-products of poultry production is the manure, which has a significant economic value, be it sold by producers or directly applied by producers to the crops grown.

2.6 Problems with diseases

Biosecurity and sanitation are necessary to prevent disease outbreaks. Biosecurity involves isolating birds by age group, restricting human access to buildings, keeping the buildings clean and properly disposing of dead birds.

2.7 Environmental considerations and sustainability of poultry farming

It takes less than 2 kg of cereals to produce 1 kg of chicken meat as compared with 4 kg of cereals to produce 1 kg of pork. This feed conversion ratio (FCR) (2:1 or less) is better than that of livestock or other poultry. Compared with cattle, chickens emit no methane and emit less phosphate and carbon dioxide than other meat-producing animals. The modern broiler industry raises more food on less land with less input than any other terrestrial food animal industry. If carefully managed, poultry litter (manure) can also be processed for commercial fertilizer.

Recent research⁵ suggests, contrary to widespread belief, that intensive (housed) poultry production may have a lesser impact on the environment and global warming than organic or free-range production. Organic poultry has a higher FCR and a longer growing period for the heavier chickens that are produced, resulting in a net increase in energy requirement for organic poultry meat production. Organic egg production also needs more energy than non-organic egg production and increases most environmental burdens (except pesticides).

⁵ *Life Cycle Assessment by Cranfield University in Silsoe, United Kingdom.*

3. CHICKEN SLAUGHTERING AND PROCESSING

The most common product produced in poultry slaughterhouses is the whole bird. However, poultry meat can be further processed into various products based on the type of poultry meat desired (e.g. from simple cuts to ready-to-eat meals). In fact, during recent years there has been a shift from fresh, whole-bird sales to sales of cut-up bird parts and convenience products because these products have higher value.

3.1 Chickens and chicken parts

Whole chickens are available fresh, frozen, bone-in, boneless, uncooked, fully cooked and seasoned.

Chicken parts are available as drumsticks, thighs, wings and breasts (see Annex 1 for further details). They are also available as legs (drumstick and thigh attached), leg quarters, breast quarters, breast halves and poultry halves. Wingettes and drumettes made from the wing are available. Chicken products taken from the breast and wing are considered white meat and the products taken from the drumstick and thigh are considered dark meat.

Cutting up and further processing chickens add value to the product and increase convenience to consumers.

3.2 Description of poultry processing

3.2.1 Poultry processing operations

Because poultry meat is a perishable product (chilled poultry meat must be sold to consumers within 72 hours after processing), the conception/organization of the slaughterhouse must be closely adapted to feed cost and availability, meat supply conditions and consumer markets (average weight and age of animals, available quantity of animals per week and seasonality of supplies).

Annex 2 provides a simplified diagram of the various operations performed in poultry processing.

■ Preprocessing⁶

The birds are usually transported by truck to the poultry slaughterhouse. Upon arrival, the birds are held in the reception area in the transport crates,

⁶.Based on *Environmental, Health, and Safety Guidelines. Poultry Processing. IFC 04/2007.*

pending veterinarian inspection. In most countries, the official veterinarian then inspects each transport crate of live birds to approve them for human consumption. Sick birds are killed and disposed of. After inspection, the birds are removed from the crates in the reception area and put on the killing line. The birds are hung upside down by their feet by shackles on a conveyor, which moves them to the stunning area. Once the birds are shackled, stunning is carried out using one of three possible methods that include (i) an electrically-charged water bath, (ii) gas inhalation or (iii) a blow to the head using a blunt object.

■ **Slaughtering, bleeding and scalding**

Slaughtering can be performed manually or by using an automatic circular-knife system. The birds should bleed for at least two minutes to ensure a total bleed-out. The blood is collected in a tank and handled as an animal by-product for further processing.

After bleeding, the birds are exposed to either steam or hot water as part of the scalding procedure. Scalding loosens the feathers and facilitates plucking.

■ **Further processing and evisceration**

Feathers are removed in a specially designed plucking machine or by hand. Feathers are collected and treated as an animal by-product. The birds are showered with water during the automated plucking operation and the feathers are collected in a trough under the plucking machine. Following scalding and plucking activities, the head and feet are removed. Inedible organs, including the intestinal tract and lungs, are removed and treated as animal by-products. The eviscerated carcass should be rinsed internally and externally with potable water before further processing. Depending on country-specific regulations, companies may use disinfectants (chlorine or tri-sodium phosphate solutions) to reduce the bacteriological contamination on meat surfaces.

■ **Storing and packaging**

After rinsing, the carcass should be cooled as quickly as possible to or below 4 °C. Several methods are used for chilling, including: air chilling, which takes place in either a chill room or by continuous air blast; spray chilling whereby water aerosols are added to the air; and immersion chilling, which involves moving carcasses through a counter-flow current in a water bath.

Birds are weighed individually and sorted according to their weight. After weighing, the birds are inspected visually and categorized. Whole birds are typically packed in plastic bags or in containers wrapped in film. Birds

are stored before sale at or below 4 °C. Birds intended to be sold as quick-frozen poultry are frozen in a blast freezer or similar equipment that enables rapid freezing.

■ **Cleaning of the processing plant**

Cleaning of the plant is one of the most important tasks in a poultry processing plant. Some rinsing and cleaning should occur during working hours. After working hours, a total cleaning and disinfection of the plant is carried out, normally on a daily basis. Cleaning involves the following major steps, including disassembling of machinery and equipment, as necessary; physical removal of solid material; cycles of rinsing and washing; disinfection; drying; and application of lubricants.

■ **Rendering**

Rendering is the heat treatment of animal by-products to eliminate the risk of spreading disease to animals and humans and to produce usable products such as proteins and fat. Rendering involves evaporative processes that may generate a foul odour.

3.3 Poultry by-products

3.3.1 Low-risk material

Low-risk by-products are by-products obtained from poultry that have been approved as fit for human consumption (e.g. blood, heads and feet).

Blood is collected in a separate tank. Depending on the storage time before further processing, the need for cooling and chemicals that can prevent coagulation should be considered. Blood is filtered and spray-dried to produce blood meal. Blood meal can be used for feeding fish, pets and other animals.

Feathers are collected in a separate container. Before transfer to the container, water from the scalding process has to be pressed out of the feathers. Because the plucking process can remove portions of the heads as well, some head bits may be present among the feathers. Feathers can be burned to produce heat or processed with heat to hydrolyze the proteins. The low-value proteins from feathers can be used in pet food or animal feed.

Heads and feet that are not destined for human consumption are collected in a separate container. When these by-products are to be used for human consumption, they should be approved during the inspection process. Typically, feet used for human consumption are heat treated in order to remove skin and nails before packing. Heads are normally not used for human consumption, although duck tongues are consumed in some countries.

3.3.2 High-risk material

High-risk by-products include birds that have died for reasons other than slaughtering, condemned birds, and condemned parts of birds, as well as all other by-products not intended for human consumption. Solid organic material that is captured in the wastewater treatment system screens and has a particle size of 6 mm or greater should also be treated as a high-risk by-product and sent for rendering. Grids used in the slaughterhouse and prefiltering of waste streams should be designed so that these kinds of animal by-products can be recovered and sent for rendering.

3.3.3 Processing of by-products

By-products should be collected in separate containers, which are isolated in such a way that food safety is not jeopardized. The containers should be covered to prevent wild birds and animals from coming into contact with the material they contain. At the rendering plant, the materials are chopped up and then heated under pressure (e.g. in the conventional batch dry rendering method) to kill micro-organisms and remove moisture.

The liquefied fat and solid protein are separated by centrifugation or pressing. The solid product can then be ground into various animal protein powders for animal feed or pet food.

The effectiveness of the heat process used for rendering depends on various factors, including the holding time, the core temperature and the particle size of the products treated. The rendering process should produce final products that are free from salmonella and clostridium and contain only a limited number of enterobacteriaceae.

3.3.4 Environmental aspects

- **Waste and wastewater** Water contamination has become a major issue confronting industrial poultry operators.
- **Chicken manure** Almost 18 billion birds are raised each year in the world and produce more than 22 million tons of manure. Poultry manure is rich in nitrogen and phosphorous and contaminates groundwater and surface waterways such as rivers and bays. Ammonia gas must be ventilated from the chicken houses and can contaminate soil and water. Arsenic, an additive to chicken feed, contaminates litter or waste generated each year by the broiler chicken industry and also contaminates the communities in which it is generated or disposed.
- **Chicken processing** Chicken guts, heads, feathers, blood and wastewater that remain from the processing are rendered down to their essence before being hauled as sludge to fertilize farmlands in the area. Treated wastewater

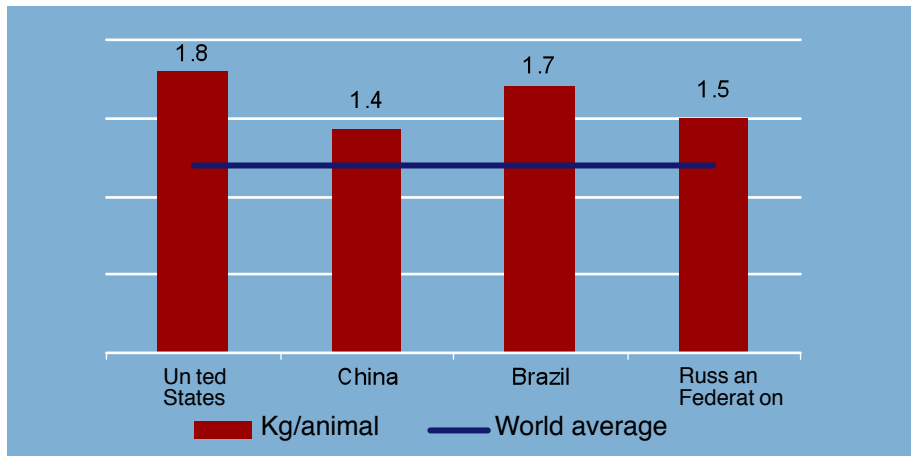
is released into nearby streams or sprayed on farmlands in the area.

- **Water use.** Three thousand five-hundred litres of water are used in the production of 1 kg of meat. Modern broiler houses (e.g. typically 500 ft long) require almost 38 litres of water per minute.

3.4 Conversion factors for live animals

The figure commonly used as the conversion factor is the carcass yield (also referred to as a killing out percentage), which is the proportion of an animal's weight salvaged at carcass point. This figure varies considerably, depending on production conditions. Some estimates are provided in Figure 3.

Figure 3: Average broiler carcass yield in selected countries, 2007 (kg/year)



Source: FAOSTAT. © FAO Statistics Division 2009

The genetic potential for broiler production under ideal conditions can be estimated from the claims of the breeding companies. One of the oldest and most respected brands in chicken breeding, Arbor Acres, indicates the following standards in its Broiler Manual:

Table 3: Arbor Acres Classic Broiler standards for straight-run (straight-run is a 1:1 ratio of males and females)

Age (weeks)	Body weight (g)	Weekly grain (g)	Feed consumption		Feed conversion	
			Weekly (g)	Cumulative (g)	Weekly	Cumulative
1	175	135	149	149	1.10	0.85
2	440	265	322	471	2.22	1.07
3	795	355	515	986	1.45	1.24
4	1,250	455	764	1,750	1.68	1.40
5	1,770	520	1,011	2,761	1.94	1.56
6	2,355	585	1,313	4,074	2.24	1.73
7	2,940	585	1,512	5,586	2.58	1.90

Source: Arbor Acres Broiler Manual

3.5 Broiler wholesale prices

Wholesale prices depend to a large degree on the product quality standard (label policy based on feed quality, intensive/extensive production). A farm chicken may be twice as expensive as an industrial chicken. Presently, wholesale broiler prices tend to increase due to a sustained demand coupled with a tight supply that is constrained by expensive feed costs.

4. THE BROILER INDUSTRY

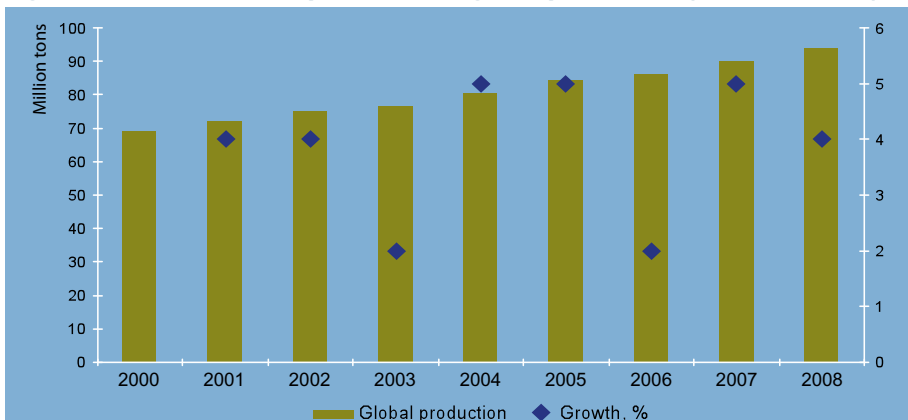
4.1 Global poultry market

The poultry sector was the most dynamic meat sector during the last decade, showing the greatest growth of all meat sectors as reflected in world consumption.

The dynamism of the global poultry sector has been supported by a strong growth in demand. In Eastern Asia, the lack of supply in pork meat already observed in 2007 and food scares resulted in a gradual shift in consumption from pork to poultry. In the Russian Federation and Latin America, income growth significantly promoted the consumption of meat in general and poultry meat in particular. The demand for poultry meat was even more important in the Middle East, where competition with pork is almost non-existent.

At the global level, total poultry meat production increased from 69 million tons in 2000 to 94 million tons in 2008 (see Figure 4), which corresponds to an increase of 35%. This growth was attained despite recurrent consumer scares and regional trade restrictions linked to the spread of various diseases, such as the outbreaks of the avian influenza and the Newcastle disease, which represented major threats for the poultry sector worldwide.

Figure 4: Growth trend in poultry meat global production (in millions tons)



Source: FAO Food Outlook, June 2009

It is expected that in the next ten years, the meat sector as a whole will continue the upward production trend driven by world population growth, particularly in developing countries.

4.2 Consumption patterns

With continued economic growth, protein demand in developing countries also is increasing especially for low-priced foods such as poultry and eggs. Also consumer preferences are changing in many developed countries. Demand for low-calorie food products and changes in lifestyle, which reduce the time consumers wish to spend on food preparation, have been observed in the past and will likely continue in the future. Again, it is mainly poultry meat that complies with increased consumer demands for lean and easy-to-cook meat.

In 2008, global poultry meat consumption increased by a healthy 4%. The highest annual growth rates of poultry meat consumption in 2007–2008 were registered in the Russian Federation with 8% growth, and China and Mexico each with 6% growth (see Table 4 and Figure 8).

Table 4: Evolution of poultry meat domestic utilization in the heaviest consuming countries (in thousand tons)

	2004	2005	2006	2007	2008	Trend Y-1 %
World	80,016	83,733	85,918	90,046	93,474	4
■ 1 China	13,444	14,642	15,262	16,896	17,923	6
■ 2 United States	15,741	16,064	16,253	16,130	16,218	1
■ 3 EU*	10,355	10,658	10,340	11,198	11,451	2
■ 4 Brazil	6,198	5,796	5,938	6,333	6,601	4
■ 5 Russian Federation	2,313	2,723	2,913	3,165	3,434	8
Rest of the world	31,965	33,850	35,211	36,323	37,848	4

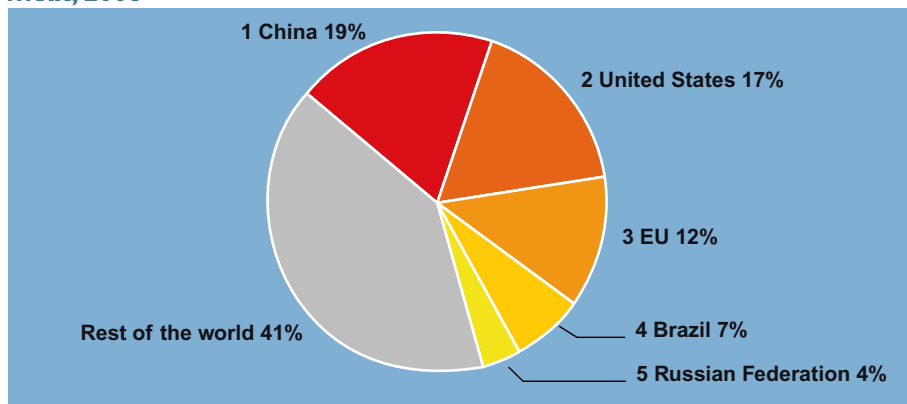
* EU-25 from 2004 to 2006 and EU-27 from 2007.

Source: FAO Food Outlook, June 2009

With nearly 18 million tons of poultry meat consumed in 2008, China has become the world's leading poultry meat consuming country, surpassing the United States. Per capita poultry meat consumption in China was estimated at 13.5 kg/year⁷ – slightly below the world average (14 kg/year).

⁷. FAO Food Outlook, June 2008.

Figure 5: Shares of leading countries in global consumption of poultry meat, 2008



Source: FAO Food Outlook, June 2009

In the EU, per capita poultry meat consumption has been stable at the level of 24 kg/year (2008 data, 23 kg/year in 2004). Population growth induced a slight increase in consumption, which reached 11.5 million tons of poultry meat in 2008 or 2% more than in the previous period.

In the Russian Federation, poultry meat consumption has grown rapidly in recent years. In 2008, Russia's per capita consumption reached 24.7 kg (close to the EU-average of 23.6) as compared with 16.2 kg in 2004.

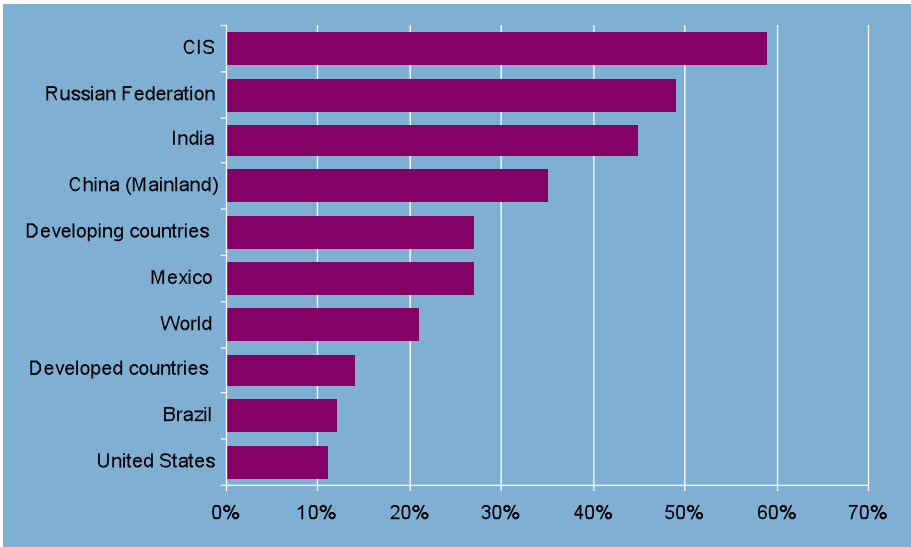
Table 5: Consumption of poultry meat in selected countries (kg/capita/year)

	2007	2008	2008/2007
World average	13.6	14.0	3%
■ 1 Qatar	92.4	99.2	7%
■ 2 United Arab Emirates	89.1	93.3	5%
■ 3 Israel	71.4	71.6	0%
■ 4 Hong Kong	53.9	54.8	2%
■ 5 United States	52.7	52.5	0%
Developed countries	27.7	28.4	2%
Developing countries	9.8	10.1	3%
EU including Baltic states	23.1	23.6	2%
CIS	16.4	18.3	12%

Source: FAO Food Outlook, June 2009

In developing countries, poultry meat consumption growth is much more pronounced than in developed countries.

Figure 6: Poultry meat domestic utilization five-year CAGR* (growth 2008/2003, %)



* Compound Annual Growth Rate (CAGR).

Source: FAO Food Outlook, June 2009

4.3 Global poultry meat production

Despite high feed costs (due to high prices of cereals and oilseeds in 2007–2008), poultry meat production continued to grow and reached 93.7 million tons in 2008 (see Table 6). This phenomenon (production growth despite high cereal prices that imply higher production costs) can be explained by the fact that poultry meat is a very efficient way to transform vegetable mass into meat protein. Consequently, cereal price growth impacts on poultry production costs to a lesser extent than on other meat production.

Table 6: Evolution of poultry meat production by the main producing countries (thousand tons)

		2004	2005	2006	2007	2008	CAGR 2008/2004 %
	World	80,481	84,544	86,117	90,058	93,729	16
Top 5	■ 1 United States	18,493	19,105	19,215	19,481	19,986	8
	■ 2 China (Mainland)	13,514	14,643	15,040	16,393	17,262	28
	■ 3 EU	10,735	10,966	10,648	11,167	11,491	7
	■ 4 Brazil	8,895	9,057	8,901	9,791	10,300	16
	■ 5 Mexico	2,313	2,470	2,505	2,593	2,710	17
EBRD region	Russian Federation	1,182	1,381	1,624	1,850	2,200	86
	Ukraine	375	497	589	670	804	114
	Kazakhstan	41	43	50	52	54	32
	Turkey	894	953	933	983	1,060	19

* EU-25 from 2004 to 2006 and EU-27 from 2007.

Source: FAO Food Outlook, June 2009

In the United States, the world's biggest poultry meat producer, despite the fact that internal demand had reached its ceiling, poultry output growth was still possible because of the favourable conjuncture on the international market. Early indications of a contraction of poultry production in the first half of 2009 suggest that output may fall by 3% to 19.3 million tons compared with production in 2008.

In China, poultry production was fuelled by a sharp drop in pig meat production and an increase in pork prices in 2007. In 2008, pig meat supply started to grow again but failed to reach the precrisis level, leaving an important opportunity for the development of poultry farming in response to constantly growing internal demand for meat products. China's growth in poultry production is expected to slow to 3% (currently +5%), amidst sluggish domestic demand. In the past, poultry consumption in China was fuelled by rising purchasing power, especially among the urban population, but this engine of growth is now under pressure from the current international financial crisis.

Little change in poultry meat production in the EU is currently anticipated.

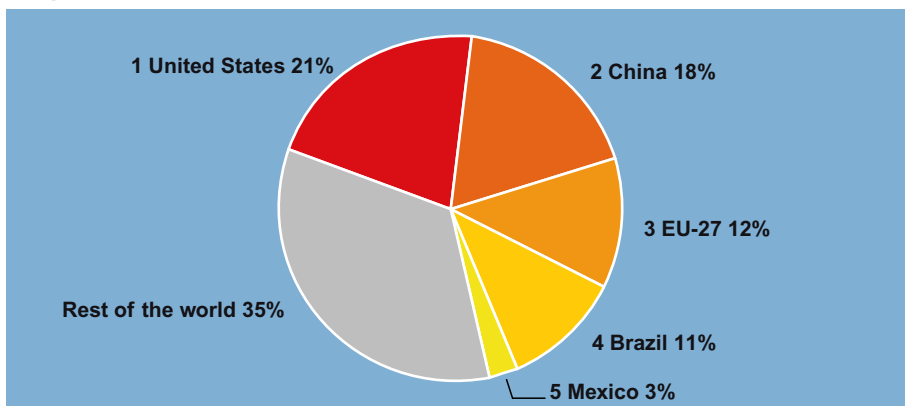
Fast growth in Brazilian production in 2008 (+5%) is linked to the expansion of the domestic market as well as to an increase in international demand. Brazil's

output was forecasted to grow by only 2% in 2009, as farmers were requested by the Brazilian Association of Poultry Exporters (ABEF) to reduce production for export to counter the difficult world market situation.

In the Russian Federation, production benefited from the dynamism of internal demand as well as from the different measures regularly undertaken by the local authorities that aim to reduce the country's dependence on imports (import quotas, sanitary barriers). Production growth in the Russian Federation may slow to 9%, weaker than the growth of 16% on average witnessed during the last two years.

The production of the five major producers of poultry meat, namely the United States, China, the EU-27, Brazil and Mexico (see Figure 7), represent more than two-thirds of global poultry meat output.

Figure 7: Main poultry meat producers and their share in global output, 2008

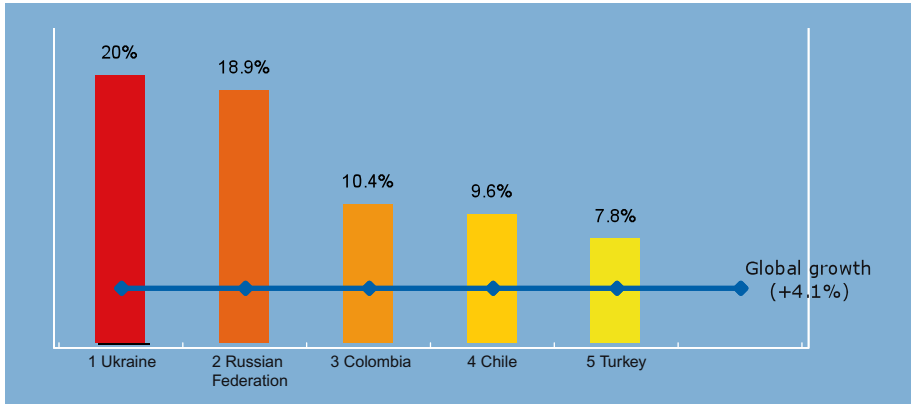


Source: *FAO Food Outlook, June 2009*

In terms of growth, Ukraine registered the highest growth rate of 20% in 2008 compared with 2007, followed by the Russian Federation with 19% growth and Colombia far behind with 10% growth (see Figure 8). Global poultry meat production grew by a fair 4%. While the consumer taste for poultry meat continues to grow in Ukraine and the Russian Federation, local suppliers have been unable to keep pace with demand. Both countries source a significant proportion of their poultry meat from overseas (Ukraine about 30%, the Russian Federation even more at 40%), but concerned by the balance of payments, and with a devalued currency, consider dependence on imports far from ideal for the governments. Faced with these difficulties, Ukraine and the Russian Federation have adopted various measures to stimulate domestic production and reduce imports. They give their poultry producers a big helping hand by

ensuring protection from competition, establishing price controls and making soft loans available. A new class of efficient farmers has emerged to respond to the constantly increasing demand for cheaper (cuts of) meats, notably chicken.

Figure 8: Poultry meat producing countries with the strongest growth, 2008



Source: *FAO Food Outlook, June 2009*

Chicken meat represents 86% of global poultry meat output.⁸ In Brazil, chicken meat is even more popular: chicken meat represents 97% of total poultry meat output. In the United States, turkey meat production occupies quite an important share of poultry output at 17% of total output. In the EU, chicken meat represents roughly 72% of poultry meat output, and most of the rest of output is distributed between turkey meat (16%) and duck meat (4%). In China, chicken meat represents a major share of poultry production (68%), leaving considerable room for the production of palmipeds (duck, geese), about 30% of poultry output due to the importance of these species in traditional cuisines of the country.

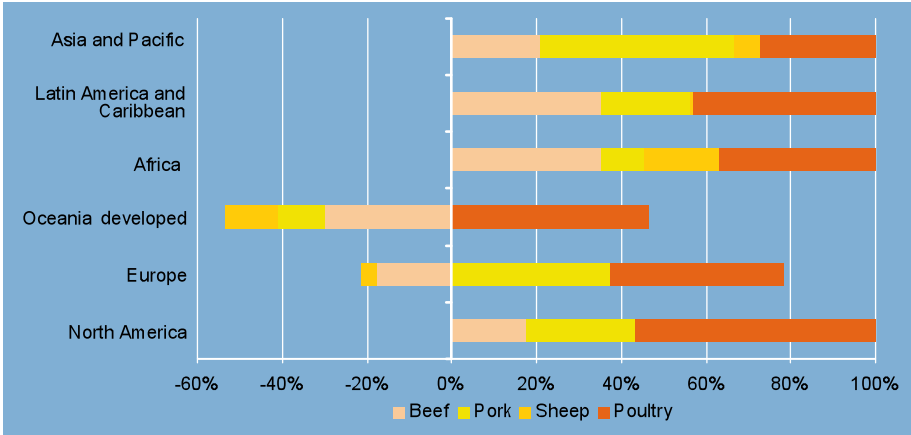
The most remarkable growth rate in poultry production among the main poultry producing countries during the recent past was attained by Brazil (+7.1% per year), while for the other three global leaders (United States, China and the EU) the pace of growth was more modest. In other terms, 20% of the increase in world poultry production between 1999 and 2006 can be attributed to Brazil, against 15% of the increase attributed to the United States and 13% of the increase attributed to China. These data show that Brazilian poultry production has considerably increased its export vocation during the recent past.

⁸ National Interprofessional Office for Meat, Livestock and Poultry Farming (OFIVAL).

4.4 The contribution of various meats to the global increase in meat production

The positive development in meat production is unequally distributed across regions as well as across commodities. Of the various types of meat, poultry and pork exhibit the strongest growth (see Figure 9).

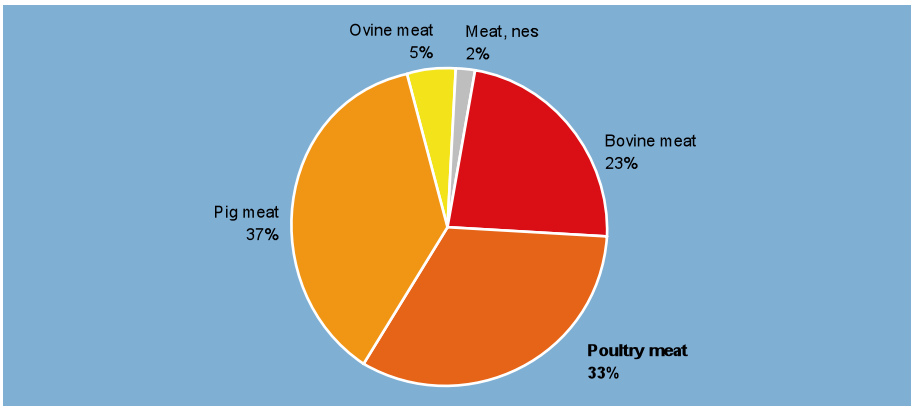
Figure 9: Contribution of various meats to production increases, 2005–2007



Source: OECD and FAO Secretariats

Poultry meat represents 33% of global meat output (282.1 million tons).

Figure 10: World meat production and poultry’s contribution



Source: FAO Food Outlook, June 2008

Nevertheless, the growth in chicken meat production has slightly slowed in 2008 (4% compared with 2007, see Figure 10). Slower growth is a reaction to generally low returns on chicken production caused by the economic troubles during 2001–2003, trade disruptions, avian influenza and, most recently, higher grain prices.

4.5 The impact of sanitary and phytosanitary measures

The outlook for global poultry meat production has been revised downwards since November 2008 to 94.7 million tons, largely because of the *avian influenza* epidemic in Asia, where numerous outbreaks have been reported since the end of last year. At the forecast level, global poultry meat production will increase by a mere 1% compared with 2008, reflecting the slower pace of growth during the past decade. Although the price of feeds, a key component of costs, fell in the last quarter of 2008, poultry meat prices remained stable, but in early 2009, the price of poultry meat fell when consumer demand started to falter, portending another year of low profits or even losses.

4.6 Major industry players

The global chicken trade is dominated by large, multinational companies – mainly based in the United States – which are commonly referred to as “integrators” because they run a vertically integrated production process whereby each firm controls every stage of its operation from the embryo to the market shelf (production, processing and distribution controlled by a single entity). The integrators coordinate the supply of chickens through a system of contracts with growers. Growers (poultry farmers) provide the land, buildings, equipment, utilities and labour in the raising of birds to a marketable age, while the companies supply the chickens, feed and medication and buy back the mature birds.

The share of the United States market of poultry industry leaders, such as Tyson Foods, Pilgrim’s Pride Corp., Perdue and Sanderson Farms, grew from 35% in 1986 to 50% in 2001⁹. In 1950, for example, there were over 250 firms operating in the United States broiler industry and today there are fewer than 50 firms.

The top five poultry producers worldwide are as follows, based on publicly available information for 2008/2009:

⁹ *Feedstuffs* 15 January 2007.

Table 7: The world's top five poultry industry leaders

Company	Description
<p>■ 1 BRF Brasil Foods SA <i>Brasil</i> www.perdigao.com.br Employees: 81,000 people 38 distribution centres 26 food processing plants</p>	<p>In May 2009, Brazil's largest food company Perdigão SA took over its rival Sadia SA. The new company is called BRF Brazil Foods SA. This transaction resulted in BRF Brazil Foods SA becoming the world's largest poultry processor by market value: it will export about 42%¹⁰ of its production.</p> <p>BRF Brazil Foods SA is valued at about USD 5.3 billion, based on the market value of Perdigão SA and Sadia SA on the day of takeover. Annual slaughter capacity of the new giant is 1.2 billion chickens, 31.9 million turkeys and 7.4 million pigs.</p> <p>In 2008, Perdigão SA produced 1,342,000 tons of poultry meat (and 697,000 tons of pork and beef).</p>
<p>■ 2 Tyson Foods, Inc. <i>United States</i> www.tyson.com Founded: 1931 Employees: 107,000 people Revenue: USD 26.8 billion¹¹ (2008) 123 food processing plants 6,729 contracted poultry farmers</p>	<p>Tyson Foods, Inc., an American multinational corporation based in Springdale, Arkansas, produces, distributes and markets chicken, beef, pork and prepared foods. Tyson Foods, Inc., operates more than 300 facilities in the United States and throughout the world. It supplies the Yum! Brands (including Kentucky Fried Chicken and Taco Bell), as well as McDonald's, Burger King, Wendy's, Wal-Mart, Kroger, Costco, IGA, Beef O'Brady's and small restaurant businesses.</p> <p>Through its wholly owned subsidiary Cobb-Vantress, Inc. (Cobb), Tyson Foods, Inc., also operates as a poultry breeding stock supplier, supplying itself, as well as a number of other poultry production companies with poultry breeding stock.</p>
<p>■ 3 Pilgrim's Pride Corp. <i>United States</i> www.pilgrimspride.com www.poultry.com Founded: 1946 Employees: 49,750 people Revenue: USD 8.5 billion¹² (2008)</p>	<p>Pilgrim's Pride Corp., headquartered in Pittsburg, Texas, is the second-largest chicken producer in the United States and Puerto Rico. The company filed for Chapter 11 bankruptcy in 2008.</p> <p>The company processes about 44 million birds per week, resulting in almost 4 billion kg of product per year, as well as 528 million table eggs. Pilgrim's Pride Corp. is vertically integrated, meaning the company has its own divisions for each production process from "egg-to-table". It is a supplier of Kentucky Fried Chicken, Wal-Mart, Publix and Wendy's.</p>
<p>■ 4 Perdue Farms <i>United States</i> www.perdue.com Founded: 1920 Employees: 21,000 people Revenue: USD 4.3 billion¹³ (2007) 2,250 contracted poultry farmers</p>	<p>Perdue Farms is a major chicken processing company based in Salisbury, Maryland. The company filed for Chapter 11 bankruptcy in December 2008. Since then, it has closed three of its processing facilities.</p> <p>The company operates live production and processing facilities in about 15 states through 2,250 contracted poultry farmers. The Perdue Farms division processes and packs 1.4 billion kg of chicken and 122 million kg of turkey per year.</p>
<p>■ 5 Sanderson Farms <i>United States</i> www.sandersonfarms.com Founded: 1947 Employees: 1,080 people Revenue: USD 1.7 billion¹⁴ (2008)</p>	<p>Sanderson Farms is the fifth largest fully integrated poultry producer and processor. It provides both fresh and frozen chicken products to food-service companies, restaurants, grocery stores, and supermarkets across the United States, and to brokers who resell frozen chicken to export markets.</p>

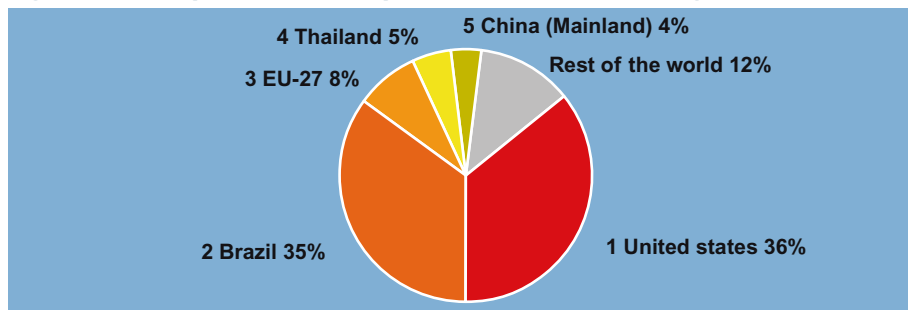
Other major producers include: Cargill (the United States), Wayne Farms (the United States), Montaire Farms (the United States), Dachan (China) and CP Foods (Thailand)¹⁵.

4.7 Global trade in poultry meat

Animal diseases such as avian influenza or Newcastle disease have affected poultry meat trade during recent years. Support policies for biofuels in many developed countries determine the availability of grain for feed production. Sanitary requirements, however, ultimately determine whether an increase in market access can de facto be used or not. The evolution of reciprocal sanitary agreements, therefore, along with tariff reduction, play a crucial role in shaping the world's meat trade.

Encouraged by the strong demand from several importing countries, poultry meat exports increased at a steady pace and reached almost 11% of total world production. The United States is the top exporter with Brazil close behind (see Figure 11 and Table 8). Together they control 71% of the global chicken trade. The EU-27, Thailand and China round out the list of the major exporters.

Figure 11: Main poultry meat exporters and their share in global trade, 2008



Source: *FAO Food Outlook, June 2009*

¹⁰ *Financial Times*.

¹¹ *BusinessWeek*.

¹² *Yahoo! Finance*.

¹³ *Yahoo! Finance*.

¹⁴ *Yahoo! Finance*.

¹⁵ Based on the United States Poultry & Egg Export Council (USAPEEC) rating.

Table 8: Global poultry meat export trend and main exporting countries (thousand tons)

		2004	2005	2006	2007	2008	CAGR 2008/2004 %
	World	7,733	9,092	8,922	9,790	10,531	36
Top 5	■ 1 United States	2,777	3,036	3,102	3,414	3,800	37
	■ 2 Brazil	2,698	3,261	2,964	3,458	3,700	37
	■ 3 EU	948	950	964	789	875	-8
	■ 4 Thailand	319	411	447	502	520	63
	■ 5 China (Mainland)	331	471	479	513	395	19
EBRD region	Russian Federation	2	20	3	3	2	0
	Ukraine	12	12	8	6	8	-33
	Kazakhstan	n/a	n/a	n/a	3	n/a	n/a
	Turkey	29	47	41	53	80	176

* EU-25 from 2004 to 2006 and EU-27 from 2007.

Source: FAO Food Outlook, June 2009

After the break up of the Soviet Union, the *United States* entered the markets of the Commonwealth of Independent States (CIS) ahead of the other main exporters Brazil and the EU. Since then, the United States has remained the main supplier of poultry meat to the CIS.

Brazilian exporters, by diversifying their markets, confirmed their leading position in global poultry trade. A 7% growth was registered in 2008 in response to strong import demand from countries in the EU, the Near East, such as Saudi Arabia and the United Arab Emirates, and Asia, particularly Hong Kong and Japan.

Exports from the EU, the third largest poultry exporter, face stiff competition from exports of the two main exporters, the United States and Brazil. They also face difficulties in gaining access to the Russian Federation's poultry market due to the historical principle of import quota distribution and poultry plant inspection demands established by the Russian food safety authorities.

On the import side, trade in poultry meat increased by 7% to 10.3 million tons, due to increased import demand¹⁶.

¹⁶ FAO Food Outlook, June 2008.

Table 9: Global poultry meat imports trend and main importing countries (thousand tons)

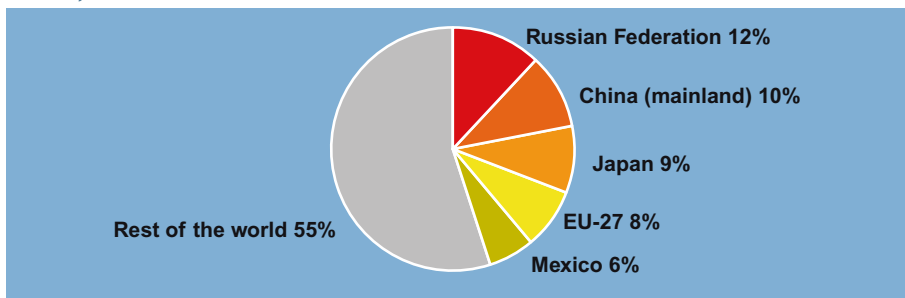
		2004	2005	2006	2007	2008	CAGR 2008/2004 %
	World	7,304	8,290	8,630	9,677	10,330	41
Top 5	■ 1 Russian Federation	1,122	1,342	1,286	1,307	1,235	10
	■ 2 China (Mainland)	261	470	701	1,016	1,056	305
	■ 3 Japan	696	913	887	867	910	31
	■ 4 EU	568	642	656	820	835	47
	■ 5 Mexico	459	549	607	584	651	42
EBRD region	Ukraine	285	126	136	129	236	-17
	Kazakhstan	14	11	33	21	21	50
	Turkey	117	114	94	75	70	-40

* EU-25 from 2004 to 2006 and EU-27 from 2007.

Source: FAO Food Outlook, June 2009

The Russian Federation, China, Japan, the EU-27 and Mexico are the main poultry meat importers.

Figure 12: Main poultry meat importers and their share in global trade, 2008



Source: FAO Food Outlook, June 2009

The Russian Federation, is the largest importer of broiler meat in the world. The government of the Russian Federation established import quotas in the early 2000s to encourage domestic poultry meat production. Since then, the country has established rigid food safety regulations and imposed mandatory inspections of the facilities of foreign suppliers.

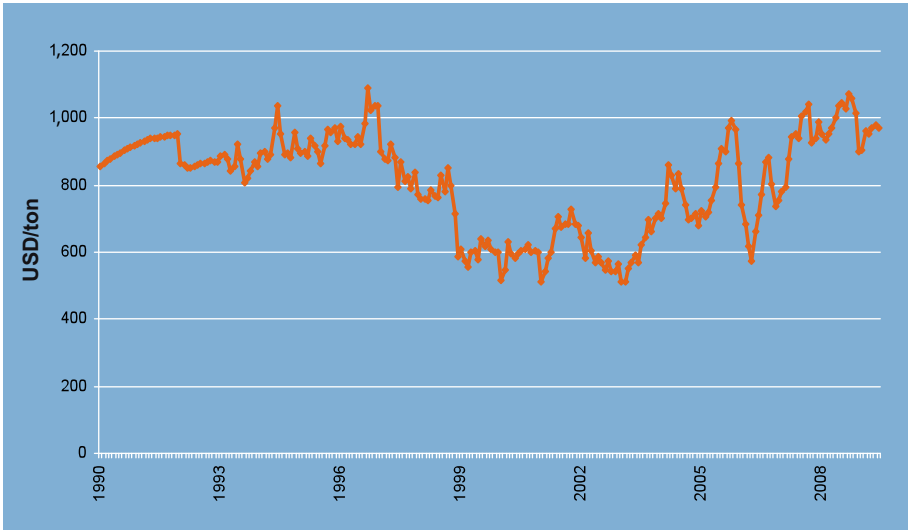
Half of the growth in poultry imports originated in Asia, especially China, where consumers are substituting broiler meat for pig meat.

The EU became a net importer in 2008, with Brazil being the major supplier. In 2008, imports increased by 2%. The importers exceeded the import quotas because high domestic prices made importing profitable despite full import duties.

4.8 Prices of broiler meat

The increase in meat prices during 2008 likely increased poultry meat producers' margins, which had been deteriorating over the last few years. However, following the price decrease since October 2008, profit outlooks for poultry producers seem uncertain. The fall of meat prices largely reflects the weakening of demand, as a worsening of the global economic environment negatively affects consumption growth, especially in the developed countries¹⁷.

Figure 13: Poultry prices, 1990–2009 (US broiler cuts, EUV, USD/ton)



Source: FAO internal data

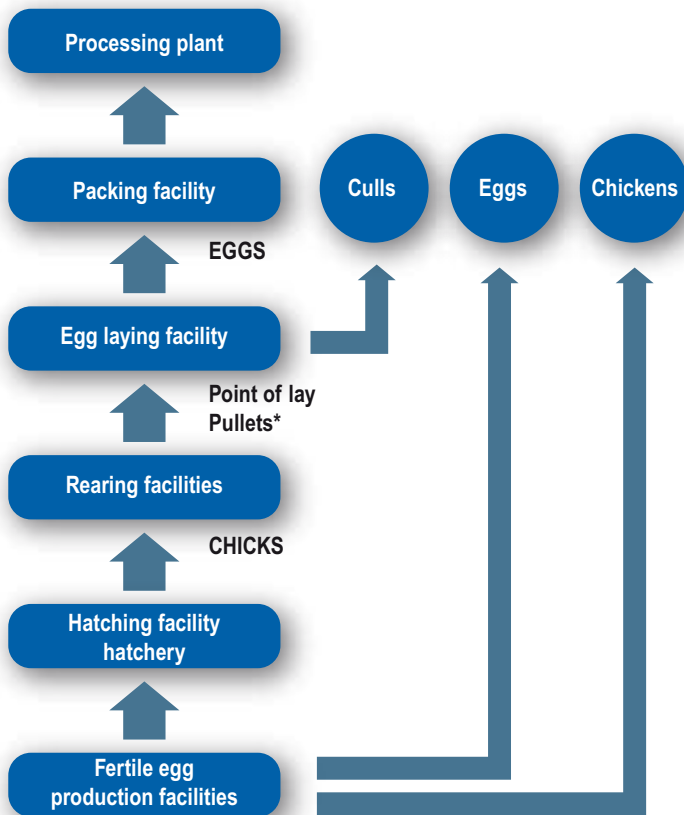
¹⁷ FAO Food Outlook, June 2009.

5. LAYING HENS FOR EGG PRODUCTION

5.1 Raising egg-laying hens

It is almost impossible that any companies rears layers in exactly the same way. All companies use a slight variation of the typical rearing programme described in this section. Management differences in rearing layers may be accounted for by economics (breed selection, vaccination package and the decision as to when to allow moulting), producer preference (breed and strain selection) and/or geography (breed selection and vaccination package).

Figure 14: Egg production process



* A young domestic hen, usually one that is less than one year old.

Hatching and placement. Egg producers purchase their layer stock (i.e. day-old Leghorn or other genetic lines of chicks) from a hatchery. At the hatchery, chicks are vaccinated according to the producer's specifications. Hatcheries deliver chicks to the producer within one to two days of hatching. Upon arrival, chicks are placed in typical layer pens or are reared in a pullet house.

Lighting and temperature. From chick placement through to approximately 16 weeks of life, the pullets are fed according to body-weight gain and/or age. The goal is to raise a strong and healthy bird that can support egg production. An increase in daily light exposure triggers hens to begin laying eggs. If the laying hen has not reached proper body weight (usually 1 kg) by week 18, egg production will cease very quickly.

Feeding. Feed is usually offered to birds via the chain system. The chain system transports feed into the metal feeder at precise times during the day. In addition to monitoring dietary protein, producers must closely examine other feed ingredients: lysine, methionine, calcium and phosphorus. Before being slaughtered, laying hens are given appropriate feed to reconstitute muscle volume.

Egg production. Hens start laying regularly at around 18–20 weeks of age and in commercial systems, they typically lay for about a year before being sent for slaughter¹⁸. Producers begin to photostimulate (regulate the light and its intensity) and adjust the diet around 18 weeks of age in order to support egg production. The calcium levels in the diet are approximately 5–7 times greater than phosphorus levels. When a flock first enters egg production, the rate of egg lay will be around 10 to 20%. This means that 10 to 20% of the hens are laying eggs at 18 to 22 weeks of age. The flock quickly reaches peak egg production (>90%) at 30 to 32 weeks of age. After about 50 weeks, when the laying curve decreases greatly, hens are gathered a few weeks out of the regulated light cycle in order to perform the so-called moulting (change of feathers). A second laying cycle can then begin. Post-peak egg production (after 30 to 32 weeks of age) continually decreases to approximately 50% of the hens around 60 to 70 weeks of age. At this point an economic decision must be made by the producer; production by 50% of the hens is near the “break-even” point for egg producers (e.g. feed cost = market price of eggs).

The time from ovulation to laying is about 25 hours. About 30 minutes after laying, the hen will begin to make another egg. Commercial hens have been bred to produce a very high yield of around 300 eggs per year. Feed quality, heat regulation, sanitary control and animal density within hen-houses are the key factors that affect chick mortality rates.

¹⁸ *Layers raised organically and used for producing organic eggs are much more valuable at the end of their production cycle; they can be sold as roasters. Non-organically raised layers are sold for use as protein supplements for dog and cat food.*

Egg collection. Hens lay eggs onto an angled wire floor and the eggs roll towards the front of the cage and onto a belt. The belt transports eggs out of the house either to the egg packaging facility or to a storage cooler. Once the eggs enter the egg packaging centre, they are washed (detergent solution near 40 °C and pH 11 that removes soil) within minutes or no later than 12 to 14 hours post-lay.

Bacteria can be on the outside of an eggshell because the egg exits the hen's body through the same passageway as faeces; thus, the reason for washing and sanitizing eggs at the processing plant. Bacteria can be inside an uncracked, whole egg. Contamination of eggs may be due to bacteria such as *Salmonella Enteritidis* in the hen's ovary or oviduct before the shell forms around the yolk and white. *Salmonella Enteritidis* does not make the hen sick. It is also possible for eggs to become infected by *Salmonella Enteritidis* faecal contamination via the pores of the shells after they have been laid.

After washing, eggs are visually inspected (checked for eggshell problems, cracks and blood spots), and then graded for packaging. The weight of a hen's egg may vary from 50 to 70 g, but the average weight is 55 g. Following packaging, eggs are moved to a cool room (4–7 °C), where they await shipment to retail outlets.

Sizing of eggs	
Chicken eggs are graded by size for the purpose of sales. In Europe, current egg sizes are defined as follows:	
Modern sizes (Europe)	Mass per egg
Very large	73 g and over
Large	63–73 g
Medium	53–63 g
Small	53 g and under

5.2 The composition and nutritional value of eggs

Eggs are one of nature's highest quality sources of protein and indeed contain many important nutrients. They are a good source of high biological-value protein and they are easily digested. Therefore, they are valuable food for people who are recovering from illness.

Eggs are composed of three main parts:

1. Shell
2. Egg white
3. Egg yolk

88.5% of an egg is edible.

Shell. The shell of an egg is porous to allow the developing chick to obtain oxygen. Other than oxygen, bacteria and odours can enter the egg. The pores also allow water and carbon dioxide to escape. The membrane that lines

the inside of a shell acts as a filter to protect against bacteria. At one end of the egg, the membrane separates into an air space to supply the chick with oxygen. The shell is generally strong but the older birds tend to produce weaker shells. The shell's colour varies according to the breed of the bird.

Egg white. There are two layers of egg white:

1. The thick white layer (nearest to the yolk)
2. The thin white layer (nearest to the shell)

Yolk. The colour of the egg yolk is related to the diet of the hen and is due to the presence of carotenes and colourings added to a hen's feed. The nutritional value of the egg is not affected by the colour of the yolk.

The nutritional content of egg white is:

- 10.5% protein
- 88.5% water
- riboflavin and other B vitamins
- a trace of fat

The nutritional content of egg yolk is:

- 16.5% protein
- 33% fat
- 50% water
- fat-soluble vitamins A, D, E and K
- mineral elements, including iron
- lecithin (an emulsifier)

5.3 Egg products

The term "egg products" refers to eggs that are removed from their shells for processing. The processing of egg products includes breaking eggs, filtering, mixing, stabilizing, blending, pasteurizing, cooling, freezing or drying, and packaging. Liquid, frozen, and dried egg products are used widely by the food-service industry and the commercial-food industry. They are scrambled or made into omelettes, or used as ingredients in egg dishes or other foods such as mayonnaise or ice cream. Pasteurized egg products are products that were rapidly heated and held at a minimum required temperature for a specified time. This destroys *Salmonella*, but it does not cook the eggs or affect their colour, flavour, nutritional value or use. Dried whites are pasteurized by heating them in the dried form again for a specified time and at a minimum required temperature.

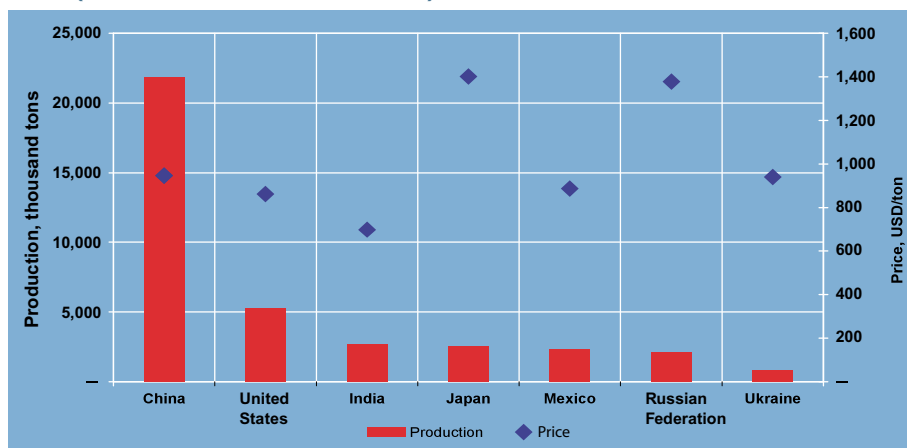
Egg white powder is dried egg white (pure albumen). It can be reconstituted by mixing the powder with water. The reconstituted powder whips like fresh egg white and, because it is pasteurized, can be used safely without cooking or baking it. The product is usually sold along with supplies for cake baking and decorating.

Eggs are commonly used in food preparation for:

- **Thickening.** Eggs are used to thicken custards, sauces, soups, etc., because of the coagulation of the egg proteins.
- **Emulsifying.** Egg yolk contains lecithin, which is an emulsifier and enables oil and water to be mixed without separating. It is used in making mayonnaise and cakes.
- **Binding.** Ingredients for rissoles, croquettes, and meat or fish cakes can be bound together with egg, which when heated will coagulate and hold the ingredients together.
- **Coating.** Eggs are used as a coating for fried foods because they form a protective layer on the outside of the food that sets and holds the food together and prevents it from being overcooked.
- **Glazing.** Egg yolk, egg white or whole egg is brushed over pastries and bread to produce a golden brown shiny glaze during baking.

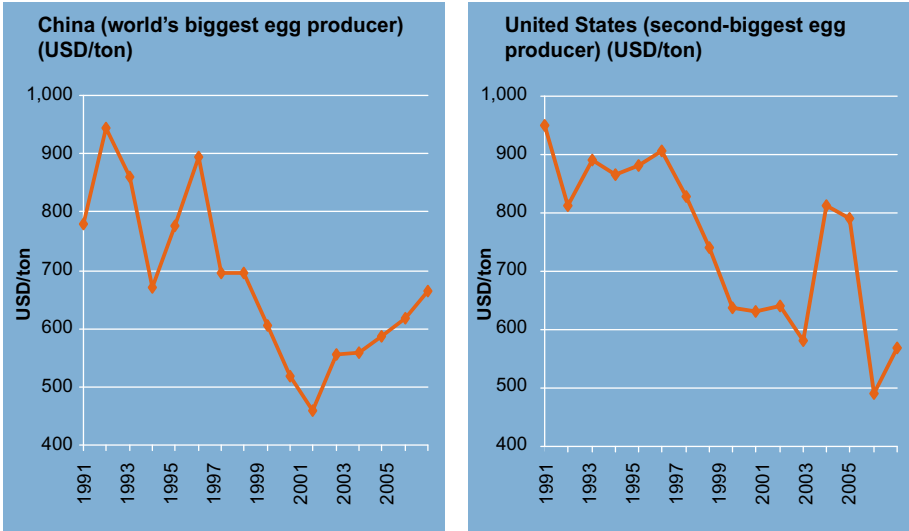
5.4 Sale prices of hen eggs

Figure 15: Average producer prices of hen eggs in selected countries, 2007 (thousand tons and USD/ton)



Source: FAOSTAT. © FAO Statistics Division 2009

Figure 16: Dynamics of egg prices in selected countries, 1991–2005



Source: FAOSTAT. © FAO Statistics Division 2009

5.5 Average margins of breeders

Feed costs often represent more than 70% of the production cost of a dozen eggs. Feed costs per dozen eggs must always be the least cost against expected egg revenue in order to maximize profits. Any savings from reduced feed consumption will usually increase the profit margin.

Egg producers will normally attempt to get the largest number of high-quality eggs of the correct size from each hen housed in the shortest period of time at the lowest cost. There are numerous feeding and management programmes that have an effect on producers' investments. A sample of a gross margin in egg production is provided in Table 10 (a contract-growing facility).

Table 10: Gross and net margins before marketing costs (all egg production systems)

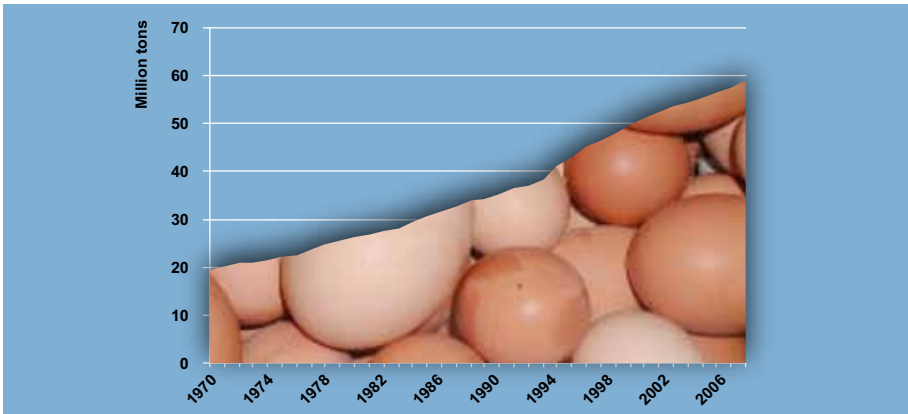
		£/bird	Pence/dozen (own produced eggs)
Output	Egg output from own birds	22,19	
	Total bird depreciation	-3,69	
	Net margin from egg purchases for resale	0,13	
	Miscellaneous revenue	0,02	
	Total gross output (a)	18,65	80,37
Production costs (variable)	Feed	9,47	
	Packing materials	0,04	
	Disposal of old hens	0,11	
	Vet	0,08	
	Contract charges (excl. milling & mixing)	0,21	
	Causal labour	0,02	
	Others	0,06	
	Total variable costs (b)	9,98	43,04
Gross margin before marketing costs (a-b) = (c)		8,66	37,33
Production costs (fixed)	Mill & mixing charge (incl. labour/contract)	0,02	
	Production buildings charge	0,58	
	Specialist production equipment charge	0,87	
	Mobile equipment charges	0,09	
	Labour: farmer & spouse (f)	0,47	
	unpaid labour	0,06	
	paid labour	1,81	
	Electricity	0,26	
	Other heating fuels	n/a	
	Water	0,08	
	Office expenses	0,17	
	General insurance	0,15	
	Rent or rental value	0,23	
	Free range/organic paddock costs	n/a	
	Others	0,08	
Total fixed costs (d)	4,86	20,94	
Net margin before marketing costs (c-d) = (e)		3,80	16,39
Net margin plus farmer & spouse labour (Before marketing costs) (e+f)		4,28	18,38

Source: *The Economics of Egg Production*. School of Social Sciences, The University of Manchester, February 2005

5.6 Egg production

Global egg production has rapidly grown in recent years. It has tripled since 1970 when global output was about 20 million tons compared with almost 60 million tons in 2007 (see Figure 17). Experts from the International Egg Commission expect that within a few years the production volume of eggs will be greater than that of beef and veal (assuming the growth rates remain fairly constant).

Figure 17: Dynamics of in-shell egg production in selected countries (million tons)



Source: FAOSTAT. © FAO Statistics Division 2009

It is estimated that there are 4.93 billion egg-laying hens¹⁹ in the world. Approximately 800–1,000 million laying hens are kept in China, 276 million hens are kept in the United States, over 380 million hens are kept in the laying flock in the EU-27, 133 million hens are kept in India and 115 million hens are kept in Mexico.

In some countries, many of the hens are traditional breeds kept outdoors in villages and backyards or on smallholdings. However, over 60% of the world's eggs are produced in industrialized systems, mostly using battery cages. In some EU countries and in the United States, nearly all the hens are caged.

The eggs from the hens are sold either in their shells for use by restaurants and consumers or processed into egg products that are used later in a wide range of food products from soups and sauces to ready meals, cakes, biscuits and desserts.

¹⁹ The International Egg Commission.

In 2007, around 59 million tons (or 93.2 dozen eggs) were produced around the world. Asia, the largest egg producing region (58% of global output), produced 34.4 million tons in 2007 and China, the world's largest egg producing country, produced 21.8 million tons (37% of global egg production). The EU produced just over 6.4 million tons, while the United States produced 5.3 million tons (see Table 11 and Figure 18).

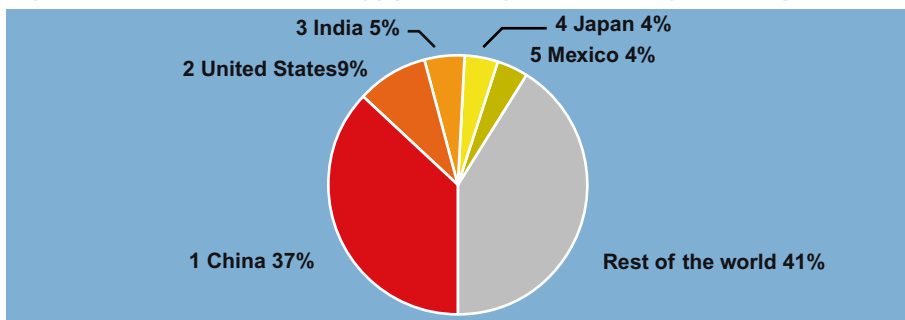
Table 11: Hen egg production in selected countries (million dozens and million tons)

	2003		2004		2005		2006		2007		2007/2003 (weight data) %
	M doz. eggs	M tons	M doz. eggs	M tons	M doz. eggs	M tons	M doz. eggs	M tons	M doz. eggs	M tons	
World	1,023	54.4	1,043	55.4	1,066	56.6	1,084	57.6	1,107	59.0	8
■ 1 China	404	20.2	410	20.5	421	21.0	419	20.9	437	21.8	8
■ 2 United States	87	5.2	89	5.3	90	5.3	91	5.4	90	5.3	2
■ 3 India	40	2.2	45	2.5	46	2.5	47	2.6	49	2.7	23
■ 4 Japan	42	2.5	41	2.5	41	2.5	42	2.5	42	2.5	0
■ 5 Mexico	37	1.9	40	2.0	40	2.0	46	2.3	46	2.3	21
EU	112	6.6	117	6.8	114	6.6	112	6.5	110	6.4	-3
Russian Federation	36	2.0	36	2.0	37	2.0	38	2.1	38	2.1	5
Ukraine	11	0.6	12	0.7	13	0.7	14	0.8	14	0.8	33
Kazakhstan	2	0.1	2	0.1	2	0.1	2	0.1	3	0.1	0
Turkey	13	0.8	11	0.7	12	0.8	12	0.7	13	0.8	0

Source: FAOSTAT. © FAO Statistics Division 2009.

The top five egg producing countries contribute almost 60% of the global volume of egg production (based on 2007 delivery).

Figure 18: Share of the main egg-producing countries in global output, 2007



Source: FAOSTAT. © FAO Statistics Division 2009

China is by far the world's largest producer and consumer of eggs. Much of China's production is directly consumed in the country as fresh brown eggs.

The United States is the world's second largest egg producer. However, a major difference in consumer preferences and egg usage exists between the two nations. In the United States, about a third of production is processed eggs, and white eggs are more favoured for table use than brown eggs.

In the EU (production of 6.4 million tons), the main producing countries are France with 14% of total output in 2007, and Germany and Spain with 12% and 11% of output, respectively.

5.7 Egg consumption

Together with poultry meat, eggs are an important source of protein intake. With rising incomes, the demand for animal protein increases and the efficient conversion of feed into eggs stimulates animal protein consumption.

While total egg consumption and the uptake of eggs per capita continue to grow everywhere, in developing countries the gain is made from an increase in purchases of in-shell eggs. By contrast, for many developed economies, the gain reflects an increase in the purchase of egg products. Indeed, in the United States, the proportion of eggs broken for further processing and consumed in product form now exceeds 30% of total production²⁰.

During recent years, there has been significant growth in the use of egg products (liquid/frozen yolk, albumen, egg blends, ready-made omelettes). This reflects an increase in the number of meals eaten out of the home. At present, many consumers in developed countries are able to pay for the higher-priced eggs that were produced in line with certain animal welfare, feeding and environmental principles (free-range eggs as opposed to eggs produced by chickens kept in cages). However, these markets remain a niche for table egg producers.

Certain policies may have significant implications for egg consumption and trade in the near future. For instance, the EU aims at moving egg producers away from using conventional cages²¹ by 2012. EU regulations, if implemented, may result in a considerable increase in the importation of eggs and egg products by some of the EU member countries with high deficits in eggs and egg products.

²⁰ *The International Egg Commission.*

²¹ *For more information consult http://ec.europa.eu/food/animal/welfare/farm/laying_hens_en.htm*

Egg consumption per capita ranges widely among countries. In the countries surveyed by the International Egg Commission, consumption varied from a low of 47 eggs/capita/year in India to a high of 349 eggs/capita/year in China (see Table 12), where more eggs are eaten per person each year than in any other country in the world. The country with the second highest per capita consumption of eggs is Mexico (345 eggs/capita/year), followed by Japan (323 eggs/capita/year). Table 12 provides per capita egg consumption data for all major egg producing countries.

Table 12: Consumption of hen eggs in selected countries, 2007 (ranked by estimated consumption)

Country	Population, millions	Eggs per capita 2006			Eggs per capita 2007		
		In shell	In products	Total	In shell	In products	Total
China	1,321	n/a	n/a	340	286	63	349
Mexico	109	351	n/a	351	345	n/a	345
Japan	127	164	160	324t	155	169	323
Denmark	5	n/a	n/a	270	174	126	300
Hungary	10	n/a	n/a	295	n/a	n/a	295
Ukraine	46	n/a	n/a	n/a	280	11	291
United States	301	176	80	256	172	78	250
France	63	167t	84	251	169	76	245
Czech Republic	10	244	n/a	244	244	n/a	244
Austria	9	n/a	n/a	227	n/a	n/a	230
Italy	58	145	74	219	150	74	224
Spain	45	196	n/a	196	211	n/a	211
Germany	82	n/a	n/a	209	n/a	n/a	210
Belgium	11	108	92	200	108	92	200
Argentina	39	170	16	186	187	12	199
Sweden	9	164	34	198	162	35	197
Switzerland	8	113	72	184	117	72	189
Colombia	44	205	n/a	205	188	n/a	188
Norway	5	157	24	181	160	26	185
Netherlands	16	140	42	182	140	42	182
United Kingdom	60	140	33	173	143	35	178
Canada	33	138	49	187	132	42	174
Ireland	4	156	15	171	150	15	165

Country	Population, millions	Eggs per capita 2006			Eggs per capita 2007		
		In shell	In products	Total	In shell	In products	Total
Greece	11	120	12	132	n/a	n/a	136
Brazil	189	122	10	132	120	12	132
South Africa	48	118	6	124	130	7	130
India	1,177	38	n/a	38	47	n/a	47
Slovakia	5	199	n/a	199	n/a	n/a	n/a

Note: Few countries actually directly measure egg consumption. The published figures are derived from a number of calculations, all of which are surrounded by question marks.

Source: The International Egg Commission

Egg consumption has been increasing constantly in most Asian countries due to the growing purchasing power of an expanding middle class of buyers. Because Asia is home to roughly 60% of the global population, even a slight increase in per capita consumption in this region leads to a remarkable growth in global egg consumption trends.

Egg consumption in most of the EU member states has been fairly stable over the last years, with considerable increase being mainly attributed to the new member states and the growing buying power of their new middle class.

In developed economies, changes in real incomes have little or no impact on egg purchases. By contrast, in developing countries improvements in real disposable income play a significant role in the number of eggs purchased. Indeed, the two key factors impacting on the demand for eggs are population growth and real income growth. Other factors, such as changing lifestyles, type of egg production systems and health scares, have a role to play in influencing the demand for eggs but are mainly evident in developed economies.

In the developing countries, people are much less concerned about whether layers are kept in cages or not, or whether eating eggs can have a negative impact on the blood cholesterol levels of a small proportion of the population.

The news coverage given to the outbreaks of highly pathogenic avian influenza has not had as adverse an impact on the demand for eggs as it has had on the demand for poultry meat. By contrast, the publicity – much of it incorrect – about eggs and cholesterol has negatively hit egg consumption, particularly in developed economies.

5.8 Trade in eggs

Foreign trade in eggs is relatively small compared with that of poultry meat. As shown in Table 13, almost 273,000 tons or 0.5% of global egg production, including in-shell (liquid) and dried eggs, that entered world trade in 2007. About 90% of the world's in-shell egg trade occurs in Europe and Asia.

Table 13: The five leading egg exporting countries

Country	Item	Export quantity tons		Export value thousand USD	
		2006	2007	2006	2007
World	<i>Eggs dried</i>	51,469	54,767	192,190	226,942
	<i>Eggs liquid</i>	205,292	217,895	306,122	394,057
	Total eggs	256,761	272,662	498,312	620,999
■ 1 Netherlands	<i>Eggs dried</i>	5,118	6,457	22,374	32,119
	<i>Eggs liquid</i>	81,869	86,089	114,202	149,840
	Total eggs	86,987	92,546	136,576	181,959
■ 2 France	<i>Eggs dried</i>	6,454	6,729	27,675	33,530
	<i>Eggs liquid</i>	31,271	28,206	39,860	47,651
	Total eggs	37,725	34,935	67,535	81,181
■ 3 United States	<i>Eggs dried</i>	9,917	11,323	30,501	34,698
	<i>Eggs liquid</i>	15,889	15,335	27,870	26,403
	Total eggs	25,806	26,658	58,371	61,101
■ 4 Germany	<i>Eggs dried</i>	4,059	3,404	17,693	19,599
	<i>Eggs liquid</i>	9,792	13,306	18,274	27,265
	Total eggs	13,851	16,710	35,967	46,864
■ 5 India	<i>Eggs dried</i>	8,725	7,719	33,648	36,751
	<i>Eggs liquid</i>	61	351	141	652
	Total eggs	8,786	8,070	33,789	37,403
Russian Federation	<i>Eggs dried</i>	163	170	287	326
	<i>Eggs liquid</i>	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>
	Total eggs	163	170	287	326
Kazakhstan	<i>Eggs dried</i>	<i>n/a</i>	2	<i>n/a</i>	3
	<i>Eggs liquid</i>	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>
	Total eggs	<i>n/a</i>	2	<i>n/a</i>	3
Turkey	<i>Eggs dried</i>	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>
	<i>Eggs liquid</i>	9	9	17	21
	Total eggs	9	9	17	21

Source: FAOSTAT. © FAO Statistics Division 2009

There three categories of egg exports are:

- in-shell table eggs for consumption (i.e. the United States exports to Canada and Mexico);
- in-shell eggs for hatching (for egg-laying birds or broiler type birds); and
- egg products (dried and non-dried albumin and dried and non-dried yolk).

The EU dominated egg trade with a 68% share of in-shell egg exports and a 66% share of in-shell egg imports. The EU is the world's largest egg exporting region. In 2006, the EU-27 exported almost 781,000 tons of in-shell eggs. Main destination countries of the EU exports are Switzerland (22% of trade, in value), the Russian Federation (16% of trade) and Libya (14% of trade).

Many EU member states (the Netherlands, Germany and others) are significant egg importers (see Tables 14 and 15) as well as exporters. As mentioned above, the EU's decision to abandon the use of cages in egg production by 2012 will likely result in considerable import growth in some member countries.

Table 14: The five leading egg importing countries

Country	Item	Import quantity tons		Import value thousand USD	
		2006	2007	2006	2007
World	<i>Eggs dried</i>	56,899	60,601	210,202	248,274
	<i>Eggs liquid</i>	194,614	213,940	303,888	390,551
	Total eggs	251,513	274,541	514,090	638,825
■ 1 Germany	<i>Eggs dried</i>	7,555	6,441	34,167	31,712
	<i>Eggs liquid</i>	47,506	49,602	62,162	79,154
	Total eggs	55,061	56,043	96,329	110,866
■ 2 United Kingdom	<i>Eggs dried</i>	6,102	9,426	27,333	35,006
	<i>Eggs liquid</i>	15,561	22,125	26,561	40,722
	Total eggs	21,663	31,551	53,894	75,728
■ 3 Denmark	<i>Eggs dried</i>	7,776	5,588	27,839	26,092
	<i>Eggs liquid</i>	8,876	11,711	11,458	23,005
	Total eggs	16,652	17,299	39,297	49,097
■ 4 Belgium	<i>Eggs dried</i>	1,549	734	3,829	4,075
	<i>Eggs liquid</i>	21,787	21,706	34,439	41,851
	Total eggs	23,336	22,440	38,268	45,926

Country	Item	Import quantity tons		Import value thousand USD	
		2006	2007	2006	2007
■ 5 France	Eggs dried	1,476	1,902	5,592	7,018
	Eggs liquid	20,716	27,491	27,963	36,773
	Total eggs	22,192	29,393	33,555	43,791
Russian Federation	Eggs dried	2,699	2,571	7,416	6,731
	Eggs liquid	1	n/a	3	n/a
	Total eggs	2,700	2,571	7,419	6,731
Ukraine	Eggs dried	245	323	952	1,903
	Eggs liquid	0	0	0	0
	Total eggs	245	323	952	1,903
Turkey	Eggs dried	76	40	358	253
	Eggs liquid	3	2	11	12
	Total eggs	79	42	369	265

Source: FAOSTAT. © FAO Statistics Division 2009

The trade in dried eggs is similar to that of in shell or liquid eggs with an upward trend observed in recent years. Again, most of the trade is conducted among EU member states.

The dried egg products are used mainly in the restaurant and catering industry for the production of bakery and other prepared food products.

The EU-27 (the Netherlands and France most importantly) accounts for 43% of world export of dried egg products.

Table 15: The five leading exporting countries of egg products (eggs not in-shell and egg yolks)

Country	Net weight thousand tons			Trade value thousand USD		
	2005	2006	2007	2005	2006	2007
■ 1 Netherlands	82.8	87.4	107.2	124,569	137,956	211,375
■ 2 France	21.7	38.5	35.1	49,308	67,569	81,200
■ 3 United States	24.9	25.8	26.7	54,573	58,371	61,101
■ 4 Germany	14.3	17.5	16.7	33,929	42,775	47,125
■ 5 Denmark	5.8	11.8	11.3	14,197	43,872	50,200

Source: United Nations Commodity Trade Statistics Database

Table 16: The five leading importing countries of egg products (eggs not in shell and egg yolks)

Country	Net weight thousand tons			Trade value thousand USD		
	2005	2006	2007	2005	2006	2007
■ 1 Germany	54.7	60.3	56.0	88,606	102,947	110,767
■ 2 United Kingdom	21.2	21.5	30.5	47,492	53,656	73,775
■ 3 France	24.1	22.1	29.5	29,171	33,393	44,022
■ 4 Belgium	17.4	23.3	22.8	27,182	38,278	46,477
■ 5 Denmark	12.5	14.7	19.1	21,549	31,367	48,744

Source: United Nations Commodity Trade Statistics Database

6. THE POULTRY AND EGG INDUSTRIES IN THE EARLY TRANSITION COUNTRIES (ETCs) AND THE WESTERN BALKAN COUNTRIES (WBCs)

6.1 Poultry meat consumption

Chicken meat plays different roles in the meat diets of the populations of the two groups of countries. In the *Western Balkan Countries (WBCs)*, for instance, poultry is a popular meat and represents roughly 30% of total meat consumption (see Table 17 and Figure 19).

In the Caucasus region of the *Early Transition Countries (ETCs)*, namely Georgia and Armenia, chicken is even more popular than in the WBCs and accounts for almost 40% of total meat consumption due to the local culinary traditions. Poultry meat is popular in this region also because of its lower price in comparison with the price of lamb and other red meat.

In Central Asia and Mongolia, poultry meat is far less popular than in the Caucasus and the WBCs. Only an estimated 6% of meat consumed in this region is poultry. Mongolia is the country with the lowest registered poultry meat consumption (0.5% of total consumption). Tajikistan, thanks to significant poultry meat imports, is the country with the highest consumption of poultry meat (13% of total consumption). Traditionally, beef, the most popular meat in these countries, accounts for more than 50% of total meat consumption. However, in some countries, mutton, lamb and horse meat are more popular than beef (Kyrgyzstan and Mongolia are the leading consumer countries).

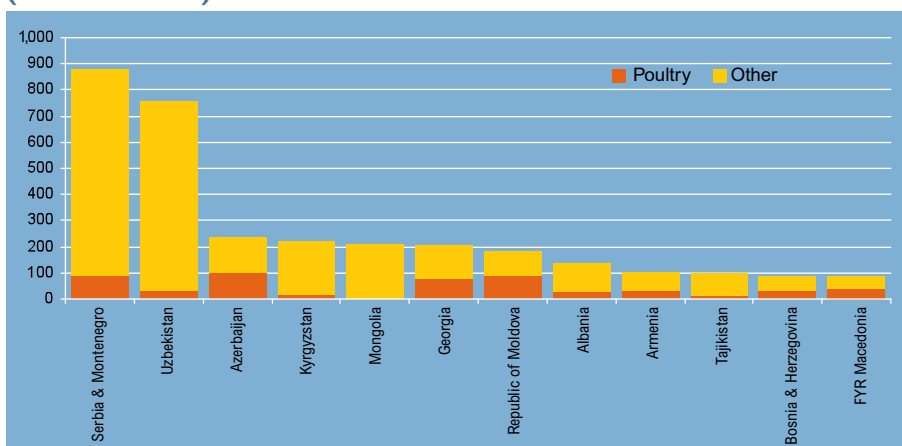
Table 17: Total meat domestic utilization and the share of poultry in total meat utilization (housand tons)

Country	Total meat		Poultry		% of poultry in total meat product	
	2007	2008	2007	2008	2007	2008
WBCs:						
Albania	134	138	27	29	20	21
Bosnia & Herzegovina	87	90	33	34	38	38
FYR Macedonia	87	90	39	41	45	46
Serbia & Montenegro	858	879	86	89	10	10
ETCs:						
Armenia	104	107	32	33	31	31
Azerbaijan	229	235	95	100	41	43
Georgia	200	203	72	74	36	36

Country	Total meat		Poultry		% of poultry in total meat product	
	2007	2008	2007	2008	2007	2008
ETCs:						
Republic of Moldova	173	180	83	86	48	48
Mongolia	204	208	1	1	0	0
Kyrgyzstan	218	219	14	16	6	7
Tajikistan	91	97	10	13	11	13
Uzbekistan	734	760	31	32	4	4

Source: FAO Food Outlook, June 2009

Figure 19: Share of poultry meat in total meat utilization (thousand tons)



Source: Based on Table 17

As incomes rise in the developing countries, consumers generally diversify their diets, moving away from staple foods and towards including more meat (along with dairy products and fruits). The new lifestyle favours “ready-to-eat” and “convenience” food products. This shift in consumption pattern increases the demand for high-value food products such as poultry meat and eggs.

This trend has already been observed in the WBCs and the ETCs. Poultry meat per capita consumption has risen two times in the WBCs, 11 times in the Caucasus region (the highest growth is registered in Georgia) and three times in Central Asia (the highest growth is in Tajikistan) in the last ten years. See Table 18 for country-level details.

Table 18: Per capita poultry meat consumption in the WBCs and the ETCs (kg/year)

Country	2004	2005	2006	2007	2008	CAGR 2008/2004 %
WBCs:						
Albania	9.6	9.7	7.5	8.3	8.8	-8
Bosnia & Herzegovina	6.8	6.2	6.4	7.8	7.9	16
FYR Macedonia	16.7	15.0	12.6	18.7	19.6	17
Serbia & Montenegro	10.4	10.0	8.0	8.2	8.5	-18
ETCs:						
Armenia	6.0	7.3	4.9	10.5	11.0	83
Azerbaijan	12.0	9.8	6.5	10.9	11.4	-5
Georgia	15.4	19.9	12.9	14.5	15.1	-2
Kyrgyzstan	1.0	1.0	1.4	2.6	2.8	180
Republic of Moldova	17.9	22.3	16.7	19.6	20.3	13
Mongolia	n/a	n/a	n/a	n/a	n/a	n/a
Tajikistan	1.3	0.9	1.3	1.5	2.0	50
Uzbekistan	0.9	1.1	1.1	1.1	1.1	19
Neighbouring markets:						
Kazakhstan	3.6	3.5	5.4	4.6	4.9	37
Russian Federation	16.2	19.2	20.7	22.6	24.7	52
Ukraine	13.5	12.8	15.1	16.8	22.1	64

Source: FAO Food Outlook, June 2009

The increasing domestic demand and relatively low domestic poultry meat production leave quite an important shortfall in supply that is currently being filled through imports. In the WBCs, local producers supply an estimated 50% of total domestic consumption, in the Caucasus they supply 30% of total domestic consumption, in the Republic of Moldova they supply 43% of total domestic consumption and in Central Asia they supply 36% of total domestic consumption. Mongolia has almost no significant poultry industry. By contrast, Uzbekistan produces 81% of the poultry consumed domestically. Please refer to Table 19 for further details.

Table 19: Consumption and production patterns in the WBCs and the ETCs (thousand tons)

Country	Domestic poultry consumption thousand tons		Domestic poultry production thousand tons		% of domestic poultry production consumed domestically	
	2007	2008	2007	2008	2007	2008
WBCs:						
Albania	27	29	8	9	30	31
Bosnia & Herzegovina	33	34	24	26	73	76
FYR Macedonia	39	41	4	3	10	7
Serbia & Montenegro	86	89	77	78	90	88
ETCs:						
Republic of Moldova	83	86	35	37	42	43
Armenia	32	33	5	5	16	15
Azerbaijan	95	100	49	50	52	50
Georgia	72	74	15	15	21	20
Mongolia	1	1	0	0	0	0
Kyrgyzstan	14	16	6	6	43	38
Tajikistan	10	13	3	3	30	23
Uzbekistan	31	32	25	26	81	81

Source: *FAO Food Outlook, June 2009*

6.2 Production of poultry meat and hen eggs in the WBCs and the ETCs

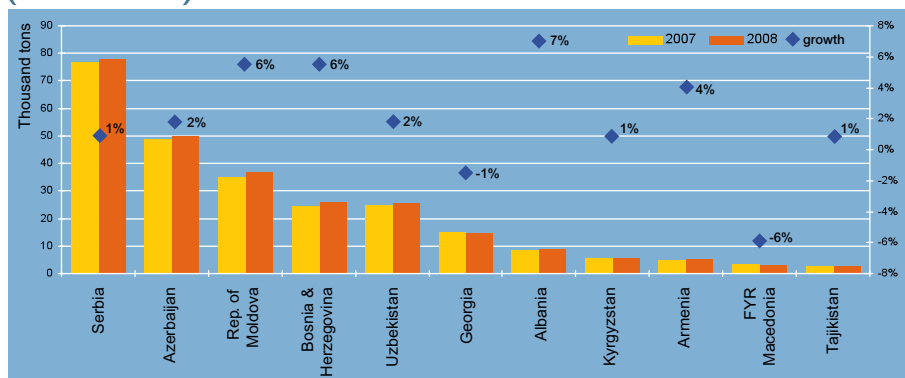
Serbia, Azerbaijan and the Republic of Moldova are the most important poultry meat producers with outputs of 78,000, 50,000 and 37,000 tons of broiler meat, respectively, in 2008 (Table 20 and Figure 20).

Table 20: Poultry meat production in the WBCs and the ETCs (thousand tons)

Country	2004	2005	2006	2007	2008	CAGR 2008/2004 %
WBCs:						
Albania	9	9	10	8	9	0
Bosnia & Herzegovina	16	12	17	24	26	63
FYR Macedonia	3	4	4	4	3	0
Serbia & Montenegro	86	89	75	77	78	-9
ETCs:						
Armenia	4	5	5	5	5	25
Azerbaijan	32	35	36	49	50	56
Georgia	15	17	17	15	15	0
Kyrgyzstan	5	5	5	6	6	20
Republic of Moldova	25	28	31	35	37	48
Mongolia	0	0	0	0	0	0
Tajikistan	2	3	3	3	3	50
Uzbekistan	17	21	23	25	26	53
Neighbouring markets:						
Kazakhstan	41	43	50	52	54	32
Russian Federation	1,182	1,381	1,624	1,850	2,200	86
Ukraine	375	497	589	670	804	114

Source: FAO Food Outlook, June 2009

Figure 20: Poultry meat production and growth in the WBCs and the ETCs (thousand tons)



Source: FAO Food Outlook, June 2009

When private business moved into the poultry industry after the fall of the centrally planned economies in the WBCs and the ETCs, local poultry production and processing facilities were severely hampered by technological and managerial inefficiencies (outdated equipment and lack of a skilled and motivated workforce). In a little over ten years, many countries showcase successful projects in the poultry industry. For example, the Albanian company Driza Limited currently produces high-quality poultry and poultry meat products on an industrial scale.

In the Caucasus as well, poultry meat production has been rising over recent years, doubling between 2000 and 2008. The Georgian poultry industry is doing well compared with the difficulties in other agricultural sectors. There are 20 large- and medium-sized poultry farms and about 1,500 small farms in the country, employing a total of 10,000 people²⁴. The Kvemo Kartli region, with 1.1 million birds, is the most important poultry producer in Georgia. In Armenia, until 1997–1998 the demand for chicken eggs was met predominantly through imports. Since the spring of 2001, Armenia stopped importing eggs and has become an egg exporter. The most popular local products are supplied by the companies Arzni and Lusakert.

In Central Asia, the poultry industry has also grown almost 3%, with Uzbekistan contributing to this positive growth. There are 58 poultry farms, of which 20 are broiler farms, 26 are laying-hen farms, 5 are turkey farms and 7 farms are specialized breeding farms.

In Tajikistan, there are 16 poultry farms, which²⁵ produce 3,000 tons of poultry meat and over 100 million eggs per year. This production covers about 25% of the domestic demand for poultry meat. Poultry farming is mostly located in the districts of Vahdat, Jomi and Shahritus, as well as in the city of Kulob.

In Mongolia, until recently there were 27 chicken farms. However, seven farms had to shut down because of difficulties arising from the economic crisis and growing egg imports. As per Mongolia's Poultry Association, 345,000 laying hens could supply all of Mongolian's demand for eggs. For the time being, the parliament does not plan to halt egg imports (which would help the domestic sector to cope with the financial crisis) but has approved a tax increase on imported eggs²⁶. Despite high local meat production, poultry from the United States has been popular, especially in Ulaanbaatar. Outside Ulaanbaatar, sales of frozen products are limited by the undeveloped cold-storage chain and by low incomes. As a result of the recent economic crisis, the significant decrease in meat prices and imports reflects

²⁴ *Business/Rezonansi (Resonance)*, July 2008.

²⁵ MOA, 2008 data.

²⁶ <http://ubpost.mongolnews.mn> (accessed 19 March 2009).

decreased consumer incomes. United States exports of chicken meat to Mongolia peaked at a record high of USD 2.2 million in 2008.

The poultry industry in the ETCs and the WBCs is characterized by a relatively low productivity. Farmers in Serbia, the Republic of Moldova and Uzbekistan obtain the best results in terms of the carcass weight of poultry: 1.4–1.5 kg per year of carcass weight as compared with 1.8 kg per year of carcass weight obtained by producers in the United States.

Table 21: Stock of different poultry in the WBCs and the ETCs, 2007 (thousand birds)

Country	Chickens	Ducks	Geese and guinea fowls	Turkeys
WBCs:				
Albania	4,712	600	400	900
Bosnia & Herzegovina	13,800	370	450	370
FYR Macedonia	2,264	n/a	n/a	n/a
Montenegro	449	n/a	n/a	n/a
Serbia	15,708	289	91	238
ETCs:				
Armenia	3,870	n/a	n/a	228
Azerbaijan	18,000	n/a	n/a	761
Georgia	5,050	n/a	n/a	350
Kyrgyzstan	4,473	131	80	160
Republic of Moldova	22,400	n/a	n/a	131
Mongolia	100	n/a	n/a	n/a
Tajikistan	2,580	n/a	n/a	n/a
Uzbekistan	24,220	n/a	n/a	360

Source: FAOSTAT. © FAO Statistics Division 2009

For more information on poultry companies operating on ETCs and WBCs, please see www.eastagri.org/agribusiness.

Small-scale poultry production in farmers' backyards is very common in all the ETCs and many WBCs. The combination of backyard chicken raising and modern poultry farming creates difficulties in veterinary control and disease prevention. The affect of avian influenza²⁷ has already been seen in some countries of the regions. This disease creates a significant risk for investors

²⁷ For updates on highly pathogenic avian influenza consult the web site of the World Organization for Animal Health at http://www.oie.int/download/AVIAN%20INFLUENZA/A_AI-Asia.htm

because industrial farmers cannot always control the territories around their poultry houses or cannot prevent their workers from raising poultry at home.

The production of hen eggs has been recovering (see Table 22).

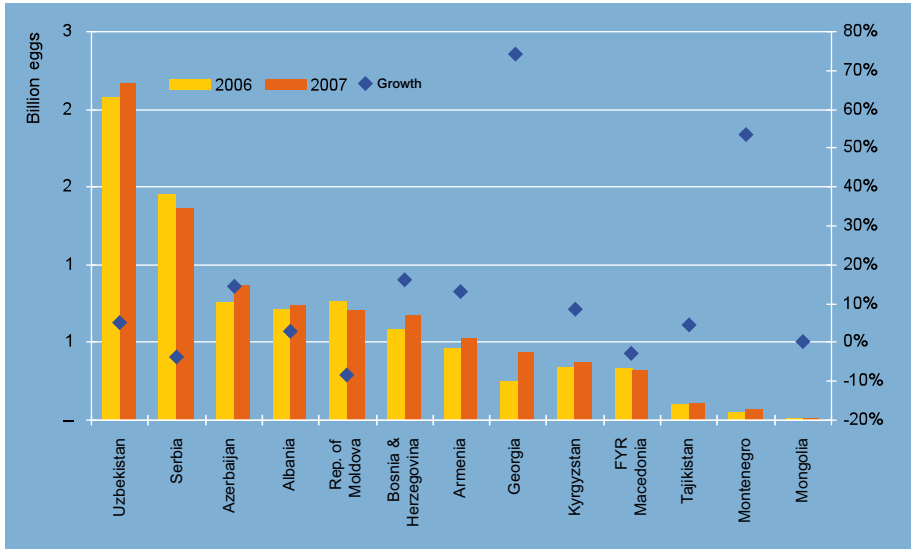
Table 22: Production of hen eggs, in-shell, in the WBCs and the ETCs (million eggs)

Country	2003	2004	2005	2006	2007	CAGR (2007/2003) %
WBCs:						
Albania	720	780	738	716	736	2
Bosnia & Herzegovina	498	558	514	460	521	5
FYR Macedonia	682	829	875	761	871	28
Montenegro	566	544	587	580	678	20
Serbia	454	492	500	248	434	-4
ETCs:						
Armenia	2,254	2,293	2,496	2,482	2,650	18
Azerbaijan	266	297	316	342	372	40
Georgia	618	666	759	763	702	14
Kyrgyzstan	7	8	8	7	7	0
Republic of Moldova	n/a	n/a	n/a	47	71	n/a
Mongolia	36,296	35,562	36,691	37,651	37,559	3
Tajikistan	n/a	n/a	n/a	1,456	1,364	n/a
Uzbekistan	57	78	99	105	111	95
Neighbouring markets:						
Kazakhstan	277	334	340	331	321	16
Russian Federation	11,380	11,883	12,955	14,122	13,978	23
Ukraine	1,629	1,863	1,964	2,080	2,165	33

Source: FAOSTAT. © FAO Statistics Division 2009

Serbia, as shown in Figure 21, is the strongest egg producer in the WBCs, while Uzbekistan is the leader among the ETCs.

Figure 21: Production of hen eggs in-shell in the WBCs and the ETCs (in billion eggs) and relative growth



Source: FAOSTAT. © FAO Statistics Division 2009

6.3 Trade in poultry meat and eggs

Economic and population growth together with new consumption patterns and EU membership perspectives for some of the WBCs shape trade flows. Table 23 provides information on poultry meat imports and the major partners of the countries covered in this section.

Table 23: Imports of poultry meat by the WBCs and the ETCs (thousand tons)

Country	Partners	2004	2005	2006	2007	2008	CAGR 2008/2007 %
WBCs:							
Albania	Brazil, Italy, United States, Greece	22	22	15	19	20	5
Bosnia & Herzegovina	Croatia, Turkey, Netherlands	13	14	10	10	9	-10
FYR Macedonia	Brazil, Slovenia, United States, Canada	32	27	23	36	38	6

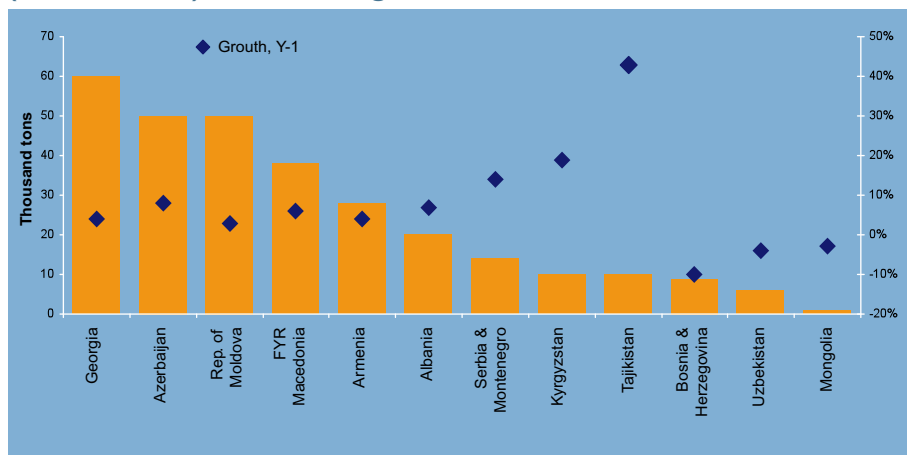
Country	Partners	2004	2005	2006	2007	2008	CAGR 2008/2007 %
WBCs:							
Serbia & Montenegro	Bosnia & Herzegovina, Hungary	25	18	11	12	14	17
ETCs:							
Armenia	United States, Brazil, Canada	14	18	10	27	28	4
Azerbaijan	Brazil, Turkey, United States	69	49	20	46	50	9
Georgia	United States, Brazil, Belgium, Canada	64	85	48	58	60	3
Kyrgyzstan	United States, China, Brazil	0	0	2	8	10	25
Mongolia	United States	0	0	1	1	1	0
Republic of Moldova	United States, Brazil	53	67	41	49	50	2
Tajikistan	n/a	6	3	6	7	10	43
Uzbekistan	n/a	8	8	8	6	6	0

Source: *FAO Food Outlook, June 2009*

The largest importing countries are Georgia, Azerbaijan and the Republic of Moldova, and Azerbaijan and the Republic of Moldova are also the biggest producers of poultry meat.

Imports continue to grow despite the fact that many of importing countries have banned imports from such countries as Turkey, the Russian Federation and Romania, which have registered avian influenza outbreaks.

Figure 22: Main importers of poultry meat in the WBCs and the ETCs (thousand tons) and relevant growth, 2008



Source: FAO Food Outlook, June 2009

The following WBCs and ETCs are members of the World Trade Organization (WTO); therefore, their tariff protection and application of sanitary measures are regulated by applicable WTO agreements.

Table 24: List of the WBCs and the ETCs with membership in the WTO

Country	Date of membership
Albania	September 2000
Armenia	February 2003
FYR Macedonia	April 2003
Georgia	June 2000
Kyrgyzstan	December 1998
Republic of Moldova	July 2001
Mongolia	January 1997

Source: www.wto.org

On the export side, only four countries in the regions ship their poultry meat to neighbouring states (see Table 25).

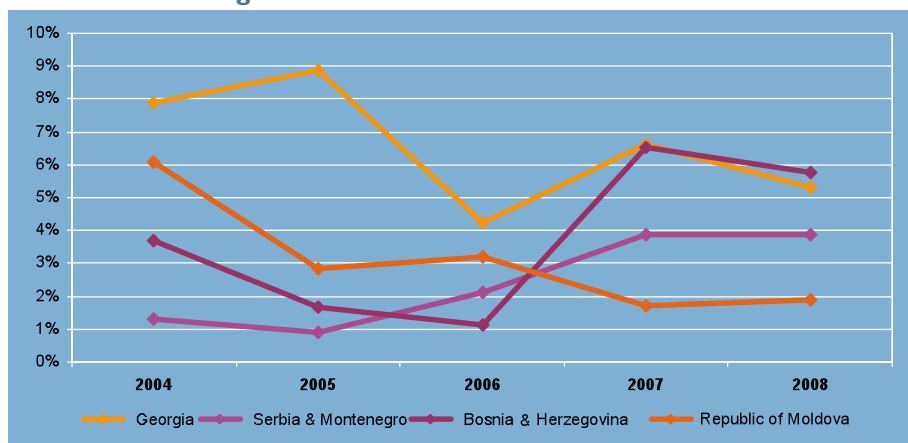
Exports of poultry meat are relatively insignificant as compared with imports of most of the WBCs and the ETCs.

Table 25: Exports of poultry meat by the WBCs and the ETCs and share of export in domestic production (thousand tons)

Country	2004		2005		2006		2007		2008		Main partner
	Export	% of prod.	Export	% of prod.	Export	% of prod.	Export	% of prod.	Export	% of prod.	
Georgia	1.2	7.9	1.5	8.9	0.7	4.2	1	6.6	0.8	5.3	Azerbaijan, Armenia
Serbia & Montenegro	1.1	1.3	0.8	0.9	1.6	2.1	3	3.9	3	3.9	Montenegro, FYR Macedonia
Bosnia & Herzegovina	0.6	3.7	0.2	1.7	0.2	1.1	1.6	6.5	1.5	5.8	Serbia, FYR Macedonia, Montenegro
Republic of Moldova	1.5	6.1	0.8	2.8	1	3.2	0.6	1.7	0.7	1.9	Kazakhstan

Source: Author's calculations based on data from FAO Food Outlook, June 2009

Figure 23: Evolution of export share in domestic production in exporting countries of the regions



Source: Based on Table 25

As can be seen from Figure 23, poultry meat producers in the WBCs and the ETC Georgia are doing well and their export share of domestic production has been growing steadily during recent years.

Trade of eggs in-shell or egg products is not significant compared with EU trade.

Table 26: Imports of birds' eggs, in-shell, fresh, preserved or cooked (HS2002 code 0407)

Country	Main partner	Trade value thousand USD		Net weight tons	
		2006	2007	2006	2007
WBCs:					
Albania	Italy	98	55	40	16
Bosnia & Herzegovina	Serbia, Slovenia	2,648	2,826	963	703
FYR Macedonia	Serbia	25	6.1	7.3	1.2
Serbia	Slovakia, Bosnia & Herzegovina	760	963	112	289
ETCs:					
Armenia	Iran, Ukraine	638	196	440	111
Azerbaijan	Turkey, Iran	5,860	6,429	1,381	1,286
Georgia	Ukraine, Republic of Moldova, Armenia	4,175	3,000	2,755	2,023
Kyrgyzstan	China, Russian Federation	122	317	141	835
Mongolia	Russian Federation	979	1,973	1,981	583
Republic of Moldova	Hungary	642	169	196	69

Source: United Nations Commodity Trade Statistics Database

Table 27: Exports of birds' eggs in-shell, fresh, preserved or cooked (HS2002 code 0407)

Country	Main partner	Trade value thousand USD		Net weight tons	
		2006	2007	2006	2007
WBCs:					
Albania	Italy, Serbia	n/a	2,417	n/a	n/a
Bosnia & Herzegovina	Croatia, Serbia, Montenegro	n/a	1,100	n/a	n/a
FYR Macedonia	Croatia	343	1,995	359	1,443
Serbia	Croatia, Bosnia & Herzegovina	923	2,436	609	597
ETCs:					
Armenia	Georgia	n/a	419	n/a	n/a
Azerbaijan	Georgia	n/a	272	n/a	n/a
Georgia	Turkey	n/a	769	n/a	n/a
Kyrgyzstan	Kazakhstan	n/a	110	n/a	n/a
Republic of Moldova	Georgia, Iraq	n/a	462	n/a	n/a

Source: United Nations Commodity Trade Statistics Database

Table 28: Imports of birds' eggs not in-shell and egg yolks by the WBCs and the ETCs (HS0408)

Country	Main partners	Trade value thousand USD		Net weight tons	
		2006	2007	2006	2007
WBCs:					
Albania	Greece, Italy	18	58	8.8	15
Bosnia & Herzegovina	Croatia	86	85	16	13
FYR Macedonia	Croatia, Argentina	625	1,360	152	251
Serbia	Argentina, France	483	440	100	79
ETCs:					
Armenia	India, Poland	56	68	22	23
Azerbaijan	Germany	0.9	n/a	0.5	n/a
Georgia	Germany	15	5.5	3.1	1
Kyrgyzstan	Russian Federation	4.0	3.2	12	5.5
Mongolia	China	7.6	8.8	13	15

Source: United Nations Commodity Trade Statistics Database

Table 29: Exports of birds' eggs not in-shell and egg yolks by the WBCs and the ETCs (HS0408)

Country	Main partners	Trade value thousand USD		Net weight tons	
		2006	2007	2006	2007
WBCs:					
Bosnia & Herzegovina	Serbia	6	n/a	9.2	n/a
FYR Macedonia	Croatia	n/a	7.1	n/a	5
Serbia	FYR Macedonia, Bosnia & Herzegovina	44.1	83.6	11	12
ETCs:					
Mongolia	China	0.5	n/a	0.4	n/a

Source: United Nations Commodity Trade Statistics Database

6.4 Investment projects

The enlargement of the EU with more countries of Central and Eastern Europe creates additional trade and investment opportunities for the countries of the region. However, at the moment of the writing of this handbook, there has been limited investment in the WBCs and the ETCs. Example of projects are listed in Table 30.

Table 30: Investment projects in the WBCs and the ETCs






Country	Year	Project
Albania	2009	Albania's leading poultry producer, Driza Limited, has signed a new agreement with the Dutch hatchery technology company Pas Reform for a suite of SmartSet™ setters, SmartHatch™ hatchers and Smart Hatchery Automation Systems. The hatchery of Driza Limited will ultimately produce 10 million day-old chicks per year. A feedmill, modern broiler slaughterhouse, cooling/freezing operations, and distribution and retail networks put the company well on track in its plans for full integration.
Serbia	2007	Agroziv, a meat processor in Pancevo, is building a new EUR 10 million poultry processing plant. Planned capacity is 8,000–10,000 chickens per hour. Agroziv has a 60% share of the Serbian poultry market. Revenue in 2006 was EUR 100 million. The company's main export markets are Bosnia, Macedonia and Croatia.
Armenia	2009	VTB Bank Armenia financed Araks Poultry Factory (a subsidiary of the X Group) with USD 1.66 million for the procurement of equipment.
Republic of Moldova	2005	Vencomatic together with local partner PBNord have cooperated in the modernization of egg production in the Republic of Moldova. Vencomatic delivered and installed all of the equipment for two production houses and one rearing house for layer breeders in the town of Edinets in the Republic of Moldova. The project is supported by the Dutch government. Each production house has room for 5,500 layer breeders. The houses are equipped with Vencomatic Classic Sidebelt Nests. Next to the automatic nests, Vencomatic delivered a complete installation with slats, ventilation, and drinking and feeding lines.
Tajikistan	2008	The poultry company Sverdlovskiy in Russia's Sverdloskaya region expanded cooperation with other Tajik poultry companies. Sverdlovskiy has already established cooperation with two poultry farms in Tajikistan. Russian poultry companies provide the training of personnel for the Tajik poultry breeding sector and intend to provide Tajik poultry farms with up-to-date equipment and to implement joint development projects.





7. FURTHER READING

- The International Egg Commission, www.internationalegg.com
- The USA Poultry & Egg Export Council, www.usapeec.org
- Association of Poultry Processors and Poultry Trade in the EU countries, www.avec-poultry.eu
- National Interprofessional Office for Meat, Livestock and Poultry Farming, (OFIVAL), www.office-elevage.fr
- www.thepoultrysite.com
- www.wattpoultry.com and www.wattagnet.com
- Egg Industry Magazine, www.eggindustry-digital.com/eggindustry
- World Poultry Magazine and Poultry Processing Magazine, www.worldpoultry.net

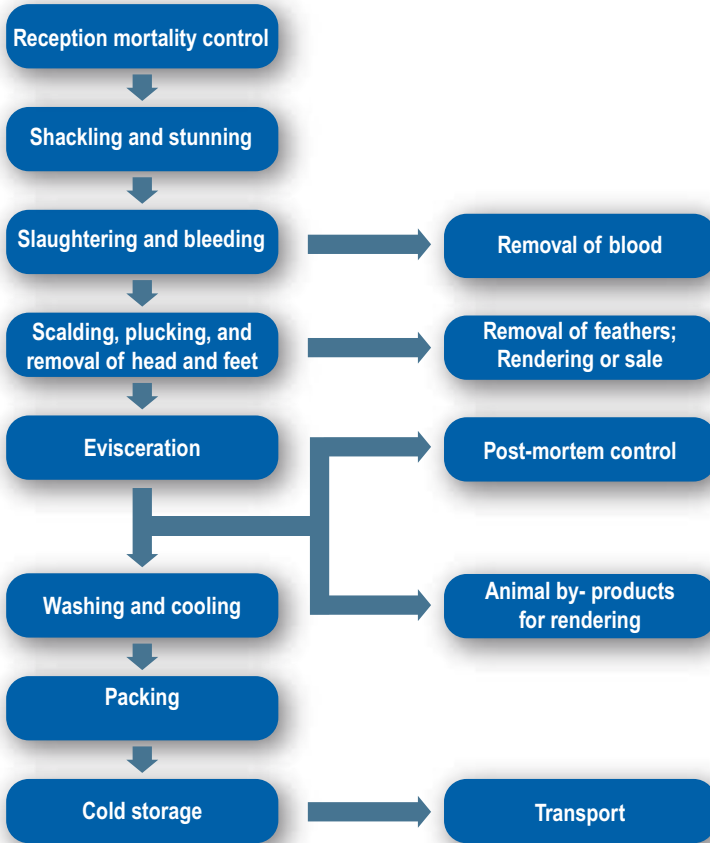
ANNEX I

Chicken parts

<p>Chicken Breasts</p> 	<p>One of the most popular chicken parts, the chicken breast, can be purchased in many different forms. Chicken breasts are considered white meat and are available fresh and frozen in various cuts, such as whole breasts, breast quarters and breast halves.</p>
<p>Chicken Wings</p> 	<p>Chicken wings, another very popular chicken product, are available in many forms. They are considered white meat.</p>
<p>Chicken Cutlets</p> 	<p>Cutlets are boneless chicken breasts or legs that have been pounded to tenderize and to provide meat that is more uniform in thickness so that it cooks more evenly.</p>
<p>Chicken Thighs</p> 	<p>Thighs are considered dark meat.</p>
<p>Drumsticks</p> 	<p>Drumsticks are the bottom portion of the leg below the knee joint and consist of all dark meat.</p>

<p>Chicken Fillets</p> 	<p>Fillets are slices of meat from the chicken breast.</p>
<p>Chicken Breast Strips</p> 	<p>Chicken breasts are cut into strips.</p>
<p>Chicken Tenders</p> 	<p>Tenders, which are part of the chicken breast, are full pieces or chunks of chicken tenderloins.</p>
<p>Giblets</p> 	<p>The giblets consist of the neck, liver and heart.</p>

Simplified diagram of the various operations performed in poultry processing



Source: Adapted from the Danish Poultry Meat Association



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