

□□□ **ACADEMIC STUDIES WITHOUT TEARS** □□□

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Outlook of animal agriculture sectors in China, from the lens of Chinese academics



What is happening with pig farming in China? When researchers based in academic and research institutions in China write about pig farming and other animal agriculture sectors in China in the past several years, what points do they highlight?

This issue of ASWT gives snapshots of current developments and outlook of five sectors in China: Pork, broiler chickens, eggs, dairy, beef – according to a sample of academic papers written by one or more academic researcher(s) in China, or a team with a China-based lead author.

A strong common theme and tone in this selection of studies – as well as in other papers by Chinese academics – is that China needs to improve and "modernize" its animal farming sectors and industries, that more needs to be done. They also point out that large-scale farms are *not yet* dominant (although they *may* in the years ahead). In other words, it is not accurate to say that currently animal-source foods produced in China come mostly from "factory farms" like those in Europe and North America.

1. More industrial pig farms to come

"Large-scale industrial pork production enterprises are preferred in China in the future." This is the top conclusion from a paper written by a team of nine researchers, all but one based in China. The lead author hails from China Agricultural University (ranked 1st or 2nd globally in agriculture sciences).

Scale and systems: Are most pigs in China kept in large-scale farms now? The answer is no. Half of all pig farmers are considered to be smallholders, slaughtering less than 500 pigs annually. And smallholders are expected to continue to co-exist with large-scale producers in the coming years.

Large-scale pork production in China makes use of two main models: 1. Enterprise plus farmer model. This is a contract system and the most common. Wens – the largest pig producer in the world – came up with this model. 2. Self-support model. In this system, the large-scale producer handles the entire process from raising the pigs to marketing pork products. The second largest pork producer – Muyuan – adopts this system.

Lately the government has been encouraging pork production cooperatives, and there is a rapid growth of cooperatives as a third model. China has numerous agricultural cooperatives, owned by farmers or investors, and aimed at building communities and improving their economic development.

Challenges: 1. Greenhouse gas emissions from pig farms and not using renewable energy. 2. Manure management. 3. A "relative shortage of domestically produced feed", and "the low utilization efficiency of feed ingredients", with the average number of piglets born per sow per year below that of U.S and Europe. 4. Antibiotics and metal residues from feed. 5. Infectious diseases – notably African Swine Fever – and sow reproductive diseases. 6. Unstable pork prices.

To address challenges: 1. Feed adjustments to avoid greenhouse gas emissions. 2. Increase manure recycling. 3. Integrate pig and crop production to help with waste management. 4. Improve feed utilization and develop precise feeding or "nutrition precision". 5. Low-protein diets. 6. Find alternatives to antibiotics and metal (e.g. Chinese herbal extracts). 7. Control diseases and pathogens (e.g. via vaccines). 8. Strengthen training of small-scale producers. 9. Market intervention to "stabilize pork production and reduce pork price fluctuations".

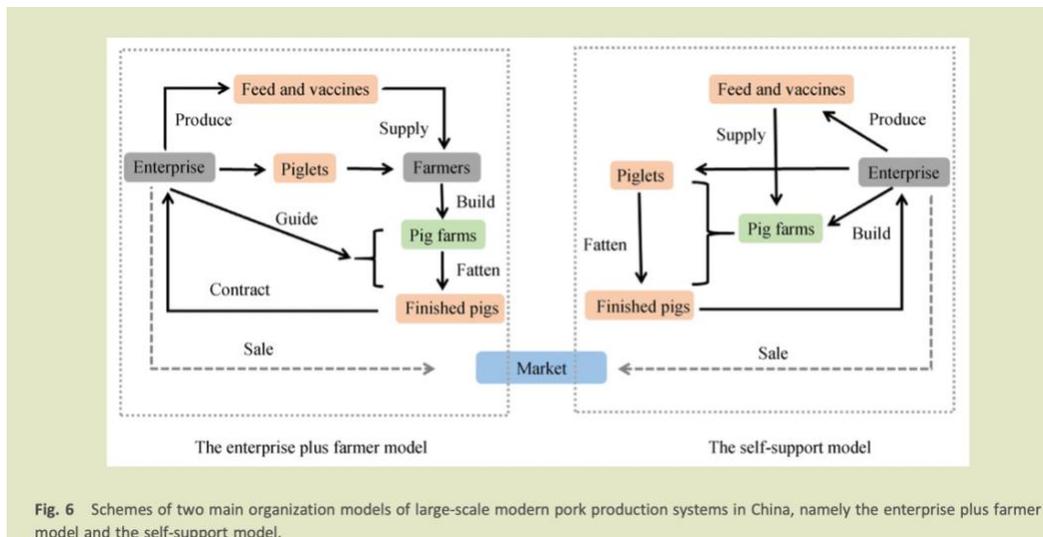


Fig. 6 Schemes of two main organization models of large-scale modern pork production systems in China, namely the enterprise plus farmer model and the self-support model.

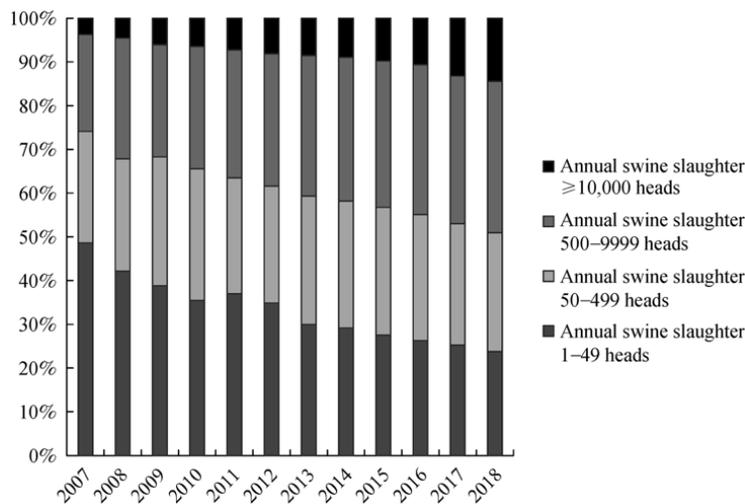


Fig. 4 Changes in pig producer scales in China from 2007–2018 (data sourced from Ministry of Agriculture and Rural Affairs of China).

Table 1 Top 15 global mega pork producers in 2020 (data sourced from the National Hog Farmer^[19])

Rank	Producer	Country	Sows owned in 2020 (1000 head)
1	Wens	China	1300
2	Muyuan	China	1283
3	Smithfield Foods	USA	1241
4	CP Foods	China	1150
5	New Hope Group	China	500
6	Zhengbang Group	China	500
7	Triumph Foods	USA	492
8	BRF	Brazil	389
9	Pipestone Veterinary Services	USA	385
10	Seaboard Foods	USA	345
11	COFCO Group	China	250
12	Cooperal	France	245
13	Iowa Select Farms	USA	243
14	Seara Foods	Brazil	213
15	Vall Company Group	Spain	213

A bit more info:

- "Large-scale factory pork production emerged after the reform and opening-up from the 1980s. Some pork producers in Guangdong Province started Sino-international joint venture companies, imported a complete set of equipment and technology from Europe and the USA, and initiated industrial pork production systems. With the implementation of the Urban Food Bases and the Vegetable Basket Project in the late 1980s, large-scale factory pork production systems were established in many cities and the development of the pork production sector was rapid. In 1997, national pork production reached 36 Mt, an increase of 58% compared to 1990, and the per capita consumption of pork reached 29 kg, which surpassed that in the USA."
- "In 2015, with the implementation of the new national environmental protection policy, the pork sector was placed under unprecedented restrictions. Many small and medium- sized producers left the sector and large-scale breeding enterprises expanded significantly. By the end of 2017, the percentage of producers able to produce > 500 swine annually exceeded 45%. The contribution of the top 10 mega pork producers accounted for 7.4% of production in 2017, whereas this proportion was 40% in the USA at that time. . . . The spread of African swine fever during 2018–2019 further impacted the structure of the pork production sector, with many small producers leaving the industry."

Zhang, Shuai, Xin Wu, Dandan Han, Yong Hou, Jianzhuang Tan, Sung Woo Kim, Defa Li, Yulong Yin, and Junjun Wang. "Pork Production Systems in China: A Review of Their Development, Challenges and Prospects in Green Production." *Frontiers of Agricultural Science and Engineering* 8, no. 1 (March 15, 2021): 15–24. doi: 10.15302/J-FASE-2020377.

Lead author affiliation: College of Animal Science and Technology, China Agricultural University.

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2. Broiler chickens sector needs improvement along the entire supply chain, from immunization, farmers' scientific knowledge, to animal welfare

Need to upgrade broiler supply chain to improve export: (a)

In just four decades, the white-feathered broiler sector in China has risen to become one of the world's top three largest producers of chicken meat, along with the U.S. and Brazil. It is the second largest animal farming sector in China after the pig industry.

But in a study on the role of chicken exports and production in the economic growth of China, U.S., and Brazil, China is found to be lagging behind the other two countries in terms of "export quantity, export value, export varieties, and export countries and regions."

The authors of the study attribute this relative underperformance to China using less "science and technology", and to the fact that there are "loads of small and medium enterprises and broiler farms, where production modes are rather raw and management levels are low, resulting in a low value of output per unit of labor."

They recommend an upgrade to the entire supply chain.

The newest caged system has the lowest animal welfare: (b)

Of the three white-feathered broiler production systems in China – net floor system (NFS), normal cage system (NCS), high standard cage system (HCS) which is the newest system – NFS has the highest welfare score, and HCS the lowest. (Welfare is mainly considered in terms of "broiler type, length of the dark period, outdoor access, and stocking density".) For production cost, profit, and efficiency: HCS has the highest cost and profit; NFS has the lowest.

In view of the low welfare in HCS, the authors suggest a "win-win situation for poultry welfare and production" by "making full use of available technology to improve the environment, such as lighting and cage furnishing". They also suggest that the Chinese government subsidize "animal welfare products to compensate for the increase in market prices and strengthen the control of the label system".

Small-scale broiler producers do not benefit from becoming contract farmers to large producers: (c)

If they have a choice of alternatives such as specializing in organic and free-range chickens, it is more profitable for small-scale farmers to do so as they will have better comparative advantages.

Challenges to broiler sector, and measures to address them: (d)

1. Immunization work is not in place. Epidemic prevention and control should be taken seriously. This includes developing systems to monitor diseases and control strictly the entire immunization process (e.g. disinfect farms regularly; do not use expired or irregular vaccines; prevent "idlers" from coming in and out of farms).

2. The continual expansion of the broiler chicken industry has increased the difficulty in controlling the environment for raising chickens, leading to diseases and deaths of chickens. The standard of chicken breeding and rearing should be elevated. For example: Large-scale producers of native chickens should adopt regional models (e.g. choose areas with greater forest coverage). Housing should be selected to ensure that each chicken has a living space that meets its needs, with good ventilation, temperature and humidity control. And feed should be improved and chosen scientifically.

3. Most chicken farmers and related personnel lack knowledge of scientific methods and professional certifications. They still adhere to traditional practices and concepts. Professional knowledge and quality of producers should be improved, including informing them of market research.

Developments in 2020-21: (e)

The broiler sector was affected by both African Swine Fever (ASF) and Covid-19. Restrictions to movements and road closures impacted broiler breeding and transportation. Market price for broilers hit record high with consumers using chickens meat as a substitute for pork when the latter's price rose sharply due to ASF. With the gradual recovery of the pig industry, the price of broilers dropped back.

More info from Publication (a):

- "China's chicken products are labor-intensive, and chicken breeding is basically small-scale raising, which is the mainstream development mode. In 2012, there were 24,387,555 broiler farms (or households),

whose annual slaughter number were under 2000, accounting for 98% of the total farms (or households). However, there were 180,262 broiler farms (or households), whose slaughter number was more than 10,000, which only accounted for 7.25% of the total farms (or households)."

- "China's exported varieties of chicken products are relatively single, including cooked chicken and conditioning products out of chicken mainly, with frozen chicken and iced fresh chicken as supplements. Chicken legs and breasts account for larger proportions in raw chicken meat exports. . . . The United States' exports of chicken products include broiler chicken, turkey, fresh eggs, and so on. Among them, chicken claws are mainly exported to China. . . . Brazil's exports of chicken products are diverse, including whole chicken, deep processing products out of chicken, bacon, and sausages. . . . China's chicken products are mostly exported to East Asian countries and regions. . . . The United States mainly exports chicken products to Mexico, Canada, China, Russia, Angola, and other countries and regions. . . . In 2014, excluding export markets containing sausages, Brazil exported 1370 thousand tons of chicken products to the Middle East, as well as Asian, African, European, and American regions. . . ."
- "In summary, we believe that in order to improve the quality of Chinese chicken products, more efforts should be made to change and upgrade the whole supply chain. To be more specific, first, policymakers should place greater emphasis on optimizing the mode of the breed, high efficiency, and less pollution. Therefore, strict control of high stocking density and small-scale farms and households is crucial. Second, education and sanitary conditions are often neglected. . . . Third, investments should be utilized to foster the new industry support and improve participation in large-scale and international chicken products enterprises. Fourth, it is urgent that a number of well-known chicken products brands are supported and established. . . . Fifth, production for exports should be carefully inspected and examined by carrying out scientific and technological innovation in order to protect our reputation. Last but not least, we should protect our legitimate rights and interests and take some measures to deal with discriminatory quarantine measures applied on us by some importing countries."

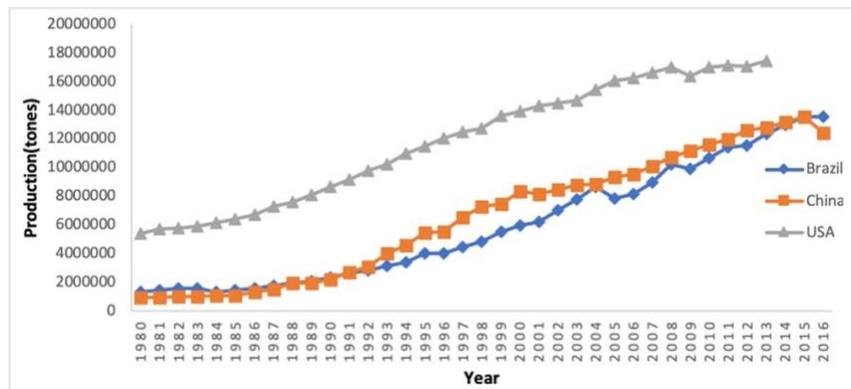


Figure 1. Productions of chicken products of China, the United States, and Brazil 1980–2016.

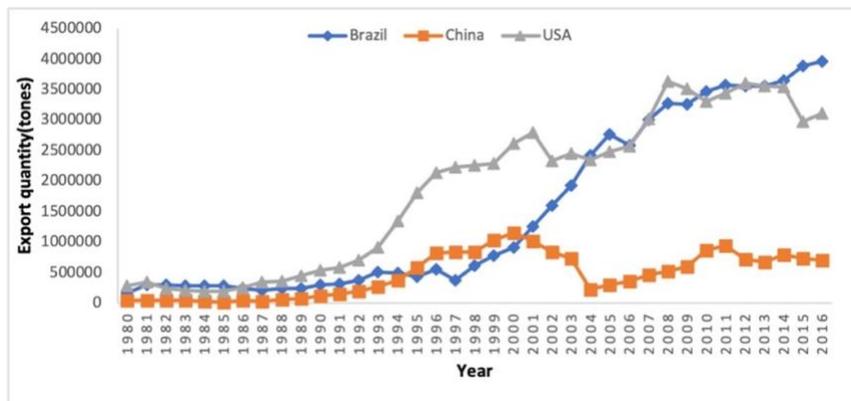


Figure 2. Export quantities of chicken products of China, the United States and Brazil: 1980–2016.

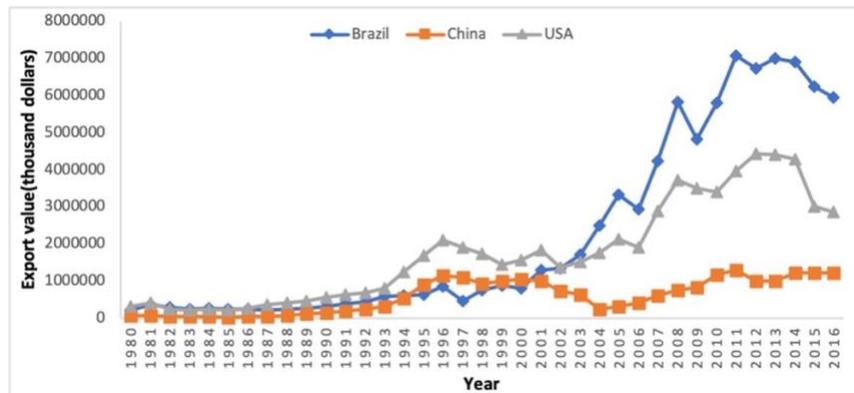


Figure 3. Export value of chicken products of China, the United States, and Brazil: 1980–2016.

(a): Wen, Xiaowei, Lin Li, Sangluo Sun, Qinying He, and Fu-Sheng Tsai. "The Contribution of Chicken Products' Export to Economic Growth: Evidence from China, the United States, and Brazil." *Sustainability* 11, no. 19 (September 25, 2019): 5253. doi: 10.3390/su11195253.

Lead author affiliation: College of Economics and Management, South China Agricultural University.

(b): Chen, Qichang, Helmut W. Saatkamp, Jan Cortenbach, and Weidong Jin. "Comparison of Chinese Broiler Production Systems in Economic Performance and Animal Welfare." *Animals* 10, no. 3 (March 15, 2020): 491. doi: 10.3390/ani10030491.

Lead author affiliation: Department of Agriculture Economic and Management, Shenyang Agriculture University.

(c): Huang, Ze-ying, Ying Xu, Di Zeng, Chen Wang, and Ji-min Wang. "One Size Fits All? Contract Farming among Broiler Producers in China." *Journal of Integrative Agriculture* 17, no. 2 (2018): 473–482. doi: 10.1016/S2095-3119(17)61752-0.

Lead author affiliation: Institute of Agricultural Economics and Development, Chinese Academy of Agricultural Sciences.

(d): 张新平, "我国养鸡业存在的问题及解决对策." *畜牧兽医科技信息*. [Zhang Xinping. "Problems in China's chicken industry and measures to solve them." *Animal husbandry and veterinary medicine information*] 2020 (10), pg.167. Author affiliation: Shandong Province, Xintai City animal husbandry and veterinary medicine center.

(e): 王佳 张博 陈凯 马丽芳 陈伟, "双重疫情形势下中国养鸡业的发展." *现代商贸工业*. [Wang Jia, Zhang Bo, Ma Lifang, Zhen Wei, "The development of China's chicken industry under dual epidemic situation." *Modern trade industry*] 2020 (24), pg.16.

Lead author affiliation: School of Geography, Shanxi Normal University.

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3. Egg industry strives to standardize and modernize, but faces challenges

The world's #1 egg producer: "The implementation of the Reform and Opening-up Policy since 1978 is the key factor boosting Chinese egg production in every aspect including capital investment, technology advancement, business model and purchasing power." 1979–1990 saw fast development. 1991–2000 was an "explosive development period". Development has been "steady" since 2001. In 2019 China produced over 40% of the world's eggs totalling 33 Mt. – a 12-fold increase from 1978.

Diversity is the chief characteristic of China's egg production:

1. *Genetic diversity*: "The Chinese government and industry have placed great importance on genetic diversity in egg production. Basically, there are three ways to achieve this goal: genetic improvement of indigenous breeds, importation of commercial hybrid layers from other countries, and development of new domestic hybrids."

2. Product diversity: The kinds of eggs marketed in China are more diversified than in any other country. This is because over 95% of eggs sold in China are for direct consumption as table eggs, and consumers care a lot about egg size and color of the eggshell (e.g. brown, pink, white, blue). In addition, there are processed egg products (e.g. century eggs, stew eggs, and other traditional products, liquid egg, frozen egg, extractions from egg white and yolk used for medicinal purposes).

3. Production system diversity: A number of different systems are used, from small village farms to "modern integrated intensive operations in which large companies control all aspects of the production and marketing chain".

Size and scale: Farms can be classified according to "back yard (<2000 hens), small family farm (2000–4999 and 5000–9999 hens), specialized layer farm (10,000–49,999 and 50,000–100,000 hens) and large layer farm (>100,000 hens)". Since 2012 "there has been an unprecedented development of large industrialized egg corporations", and an increase in the average size of farms. The number of small family farm has dwindled. But most hens are still raised in small to mid-sized farms.

Scale (hens per farm)	Farms		Hens housed		Cumulative (%)
	Number	%	Number	%	
< 2000	2814	14.9	3,590,500	3.5	3.5
2000–4999	9386	49.6	28,075,000	27.4	31.0
5000–9999	4311	22.8	26,530,000	25.9	56.9
10,000–49,999	2285	12.1	35,711,000	34.9	91.8
50,000–99,999	92	0.5	5,805,300	5.7	97.5
>100,000	21	0.1	2,570,000	2.5	100.0
Total	18,909	100.0	102,282,000	100.0	

Data adapted from Yang N, Qin F, Xu GY, Zhao YF, Xue L, Zhou XY. Survey on the current development of layer farming in China. *China Poultry*, 2014, 36(7): 2–9 (in Chinese).

Housing: Semi-open housing (i.e. a roof plus four walls with windows in north and south sides) is popular in rural areas. Closed housing (i.e. no windows, with "artificial lighting, cooling pads and ducted mechanical ventilation") is now widely used "as modern intensive farming increases". Open housing with only a roof is no longer used because of biosecurity and environmental concerns.

Manure management: Most manures are composted and fermented to be used as organic fertilizer for fruits and vegetables. There are government rules to control the spread of manure odor.

Future development: "Standardizing and modernizing the egg industry has been widely accepted as a key trend in China. A strategy focusing on upgrading family farms and promoting large-scale automated farms has been suggested and implemented as a direction for future development. The Chinese Ministry of Agriculture and Rural Affairs has provided government guidelines and related policy to advance the ambitious transition."

Challenges: This transition is easier said than done, and the sector will grow at a slower pace than in the past. "There is still a long way to go in modernizing egg production in China." Challenges include: 1. The diversified structure of the egg sector. 2. Over-production in certain years. 3. Biosecurity and diseases issues. 4. Manure management issues. 5. Consumer food safety concerns. 6. Need large investments and improvements in management and technology.

To address challenges: "State Council has issued a Regulation on Pollution Prevention of Large-scale Livestock Production". Central government has announced emergency plans and regulations to control outbreaks of major infectious animal diseases. "The egg industry has implemented stricter rules to control the entire production chain to address food safety concerns of consumers. Branding of eggs is also used widely to ensure the traceability of fresh eggs and egg products by commercial companies and corporate farmers."

Some more info:

- "Food demand is actually the main driving force for the increase in egg production. . . . Average egg consumption per capita is now around 18 kg per year in China, which is more than the average level in developed countries. Hence, over the past 40 years China has had a much faster growth pattern of egg production than that in the USA or European countries. The government has played active roles in this process mainly in two aspects: one is to encourage the establishment of standard layer farms and the other is to promote elite breeding chickens with high performance. Along with the increase in egg production, environmental regulations are more stringent. Many policies have been carried out to control pollution from layer production, organic fertilizer production from chicken manure, and the disposal of sick and dead laying hens."
- "One can find diversified production systems coexisting in most parts of the country, from hundreds of caged laying hens in simple shelters in the same yard where farmers live, to modern farms practicing industrial- type production with millions of layers. In 2010, the Chinese Ministry of Agriculture started a nationwide project to promote the standardization and expansion of layer farms, with substantial impacts on the production structure of the egg industry. As a result of the joint efforts of the industry, the market and the government, a number of large egg production corporations have developed recently, such as Beijing DQY, Beijing CP, Hubei Shengdan and Sichuan Shendile."
- Compared to floor rearing the cage system has been widely adopted by the Chinese egg industry for more than 30 years due to greater management and sanitation control, higher utilization of available space and lower labor requirement. Stair cages are a major housing system on most farms (>85%). The use of vertical cages with manure belt has increased recently for automatic collection of manure and higher stocking density. . . . Currently, furnished cages have been advocated and adopted in many countries, especially in the European Union and the United States. Animal welfare is generally given lower priority in China but there has been some pioneering research exploring the implementation of new welfare systems for egg production. [underlining added by Tiny Beam Fund]
- "Egg producers in China are mainly located in the northern and central regions of the country where most grain is produced and the climate is more suitable for chicken production. Table eggs are transported across the country along the rapidly developing highway network. In recent years, however, egg production has tended to spread nationwide in order to market fresh eggs locally and reduce transportation costs. . . . It should be noted that the top egg production regions are also the top producers of corn, the main ingredient of poultry feed."

Yang, Ning. "Egg Production in China: Current Status and Outlook." *Frontiers of Agricultural Science and Engineering* 8, no. 1 (March 15, 2021): 25–34. doi: 10.15302/J-FASE-2020363.

Author affiliation: College of Animal Science and Technology, China Agricultural University.

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4. Dairy sector needs to improve its economic, environmental, and food safety performance

The dairy industry and milk production in China has slowed down since 2015 after rapid growth for about a dozen years.

Size and scale: Large-scale farms with more than 1,000 cows have been expanding and promoted by the government, especially after 2008 (when melamine was found in infant powdered milk) so that the government can better monitor raw milk from small farms and increase milk safety.

From Publication (a):

Table 2. Dairy farming characteristics (2003–2018).

	2003	2006	2009	2012	2015	2018	% Change (2003–2018)
Milk yield (10,000 tons)	723.49	1459.58	1935.12	2545.19	2782.53	3132.82	333.02
Proportion of dairy farm output value to husbandry farm output value	3.53%	4.38%	5.04%	4.91%	5.27%	4.48%	26.91
Number of large-scale dairy farms	3667	6040	10,144	12,313	15,379	8812	140.31

But smallholder farms with less than 100 cows still make up a sizable portion of the dairy sector.

From Publication (b):

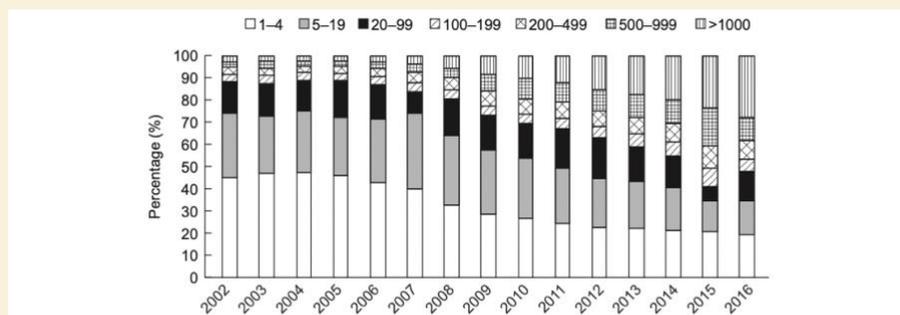


Fig. 1 The proportion of cow breeding stock by dairy farming size in China. Source: *China Dairy Statistical Summary* (MARA 2018).

The three main types of dairy farms are: 1. Traditional family backyard. 2. Centralized farming community with milk collection stations for backyard farmers. 3. Large-scale dairy operations.

Challenges: 1. Environmental and ecological concerns top the list of challenges. "The rapid development of dairy farming has caused significant environmental problems, including massive accumulation of feces and emissions of wastewater. If these issues are not promptly addressed, they will have a devastating effect on the future development of dairy farming." ^(a) 2. Ensuring milk safety is also a top priority. 3. High cost of production, and the import of a significant amount of dairy products (especially milk powder) which consumers like better than domestic products have combined to make the price of domestic milk non-competitive. 4. Dairy production is currently concentrated in the country's north and west. But in large portions of these places the yield per cow is very low.

To address challenges:

"Improving market competitiveness while ensuring economic and environmental sustainability are key to the future prospects for China's milk industry." ^(c) Evidence has shown that reducing the size of farms is better for the environment. But backyard dairy farmers adopt less milk safety practices than larger farms. This dilemma "has triggered a debate about the size of dairy farms" ^(c).

Consider practical steps and measures such as: 1. Optimize the siting of dairy farms in accordance with each region's comparative advantages and local conditions (e.g. temperature, corn yield). 2. Promote milk safety practices while reducing compliance cost, especially for smallholders. 3. Expand "forage resources production for dairy farming such as corn planting, soybean planting and green fodder planting" ^(d). 4. Improve dairy cow breeds to increase yield per cow. 5. Provide "capital subsidy and tax incentives" ^(d) to dairy farmers.

(a): Li, Ran, and Guixia Qian. "Spatial and Temporal Evolution of Dairy Farming Coordination between Economy and Ecology in China." *Sustainability* 13, no. 22 (January 2021): 12618. doi: 10.3390/su132212618.

Lead author affiliation: School of Economics & Management, Inner Mongolia University.

(b): Yang, Xin-ran, Kevin Z. Chen, and Xiang-zhi Kong. "Factors Affecting the Adoption of On-Farm Milk Safety Measures in Northern China — An Examination from the Perspective of Farm Size and Production Type." *Journal of Integrative Agriculture* 18, no. 2 (2019): 471–481. doi: 10.1016/S2095-3119(19)62567-0.

Lead author affiliation: Institute of Agricultural Economics and Development, Chinese Academy of Agricultural Sci.

(c): Wang, Qianqian, Longbao Wei, and Wenting Wang. "Review: Challenges and Prospects for Milk Production in China after the 2008 Milk Scandal." *Applied Animal Science* 37, no. 2 (2021): 166–175. doi: 10.15232/aas.2020-02074.

Lead author affiliation: School of Economics and Management, Zhejiang Sci-tech University.

(d): Yan, Bojie, Yaxing Li, Yanfang Qin, Jingjie Yan, and Wenjiao Shi. "Spatial-Temporal Analysis of the Comparative Advantages of Dairy Farming: Taking 18 Provinces or Municipalities in China as an Example." *Computers and Electronics in Agriculture* 180 (2021): 105846. doi: 10.1016/j.compag.2020.105846.

Lead author affiliation: Ocean College, Minjiang University.

Supplement: A table from a study by a research team that is not China-based

Table 1 Basic information about the dairy industries in China and the United States in 2019

	China	The United States
Total milk output (mmt)	32.01	99.02
Rank in the world based on total milk output	3rd largest	The largest
Average per cow milk production (t yr ⁻¹)	3.00 ¹⁾	10.61
Number of dairy farms	66 1760 ¹⁾	34 187
Average herd size (milk cows)	16.00 ¹⁾	273
Average farmgate milk price (USD kg ⁻¹)	0.56	0.40
Average per capita milk consumption (kg yr ⁻¹)	12.00	64.00
Average per capita cheese consumption (kg yr ⁻¹)	0.10	18.14
Market share of UHT milk (%)	More than 35%	Less than 3%
International trade of dairy products	Largest importer	4th largest exporter
Share of dairy imports in total consumption	About 35%	Less than 2%
Share of dairy exports in total production	Less than 1%	About 15%

¹⁾ For all dairy farms in China in 2018 (PwC Network 2019).

Data source: Data in this table are mainly from USDA (2020), Office of Dairy Management (2015–2019), and PwC Network (2019).

Wang, Qingbin, Chang-quan Liu, Yuan-feng Zhao, Anthony Kitsos, Mark Cannella, Shu-kun Wang, and Lei Han. "Impacts of the COVID-19 Pandemic on the Dairy Industry: Lessons from China and the United States and Policy Implications." *Journal of Integrative Agriculture* 19, no. 12 (2020): 2903–2915. doi: 10.1016/S2095-3119(20)63443-8.

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5. Beef production cannot keep up with demand

The growth of China's beef production has been slow or stalled for a number of years.

Size and scale: In 2019 China had about 92.5M animals raised for beef (an increase of roughly 3.3M from 2018), and beef production was about 2.9 million tons (an increase of 2.4% from 2018). The beef sector consists mainly of small farms. And slaughtering is mostly done by individuals and small informal operations. Over 50% of all beef producers slaughter less than ten animals each year. There are only about 200 large-scale slaughter and processing firms in the entire country, and they focus on products for mid- and high-end customers. Beef makes up about 8% of China's total meat production.

From Publication (a):

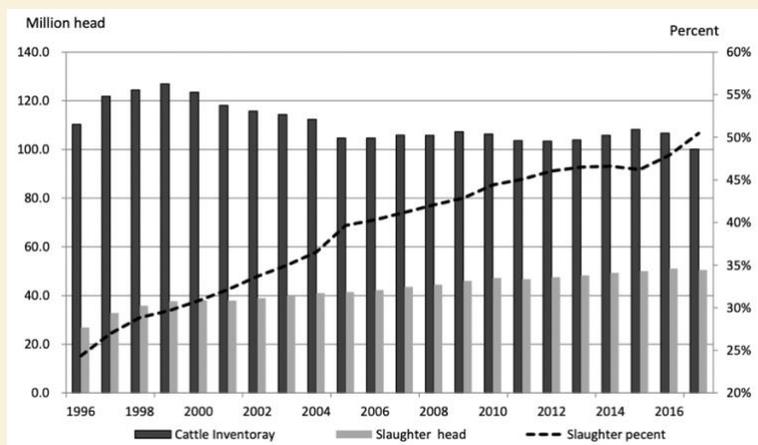


Figure 1. Annual cattle inventory and cattle slaughter head from 1996 to 2017 in China

Farming systems and regions: Both indigenous and industrial cattle breeds are farmed in China. They are concentrated in the Central Plains and the Northeast – regions with intensively-grown crops that can be used as feed. They are also found in lower densities in the Southeast, and in the Northwest where "large cattle herds are distributed over large distances"^(a).

The three cattle farming systems mirror these geographic regions: 1. In regions where crops are heavily cultivated, the animals are raised mainly on crop residues and grains. 2. In regions with pastures, farmers provide limited feed and let the animals graze on the grasslands. 3. In regions with both crops and pastures, the animals graze during the day but are confined in the evening with grains and crop residues.

Imports:

1. *Imported beef fills the huge gap between production and demand:* Although the total amount of beef consumed in China is one of the world's largest, per capita consumption is low by average world standard. Pork is by far the most favored meat, but beef consumption is steadily increasing and likely to accelerate. Consumer demand for beef has outstripped the country's beef production capacity for a long time, especially since 2013. To make up the shortfall, beef is imported – mainly from Latin America, also from Australia and New Zealand. "China may become the fastest-growing beef importer in the world."^(a) About 80% of beef consumption occurs in restaurants and in the form of processed products.

2. *Safety of imports:* Public health and food safety issues are major considerations in the government's beef import policies. "This has benefited those nations that have low disease risk and high standards of animal husbandry and food safety."^(a)

3. *Live animals:* These are also imported to improve genetics of local breeds.

Challenges: Not only is production lackluster, this slow growth has led to a sharp rise in beef prices in recent years. The sector struggles with: Shrinking inventory; low meat yields; "operating at low efficiency due to various factors including the lack of high-performance breeds optimized for local conditions"^(a); huge jumps in the domestic price of corn (which is essential in fattening the animals).

To improve the sector and increase production: 1. Strengthen scientific research and innovation (e.g. build high quality breeding system). 2. Industrialize production. 3. Improve yield of each animal and performance of native breeds. 4. Create new breeds that can adapt better to local resources and environments. 5. Upgrade and standardize slaughtering and processing to be in line with international standards. 6. Improve product development and broaden marketing channels.

(a): Li, Xiang Zi, Chang Guo Yan, and Lin Sen Zan. "Current Situation and Future Prospects for Beef Production in China — A Review." *Asian-Australasian Journal of Animal Sciences* 31, no. 7 (July 1, 2018): 984–991. doi: 10.5713/ajas.18.0212.

Affiliation of lead author: Co-Innovation Center of Beef Cattle Science and Industry Technology, Yanbian University.

(b): 郑献进 王金明 黄玮, "中国肉牛产业链分析及肉牛企业发展探讨." *中国牛业科学*. [Zheng Xianjin, Wang Jinmin, Huang Wei, "Analysis on Beef Cattle Industry Chain and Exploration of the Development of Beef Cattle Enterprise in China." *China beef industry scientific study*] 2021 (47:2), pg. 50-53, 64.

Affiliation of lead author: Beijing Shunxin Xinyuan Institute of Cattle Breeding.

EXPLANATORY NOTE:

- Academic studies are notoriously hard to find, read, and put into practical use by non-academics.
- Super-busy advocates cannot afford to spend a lot of time and effort to dig up, digest, and deploy academic research even though they recognize the value of academic studies in informing and improving their advocacy work.
- *Academic Studies Without Tears* aims to help advocates faced with this dilemma.
- Its target audience are leaders and funders of non-profit advocacy organizations addressing the many negative impacts of industrial animal agriculture in low- and middle-income countries.
- It uses a communication style – reminiscent of quiz or news items – that makes everything a breeze to read.
- Each issue focuses on a particular topic and includes 8 – 10 academic studies.

- It goes without saying that the academic studies featured are *not* the final word. They have flaws and limitations. They are just a tiny selection of perspectives and findings for advocates to consider, to whet their appetite. But every relevant data point and nugget of cogent information adds to one's store of knowledge and has the potential to spark new ideas.

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