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Research on Transformation Development of Pig Industry with Environment and Resource Restriction*

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Abstract. Adequate food and pork products are important to the safety of the world. China is the world's largest country in pig production and pork consumption. Pig industry plays a significant role in the animal husbandry production of China and has become one of most dynamic pillar industries in agriculture and rural economy at present. With the increasing environment and resource restriction, pig breeding is heading to standardized, large-scale and ecological development, which will promote the ecological transformation of pig industry, ensure animal products safety, ecological environment safety and resource safety and improve the comprehensive benefit of animal husbandry.

Key words: production and consumption of pork, situation in pig industry, imports and exports of pork, standardized large-scale development.

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1. Development status of pig industry

1.1 Pig production and consumption condition in China

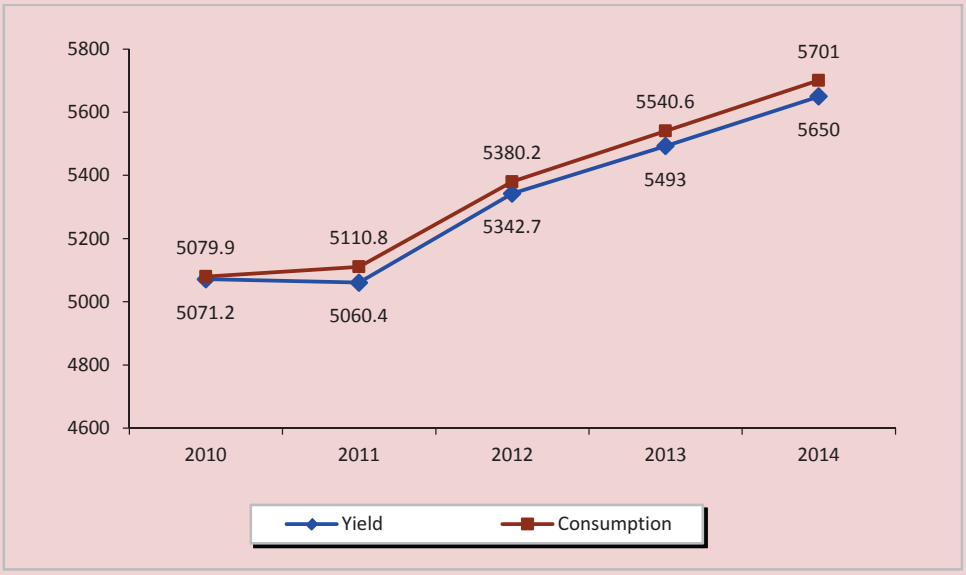
As per data from Food and Agricultural Organization, the pig slaughtering in China was 735,100,000 pigs in 2014, the breeding stock was 465,830,000 pigs at the end of 2014 and the pork production realized 56,710,000 tons, occupying 65.14% of total meat production (87,067,000 tons) of China, increasing by 0.78% compared with the same period of 2013, and occupying 51.3% of total pork production (110,540,000 tons) in the world.

As per data from National Bureau of Statistics of China, during 2010 and 2014, the pig breeding stock was slightly decreasing; however, the pork production was increasing steadily, and residents' pork consumption was increasing steadily *(Tab. 1 and Fig. 1)*. In 2014, per-capita consumption of pork for urban residents was 23.6kg, per-capita

Table 1. Pork Production and Consumption Condition in China in 2010-2014

Year	Pig breeding stock (10,000 pigs)	Pig slaughtering (10,000 pigs)	Pork production (10,000 tons)	Urban per-capita consumption (kg)	Rural per-capita consumption (kg)
2010	46460.0	66686.4	5071.2	20.7	14.4
2011	46862.7	66362.1	5060.4	20.6	14.4
2012	47592.2	69789.5	5342.7	21.2	14.4
2013	47411.3	71557.3	5493	23	15
2014	46583	73510	5671	23.6	16

Figure 1. Diagram for pork consumption and production condition in China in 2010–2014



consumption of pork for rural residents was 16kg and the average growth in recent ten years was 8.3%. With the improvement of living standards of urban and rural residents, residents' consumption was changing from originally having ample food to focusing on food nutrition and safety, which increased the market demand of pork products. Meanwhile, as the pig breeding may gain higher income than that of agricultural planting, large-scale breeding and facility feeding ensure the pig production.

1.2 Total import and export trade volume of pork and structure

As per the customs statistics, in 2014, the accumulated import and export volume of pork in China was 656,000 tons, 0.2% lower than that in 2013 (the same below); it's worth 9.04 billion yuan, increasing by 1.9%. Wherein, the import volume of pork was 564,000 tons, decreasing by 3.3%; it's worth 6.44 billion yuan, decreasing by 6%; the average import price was 11.4 yuan/kg, decreasing by 2.8%. In the same period, the export volume of pork was 92,000 tons, increasing by 24.7%; it's worth 2.6 billion yuan, increasing by 28.7%; the average export price was 28.4 yuan/kg, increasing by 3.2%. Although in international competition, Chinese pork enjoys comparative advantage of low labor cost; however, as predicted by Food and Agriculture Organization of the United Nations (FAO), the pork consumption in China will increase 1.6 percentage points per year in the future. Limited by the land, environmental protection, fodder and rising of labor cost, the pork import volume will increase rapidly *(Fig. 2)*.

Figure 2. Monthly tendency chart for import and export volume and average price of pork from January 2012 to December 2014

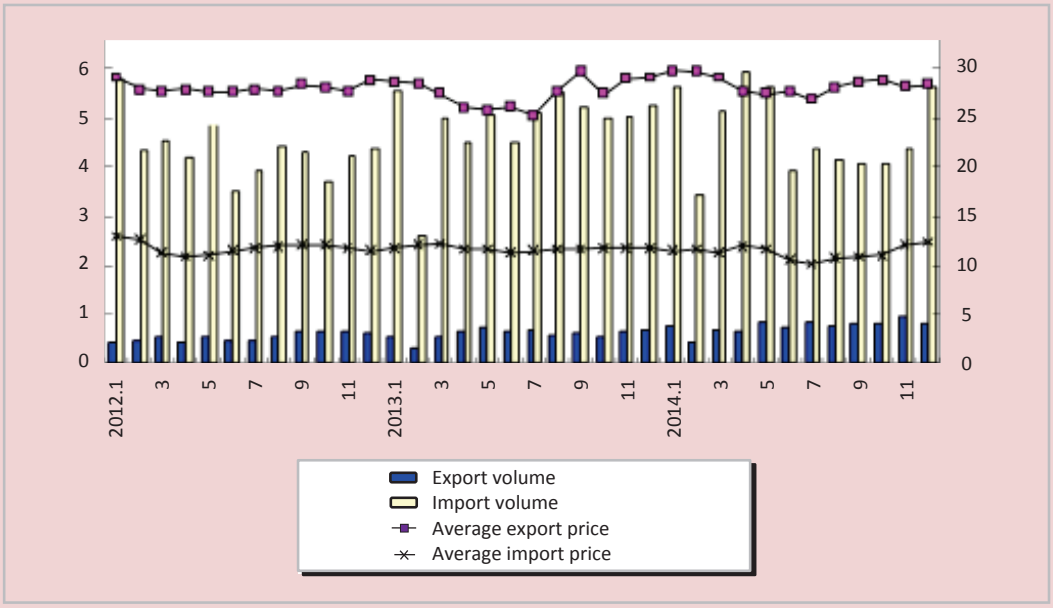


Table 2. List of China's main import countries (regions) of pork in 2014

Main market	Import volume (ton)	Year-on-year growth (%)	Import value (10,000 yuan)	Year-on-year growth (%)
EU	368576	0.0	418032	-2.8
USA	117146	-1.7	144355	-1.6
Canada	52133	-29.9	556	35.4
Chile	25500	27.8	24997	22.5
Brazil	880	-43.3	1271	-44.2
Total		-3.3	644255	-6.0
Data source: *China's Import and Export Condition of Pork in 2014*. Available at: www.xumurc.com				

Table 3. List of China's main export countries (regions) of pork in 2014

Main Market	Export volume (ton)	Year-on-year growth (%)	Export value (10,000 yuan)	Year-on-year growth (%)
Hong Kong of China	65260	8.1	186266	12.9
Kyrgyzstan	11068	205.2	31945	206.4
Macao of China	4316	5.7	12190	3.3
Russia	3599		8966	
North Korea	2488	283.7	5643	306.7
Total	91516	24.7	259622	28.7
Data source: *China's Import and Export Condition of Pork in 2014*. Available at: www.xumurc.com				

In 2014, the import volume of pork from EU was 369,000 tons, which was basically the same as that in 2013, occupying 65.3% of total import volume of pork in China in the same period. Meanwhile, the import volume of pork from the USA was 117,000 tons, decreasing by 1.7% from 0.3% in previous 11 months, presenting continuously great decreasing trend since 13.8% in June. In December, the import volume from the USA was 10,000 tons, decreasing by 15% compared with the same period. The import volume from Canada was 52,000 tons, decreasing by 29.9% *(Table 2)*. In 2014, the export volume of pork to Hong Kong of China was 65,000 tons, increasing by 8.1%, occupying 71.3% of total export volume of pork in China in the same period. The export volume of pork to Kyrgyzstan was 11,000 tons, sharply increasing 2.1 times. The export volume of pork to Macao of China was 4,000 tons, increasing by 5.7%. From October 2014, China began to export pork to Russia and the total export volume was 4,000 tons, so the export window for pig between China and Russia was opened again after ten years *(Table 3)*.

1.3 Comparison between import and export market share of pork

As per customs statistical yearbook of previous years, influenced by the consumption custom and pork price, main import varieties of pork include frozen fresh pork and chopped entrails of pigs. In 2010-2013, the import volume of chopped entrails of pigs in China occupied 80% of total import volume of pork. Main export varieties of pork mainly include frozen fresh pork. With the progress of pork processing technology, in 2010-2013, the

Table 4. Market share of main pork export countries in the world, %

Country	2010	2011	2012	2013
27 countries of EU	28	31	3%	31
Canada	20	17	17	18
USA	31	34	33	32
China	2	5	2	1

specific gravity of pork processing product was increased. Limited by domestic demand, production cost, especially fodder price, if the pig feeding fodder conversion rate in the USA reaches 1.91[1], while the pig fodder conversion rate in China is between 2.5 and 3, the pork export of China enjoys low international competitiveness *(Table 4)*.

In 2013, the export volume of pork from China was 73,000 tons, only occupying 1% of total export volume of pork in the world (7,060,000 tons). In the same year, the export volume of pork from the USA, EU and Canada respectively occupy 32%, 31% and 18% of total export volume of pork in the world. International competitiveness doesn't match with the status of the country with great pork production and consumption.

2. Standardized, large-scale and ecological development of pig industry

2.1 Standardized and large-scale breeding of pig

At present, the animal husbandry industry in China is in the development stage transforming from quantity growth to quantity and quality growth and quality improvement. The pig breeding is transforming from scattered breeding by thousands of households to breeding of appropriate scale. The pig breeding subject is realizing diversified change from general famer to industrialist and businessmen, as well as returned migrant workers. The pig breeding fund is changing from farmer's capital to multi-channel financing like industry and commerce capital, business capital, etc. The pig breeding technology support is changing from relying on experience of the owner to technical guidance of large-scale farming enterprises. Jiangxi Province is one of provinces with great pig breeding in China. Taking it for example, at present, the proportion of large-scale pig breeding in Jiangxi Province has exceeded 80%, ranking in the top of China[2]. Enterprise groups like Zhengbang, Twins, Guohong, etc. develop the mode "company+peasant household" to promote the rapid development of large-scale breeding, base construction and management integrating modernization, science, environmental protection and energy-saving. The standardized scale breeding has become a main force promoting the continuous and stable growth of pig production and ensuring effective market supply and food safety.

[1] Wang Jingjing, Chen Yongfu. Pig Industry Development in the USA: Contract Manufacturing and Longitudinal Integration. *World Agriculture*, 2014, no. 1, pp. 119-123.

[2] Tang Anlai. Reform and Practice of New Type of Agricultural Management System in Jiangxi Province. *Agricultural Science and Technology Press of China,* 2014, no. 4, pp. 8-10.

2.2 Ecological breeding of pig

Ecological breeding is a sustainable development mode for animal husbandry with basic characteristics of low consumption, low emission and high efficiency. In 2014, *Ordinance of the Scale Cultivation and Pollution Prevention and Treatment for Livestock and Poultry* was formally executed and on January 1, 2015, *Environmental Protection Act* was formally implemented. The degree of punishment for enterprises causing pollution was enhanced. The research and promotion of ecological breeding new process, new technology and new mode of all places were enhanced. Ecological breeding of pig and resourceful disposal of pig farm feces are key measures to realize the pig breeding safety, quality, high-efficiency, pollution-free and sustainable development. Jiangxi Guohong Group mainly takes following measures:

1. Reasonable location, scattered layout. From the pig farm selection, reasonably arrange the breeding production base and select the pig farm site in mountainous area, middle-levels, places away from the crowd, so as to yield twice the result with half the effort for disease prevention and control of pig farm. When newly building the pig farm, select the site strictly in line with the principle. After site selection, build the sow farm, nursery pig farm and fattening farm in different areas with distance of 10-20km in the principle of scattered layout, which is good for preventing the spreading of viral disease.

2. Planting and breeding, pollution abatement. When building the pig farm, to reduce environmental pollution or build ecological park or cooperate with farmer and enterprise implement the planting and breeding mode "pig- marsh gas-vegetable, pig-marsh gas-fruit tree, pig-marsh gas-forestry, pig-marsh gas-fish", reasonably make use of feces and reduce environmental pollution. For example, Jiangxi Nanchang Guohong Group built pig farm available for 10,000 pigs and ecological park of 1,500 mu. The feces discharged will flow to the biogas digester and then drained to irrigate the melon and fruit in the park. Pig breeding project for 180,000 pigs was built in Xiushui County. Cooperate with local peasant households, provide feces for free to farmers for growing vegetables and then buy back vegetables and sold vegetables uniformly, which can reduce pollution and bring benefit to the company and farmers.

3. Changing limited breeding and implementing open and back to nature mode. When implementing modernized and large-scale pig breeding, discuss green, organic, ecological, environmental protection and welfare breeding mode. Jiangxi Xiushui County has mountainous area of over 1,000 mu, breed pig, goat, cattle, etc. in the mountainous area with fence surrounded and let animals back to nature and enjoy freedom and welfare, which embody the harmony and unity between human and nature.

4. Green and safe fodder without illicit drug. Green and safe fodder is an important factor ensuring healthy pig and no excessive hazardous substance in pork. Strictly control the fodder safety to ensure the pork quality and safety. Slaughter pigs nearby and quarantine pigs in a concentrated way, build slaughter house to slaughter pigs bred by the company or cooperated with farmers. Animal husbandry

quarantine law enforcement officers are at site to do quarantine to prevent no diseased pigs, dead pigs and pork with illicit drug from flowing to the market. Improve the enterprise's benefit through fine processing and go on a healthy, environment-friendly, safe, and high efficient modern agricultural development road.

3. Main problems, countermeasures and suggestions for pig industry

3.1 Main problems

The pig production of China is transforming from traditional production mode to modernized production mode. Main difficulties and problems in the transformation process include:

• High breeding cost. New *Environmental Protection Act* will significantly increase the proportion of environmental protection cost to the pig breeding cost. At present, the environmental protection cost in newly built scale pig farm occupies over 40% of total cost. Small breeding households failing to reach the environmental protection standard will rapidly exit and the scale of pig breeding is to be improved.

• Poor infrastructure. Scattered feeding farm with annual slaughtering of below 50 pigs occupies about 30% of total breeding. The production facilities and production mode of breeding farm (household) are relatively lagged behind.

• Extensive growth mode. At present, the pig production is generally in extensive growth mode based on quantity. With the increasing of environment, land and labor cost, compared with developed countries, pork production in China is characterized by low efficiency but high cost.

• Poor market competitiveness. The international competitiveness of pork from China is poor so it's to decompose the structure of meat product to improve the competitiveness[3]. The export pork product is unique and the market is relatively concentrated[4]. The pig breeding industry frequently experiences market price fluctuation, excessive supply or shortage, great pressure for stable production, which directly influences the income of farmers. Pig disease prevention and control and pork price fluctuation may influence the stable development of pig production and influence the competition of pig in domestic and foreign market as well as the export of pork products.

3.2 Countermeasures and suggestions

(1) Optimizing industrial distribution and innovating industrial management mode

Scientifically calculate the regional pig breeding ability, reasonably divide the banned area for breeding livestock and poultry, controlled breeding area and proper breeding area, optimize the industrial development layout of pig, and adjust the industrial structure. Pig production leading enterprise with the concept of environmental protection, energy saving, low consumption and high efficiency builds new pig farm and drive the development of pig industry of surrounding areas. Based on the principle of pig industrial chain integrated development, promote the large-scale and industrialization of pig

[3] Liao Yi, Zhou Faming. An Empirical Study on the International Competitiveness of Pork Products in China. *Exploration of International Trade*, 2011, no. 12, pp. 25-33.

[4] Chen Changhong. Research on Pork Export Structure and International Competitiveness of China. *Journal of South China Agricultural University (Social Science)*, 2010, no. 9(2), pp. 37-42.

industrial development, actively promote the cluster development of pig industry and obtain scale benefit. Relying on information and technical innovation, satisfy the market demand, closely connect the fodder supply, breeding, processing, consumption and other links, focus on meat product quality and safety and improve the industrial added value and competitiveness.

(2) Mastering the market discipline and regulating and controlling the pork price transmission mechanism

Enhance the understanding of pig industry cycle fluctuation law, promote the collection and transfer of price information, create more reasonable pig price; greatly carry out pig price target insurance pilot and enhance the ability of pig resisting natural risk and market risk. Insist on scale breeding, maintain benefits of small scale breading households, and promote the co-development of enterprise pig breeding and farmer pig breeding. From many aspects, enhance the pig price adjustment, promote the stability of domestic consumption market and expand the foreign market of pork products.

(3) Persisting in green development and enhancing quality safety supervision

Start from environmental protection, improve the animal welfare, build "green and healthy" pig breeding and pork processing flow[5], adopt ecological pig breeding technology and mode, improve the living environment of pig to fundamentally solve health and safety problem of pork products, and reduce disease risk; establish the quality tracking system, complete the pork quality monitoring system, regulate the whole process (before, during and after production) of pig industry, and maintain documents; and establish pig products market access system (only certified harmless, green, organic pig products or products meeting national standard can be sold in the market). Protect the rights and physical health of consumer, improve the product quality safety and enthusiasm of production operators participating in the quality certification, and form the quality and safety pork product market mechanism.

(4) Promoting scientific and technological progress and completing technology supporting system

Adapt to domestic pig industry development trend, promote advanced scientific breeding technology, apply government force, connect the market, inspire the enterprise's vitality through policy, fund and technology support, lead the enterprise to optimize and modify the variety, focus on pork quality, improve the pig quality transformation and improve the benefit of local pig market. Based on the boar localization and breeding system unification and diversification, reasonably make use of quality boar resource introduced, greatly cultivate grain-saving boar, improve the growth performance of pig, meat quality and disease prevention ability and ensure that the export pork quality reaches international first class level. With reference to experience of developed countries, establish the system combining scientific research, education and promotion. Accelerate the research of key technologies like high-efficient fodder

[5] Tang Xu, Wang Kai. Research Progress and Case Study on the Competitiveness of Pork Industry Chain System. *Tianjin Agricultural Sciences*, 2014, no. 20(1), pp. 48-51.

production, disease prevention and control and feces treatment, and enhance the popularization and application of research achievements.

(5) Enhancing environmental protection and completing pig industry support policy system

Enhance the support for construction of large-scale breeding farm and feces harmless treatment facilities, improve the boar breeding, animal nutrition, pig group healthy management, high-efficient scale production, provide breeding subsidy and support to farmers, and provide high-quality pig source and open the market for commercialization development. Encourage the development of professional pig breeding organization, enhance the degree of development of leading enterprise, complete pig future market, effectively dispose price fluctuation and evade market risk; complete pig breeding insurance policy system, improve the insurance coverage and content; promote breeding of appropriate scale and environmental protection and prevent scale monopoly[6]; gradually establish pig breeding social service system; lower the pig breeding cost; consider the connection between pig industry development and other social policies, improve the policy aiming policy and maintain scientific and valid support policy.

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