

Chapter 1 Development of the Hog Industry and its Integration in China

権利	Copyrights 日本貿易振興機構（ジェトロ）アジア経済研究所 / Institute of Developing Economies, Japan External Trade Organization (IDE-JETRO) http://www.ide.go.jp
シリーズタイトル(英)	ASEDP
シリーズ番号	77
journal or publication title	Pork Production in China - A Survey and Analysis of the Industry at a Lewis Turning Point -
page range	[9]-36
year	2008
URL	http://hdl.handle.net/2344/00015872

Chapter 1

Development of the Hog Industry and its Integration in China

Hog production is an important component of agriculture in China. Pork is the main non-staple food for most of urban and rural Chinese residents. China is not only a great hog production country, but also a pork consumption country. Both hog production and pork consumption in China accounted for about half of the world's total. The development of the hog industry is integral in meeting the demand for pork. Moreover, it increases income and employment of rural labor forces and makes a significant contribution to promoting the transformation of grain and the development of relevant industries. As a result of reform and opening of the market, hog production has developed rapidly. In 2006, China's hog inventories and hog slaughters amounted to 494 million and 681 million, respectively, ranking first in the world. The output value of the hog breeding industry reached RMB 644.35 billion, accounting for 48.4% of the livestock industry.

Due to the low price of hogs, rising feed costs, the highly pathogenic blue ear pig disease, and other factors, hog production declined significantly from the second half of 2006. Since April 2007, hog and pork supplies have tightened, forcing prices to rise sharply. Prices now remain high, which has a certain impact on the livelihood of the low-income residents and macroeconomic policies and has caused widespread concern in society. This research presents an in-depth analysis of hog production and the development of problems within the hog industry. Keeping hog production and market supplies of pork stable, as well as establishing long-term mechanisms promoting hog production, are the keys to protecting the hog industry and enhancing long-term, healthy development.

1. The development course of hog production

Raising pigs represents China's traditional livestock-raising sector and has a long history. China is a major hog producer as well as a major hog consumer. Since the founding of

the People's Republic, especially after China's reform and opening up, the hog industry has been developing rapidly. In 2006, China's total output of pork was 51.792 million tons, accounting for 46.9% of world pork production and 64.6% of China's total output of meat. Looking at the development of nearly 60 courses of the pig industry in China since 1949, it can generally be divided into five periods.

1.1 The slow development period before the reform (1949-1976)

This period can be further divided into three stages. First is the recovery development stage after the founding of the new China (1949-1957). With the stability of the livestock development policies, live pig policies allowed farmers to own the pigs they raised while receiving support from the government. Implementation of the policy promoted the development of the production of live pigs. Pig inventory increased from 57.75 million of 1949 to 146 million of 1957, restored to pre-war levels.

The former part of the second stage (1958-1966) coincided with 'the Great Leap Forward' and with policies instability. Here, pig development policy demanded that private pigs be put into collectives and encouraged the promotion of "10,000 pig farms". Coupled with decreases in agricultural production and the scarcity of feed, all livestock production dropped greatly, resulting in a shortage of supply. Adding to this a number of severe natural disasters, havoc was wreaked on pig production so that pig inventories in 1961 decreased by 75.52 million. The latter part of this stage is called the adjustment phase (1961-1966). Here, the State Council made a policy where "pigs were allowed to be raised both collectively and privately, though mainly privately", which again promoted rapid development in the hog industry. In 1966, the amount of live pigs nationally reached 193 million.

The third development stage (1967-1976) represented the slow-down. The Cultural Revolution began in 1967, due to a series of "leftist" policies, and the policies of the past, which supported the private breeding of live pigs, were abolished. Later, the government undertook a series of corrective measures to encourage farmers to breed pigs, but the measure was not implemented well and caused slaughter rates and meat rates to decline. In 1978 and 1979, the slaughter rate of live pigs decreased to about 55%, at which point hog production developed very slowly.

1.2 The accelerating period of China's reform (1977-1984)

After the Third Plenary Session of the Eleventh Central Committee, ownership of China's

animal husbandry and the system of its production had changed with an emerging a new pattern, leading China's pig industry to enter a new stage of development. In 1978, the household contract responsibility system granted farmers the power to manage their own affairs regarding production and operations. This stimulated greater enthusiasm among farmers for raising pigs. From then on, independent market players began to take shape. In 1979, "the Decision of CPC Central Committee Accelerating the Development of Agriculture" indicated that China should vigorously develop animal husbandry, increase its proportion in agriculture, and encourage farmers to raise and actively develop the nation's cattle, sheep, and pig industries. The documents reiterated incentive measures, such as rewarding feed grain to the farmers who raised more livestock, and during that year, the purchase price of live pigs increased by 26.3%. By the end of 1984, the inventory of pigs reached 306.792 million and slaughtering grew to 220.471 million. Compared to that of 1978, these factors grew by 18.26% and 36.85%, respectively, and pork production also increased rapidly.

1.3 The rapid development period (1985-1997)

The CPC Central Committee and the State Council issued "10 policies for furthering activity in the rural economy", which canceled the system of compulsory or contract purchasing of live pigs in January 1985. A new system of free market and free trade was executed where policies of uniform pricing of the majority of animal production had been removed. Free pig markets provided an opportunity for the pig-farming industry. In 1988, the Ministry of Agriculture proposed the building of a "vegetable basket project". In the 1990s, with the reform of the producing and marketing systems continuously pushing forward, the hog industry grew quickly. In 1997, pork production soared to 35.963 million tons compared to only 22.811 million tons in 1990, averaging 6.7% annual growth. In 1997, national per-capita possession of pork amounted to 29 kilograms and the pork market had attained a slight surplus for the first time.

1.4 Structural adjustment period (1997-2006)

Since the end of the last century, the factors affecting the hog industry have been becoming increasingly complex. A variety of issues, such as a structural surplus of animal products, shortages of feed resources and labor, high energy prices, livestock and poultry diseases, safety of animal product quality, and environmental factors, have restricted the development of China's animal husbandry. The pig industry has also been

faced with dual constraints from markets and resources and is under pressure to protect the ecological environment. This has led the production of live pigs into new stage of development; a market-oriented approach that focuses on enhancing quality, optimizing the structure of production, and increasing efficiency.

In 1999, document from the CPC Central Committee such as "views on adjustment of the current agricultural production structure" and "views on accelerating the development of animal husbandry", proposed the spread of excellent new varieties, lowering costs, improving efficiency, and achieving a market balance. Additionally, the views of these documents sought to change the production mode, adjust and optimize the structure and region arrangement of the livestock industry, and strengthen seed-breeding, feed production, and disease prevention systems. Through these measures they would be able to improve the quality and safety of animal products. In this period, live pig production was transformed from being numerically superior to qualitatively efficient. The level of breeding seeds has been constantly improving from local hybrid pigs to hybrid varieties of pigs. Patterns of pig and feed production methods have been changing from small-scale to specialization and large-scale operations, with the production of live pigs being concentrated gradually in the advantaged regions and the integration of industries accelerating to make remarkable achievements.

1.5 Towards large-scale, standardization, and integration

Since 2007, animal husbandry entered into a transition period, the features of which are mainly to change the mode of development, to establish long-term mechanisms for promoting sustainable and healthy development of animal husbandry, and then to construct modern modes of animal husbandry (11th Five-Year Plan for National Livestock Development, 2005) . Even in this transition period, pig production has grown rapidly, with sharp fluctuation in recent years. To the present, China's market for live pigs has gone through three complete cycles. The fourth cycle occurred in the second-half of 2006, when pig inventories and pork production dropped for the first time in decades, though pork prices were still very high. This fluctuation has influenced the stable development of the pig industry and residential consumption of pork. It has exposed new problems and challenges in the aspects of hog production in China. Thus, the central government have begun to attach great importance to the development of animal husbandry and issued a series of policies to support pig production to an unprecedented degree.

“The State Council’s Views on Promoting the Development of Live Pigs and the Stability of Pig Markets in 2007” stressed the need to increase support for the production of live pigs in order to establish a long-term mechanism guaranteeing stable development of live pigs industry. The series of supportive policies and measures supplied various subsidies. Some of these subsidies were for sow-insurance, epidemic disease prevention for pigs, and compensations for the losses from ‘blue ear disease’. Some were also for the seed-breeding of live pigs, rewards for the main producing counties, supporting standardized infrastructure construction, building systems of early-warning for production and consumption of live pigs, and a system of central and local meat reserves. Still others provided grants for the safe disposal of sick pigs at slaughter (Sun Zhengcai -Minister of Agriculture, 2007)

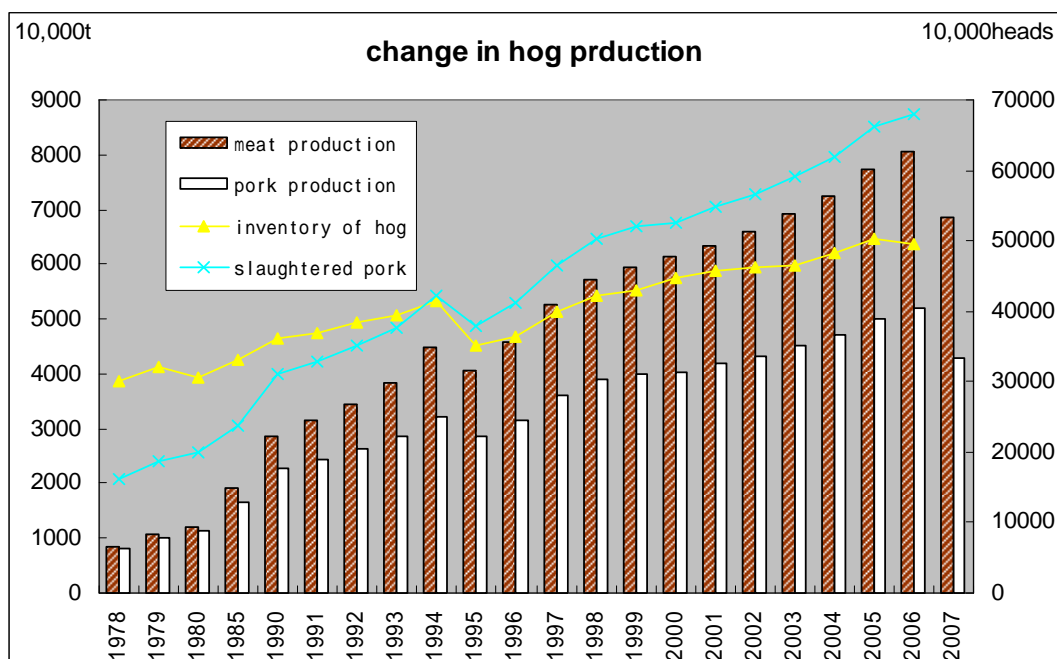
These measures improved national pig farming households’ enthusiasm , promoted the transformation of production modes, and accelerated the pig industry towards industrialization, large-scale development, and standardization. Moreover, they worked to strengthen macro-market regulatory capacity for the benefit of the long-term, stable, and healthy development of the pig industry.

2. Hog Production

2.1 Pork production

With the implementation of household contract responsibility systems, the elimination of pig contract purchases, and the opening of meat markets, the livestock industry developed rapidly and the quantity of pork continually increased (Figure 2-1). In 2007, the number of slaughtered pig rose to 565.1 million tons, which is 3.5 times greater than in 1978. Pig inventories also grew, reaching 439.9 million tons and increasing by 50% more than inventories in 1978. China's pork production has grown by rate of 6.4% since 1980. The growth rates for 1980, 1985, 1994, and 1995 were all higher than 10%. Pork production in 2006 amounted to 51.97 million tons, being more five times than in 1979. This pork production growth, however, has fluctuated over time.

Figure2-1 Change in hog and pork production



Source: annual statistics of Chinese live stock industry

We next divided the data into five years stages and analyzed total hog production over thirty years according to inventory, slaughtered pigs, pork production, slaughter rates, and carcass weight. After the implementation of reforms and market liberalization, pig inventories began to increase. The inventory of pigs in 1985, 1990, 1995, 2000, and 2006 were 331, 362, 350, 447, and 494 million heads, respectively. Annual growth rates for these periods were 1.36%, 1.80%, -1.00%, 4.98%, and 1.70%. Inventories of live pigs and growth rates were on the rise before 1990, but saw a drop in the mid 1990s. Pig prices fell sharply and inventories of pigs decreased by 56 million, lower than in 1990. Following this fluctuation, production of live pigs resumed gradually and in 2000, inventories of pigs increased by about 90 million above 1995 inventories. During this period, the annual growth rate was nearly 5%. In the new century, inventories continued to increase, but the growth rates slowed as the production of live pigs transformed from a quantity pursuing to a quality and efficiency pursuing industry.

The numbers of slaughtered pig continued to grow and rate of slaughter has continued to increase. The number of slaughtered pigs in 1985, 1990, 1995, 2000 and 2006 were 239, 309, 378, 526 and 681 million heads, respectively, representing annual growth rates

of 5.78%, 5.35%, 4.07%, 6.83% and 4.36%. Since 1978, pig slaughtering increased year by year and had a higher growth rate than that of pig inventories.

Pork yields have also continued to rise. At the beginning of the reform and opening up periods, pork production increased rapidly and then slowed to a stable, but consistent, growth. After 1995 the balance of supply and demand in the pork market and the diversification of peoples' meat consumption caused increases in pork yields to slow, but they did still increase nonetheless. Resulting from pig diseases and feed price increases, pig production decreased by 9.2% in second half of 2007, which was the first decrease since 1995.

Carcass weights of pigs increased initially and then held stable over time. Before 1990, consumers, especially rural residents, ate more pork fat as a consequence of pork shortages. Pig breeding households during this period bred and raised larger and fatter pigs to increase carcass weights. After the 1990s, carcass weights returned to those of fifteen years prior because people changed their eating habits and began to prefer leaner pork (Table 2-1).

Table 2-1 Index change of pig production

	Pork yield	Inventory	slaughtered	Rate of slaughtered	carcass eight
	0000 ton	0000 head	0000 head		KG/ head
1978	807.1	30129	16,109.5	78%	50.10
1985	1654.7	33139.6	23,875.2	88%	69.31
1990	2281.1	36240.8	30,991	91%	73.61
1995	2853.5	35040.8	37,849.6	122%	75.39
2000	4031.4	44681.5	52,673.3	135%	76.54
2006	5197.2	49440.7	68,054.4	78%	76.37

Source: Annual Statistics of Chinese live stock industry

2.2 Regional arrangement of pig production

The hog industry is a grain-consuming and labor-intensive form of animal husbandry. The middle and lower reaches of the Yangtze River region and North China are the major and traditional grain-producing areas where feed resource and labor are abundant. Pig inventories, slaughtered pigs, and pork yields of these areas account for 60% of national total. Pork production is affected by natural conditions as well as economic and social development. These conditions can include things such as climate, environment,

labor, material inputs, transportation, consumption levels, scientific and technological progress, and so on.

With the economic and social development after reform and opening up, the regional arrangement of live pigs has changed and become increasingly optimized. China's pig production areas can be divided into six areas: Middle and lower reaches of the Yangtze River (including Sichuan, Hubei, Hunan, Jiangxi, Jiangsu, Zhejiang, and Anhui Provinces); North China (including Shanxi, Shandong, and Henna Provinces); Northeast China (including Liaoning, Jilin, and Heilongjiang Provinces); Southeast China (including Fujian, Guangdong, Guizhou, and Hainan Provinces); municipalities (Beijing, Tianjin, and Shanghai); and other areas (including the rest of 10 provinces). Some features of regional development and changes are as described in the following sections.

2.2.1 Pig production has maintained a more robust momentum of development

Production of live pigs has grown rapidly from 1980 to 1985. In 1995, pig inventories, slaughtered pigs, and pork yields increased by 1.42, 0.45, and 2.22 times, respectively from 1980. The average growth rate of pork yields was 8.1% and it continued to grow steadily after 1995. In 2006, pig inventories, slaughtered pigs, and pork yields increased by 42%, 12%, and 42 % from 1995. The average growth rate of pork yields from 1995 to 2006 was 3.27%.

In first phase of development, the North and Southeast China industries grew quickly, where pork yields increased by nearly three times and the number of slaughtered pigs grew by about 2 times. The Yangtze River area and Northeast China industries followed with pork yields increasing by nearly 2 times and the number of slaughtered pigs growing slightly. In second phase of development, North China industries continued to grow rapidly. Pork yields here increased by 0.81 times in ten years and in Northeast China and the Municipalities, pork increased by 38%. Growth rates of the Yangtze River area and the Southeast slowed during this period (Tables 2-2 and 2-3).

Table 2-2 Change of regional pig production from 1980 to 2006

Region	Hog inventory			Hog slaughtered			Pork yield		
	(0000 heads)			(0000 heads)			(0000 heads)		
	1980	1995	2006	1980	1995	2006	1980	1995	2006
Yangtze River	14395	19853	18547	10786	23942	27025	568	1697	2006
North China	4880	7206	10464	2643	8352	15311	176	666	1203

North East	2367	3324	3714	1420	3300	5078	101	299	412
South East	3636	6007	6584	2058	6316	9033	130	505	633
Municipality	594	550	575	669	956	1139	35	60	83
Other	4671	7180	9558	2285	5085	10465	124	421	861
Nation	30543	44169	49441	19861	48051	68050	1134	3648	5197

Source: annual statistics of Chinese live stock industry

Table 2-3 Increase times of pig production among regions

	Changes between 1980-1995			Changes between of 1995-2006		
	Pork yield	Inventory	Slaughtered	Pork yield	Inventory	Slaughtered
Yangtze River	1.99	0.38	1.22	0.18	-0.07	0.13
North China	2.78	0.48	2.16	0.81	0.45	0.83
North East	1.97	0.40	1.32	0.38	0.12	0.54
South East	2.88	0.65	2.07	0.25	0.10	0.43
Municipality	0.70	-0.07	0.43	0.38	0.04	0.19
Other	2.40	0.54	1.23	1.04	0.33	1.06
Nation	2.22	0.45	1.42	0.42	0.12	0.42
Growth rate at the nation	8.10	2.49	6.07	3.27	1.03	3.21

Source: Annual statistics of Chinese live stock industry

2.2.2 Regional changes are significantly different

The status of the main producing areas of Yangtze River areas declined in the first phase of development with its proportion of pig inventories and pork yields decreasing from 47.13% in 1980 to 44.95% in 1995. The proportions rose in the Southeast during this period. Pig inventories, slaughtered pigs and pork yields in Northeast China, the Municipalities, and the Yangtze River area decreased. During second phase, the status of pig production of Yangtze River area, the Northeast area and Municipality area continued to decline. In 2006, the proportion of pig inventories, slaughtered pigs, and pork yields of the Yangtze River area decreased to 37.5%, 39.1%, and 38.6%, respectively, representing a decrease of 5-8 points from 1995. Proportions of pig inventories, slaughtered pigs, and pork yields of North China continued to increase beyond the first phase. That of the Southeast decreased, with the proportion of pork yields falling by 1.66% (Tables 2-4 and 2-5).

Table 2-4 Proportion of pork yields of 1980-2006

Region	Proportion of inventory			Proportion of slaughter			Proportion of pork		
	1980	1995	2006	1980	1995	2006	1980	1995	2006
Yangtze River	47.13	44.95	37.51	54.31	44.95	39.71	50.08	46.52	38.59
North China	15.98	16.31	21.16	13.31	16.31	22.50	15.52	18.24	23.15
North East	7.75	7.52	7.51	7.15	7.52	7.46	8.88	8.20	7.92
South East	11.90	13.60	13.32	10.36	13.60	13.27	11.48	13.84	12.18
Municipality	1.95	1.24	1.16	3.37	1.24	1.67	3.11	1.64	1.59
Other	15.29	16.26	19.33	11.51	16.26	15.38	10.93	11.54	16.57

Table 2-5 Change in proportion of pig production of 1980-2006

	1980-1995			1995-2006		
	Inventory	Slaughter	Pork yield	Inventory	Slaughter	Pork yield
Yangtze River	-2.18	-9.36	-3.56	-7.44	-5.24	-7.93
North China	0.33	3	2.72	4.85	6.19	4.91
North East	-0.23	0.37	-0.68	-0.01	-0.06	-0.28
South East	1.7	3.24	2.36	-0.28	-0.33	-1.66
Municipality	-0.71	-2.13	-1.47	-0.08	0.43	-0.05
Other	0.97	4.75	0.61	3.07	-0.88	5.03

Source: Annual Statistics of Chinese live stock industry

To sum up, in the 1980s, China's production region arrangement was that the North yields grain and the South produces meat, where meat is then transported from the South to North. At present, China's main production region of pork is concentrated in the Sichuan Basin, the main producing areas of corn and wheat are in Northern China, and the main rice-producing areas are the middle and lower reaches of the Yangtze River. In 2006, the top three pork production provinces were Sichuan, Henan, and Hunan, which accounted for 28.1% of national production, followed by Shandong, Hebei, Yunnan, Guangdong, Hubei, Anhui, and Jiangsu. The pork production of the top ten provinces accounts for 65.7% of the national total.

North China is primarily a grain-producing area for corn and wheat. Because of advantages in breeding costs and transportation in this area, the future of pig production

will gradually shift to this region (Feng Yonghui, 2006). The economic development of the Yangtze River area, the northward movement of grain production, feed resources, and labor, and low pig breeding efficiency has put a constraint on live pig production. However, Sichuan, Hunan, and other areas remain traditional producing areas because of the advantages of small, miscellaneous grains and land.

Southeast China and the Municipalities have developed rapidly as a result of the own resources, funds, and market advantages. In the past 10 years, mainly because of the increasing cost of resources and continuously enhanced awareness of environmental protection, pig production has developed slowly in these areas. Breeding pigs need to occupy a lot of land and consume large amounts of water, electricity, and other resources. In addition, pollution from pig operations can be serious, so pig production development has shifted from economic centers to the mountain and the surrounding areas (Hu Hao, 2005). Still, pig production in these areas does have a certain prospect because of market potential and exports to Hong Kong.

Pig production has developed continually in Northeast China since the 1980s. However, the speed of development is slower than other areas and the proportion of live pigs has decreased in the nation as a whole. Production of corn and soybeans in Northeast China are greater than that of North China and feed is the most abundant in Northeast China. Livestock industries in Northeast China have accelerated in recent years and pig breeding potential is being developed. The pig industries in these areas are expected to develop rapidly in the next few years.

2.3 Large-scale hog production

Large-scale breeding has recently accelerated. Pigs are the traditional livestock bred by the Chinese, but for a long time the pig breeding level was low and production methods fell behind the times as most pigs were bred in backyards. After the new China was founded, mainly collectives and farmers bred pigs and only a small number of these were large-scale state-owned farms. After the reform and liberalization, special pig-breeding households gradually emerged. By the mid of 1990s, small breeding farmers accounted for 1% of all farmers. After the mid of 1990s, the standardization and scale of live pig operations developed rapidly and the proportion of large-scale operations has risen constantly. From 1995 to 1999, the share of large-scale pig-raising rose from 13.6% to 21.5%.

After entering the new century, many backyard households withdrew from the pig breeding industry because of the epidemics and low price of 2006. Since then, China's large-scale pig farmers had accelerated. In 2006, the total slaughters of farmers which slaughter 50 heads above accounted 43% of the national slaughters, which was 25.72% in 2000.

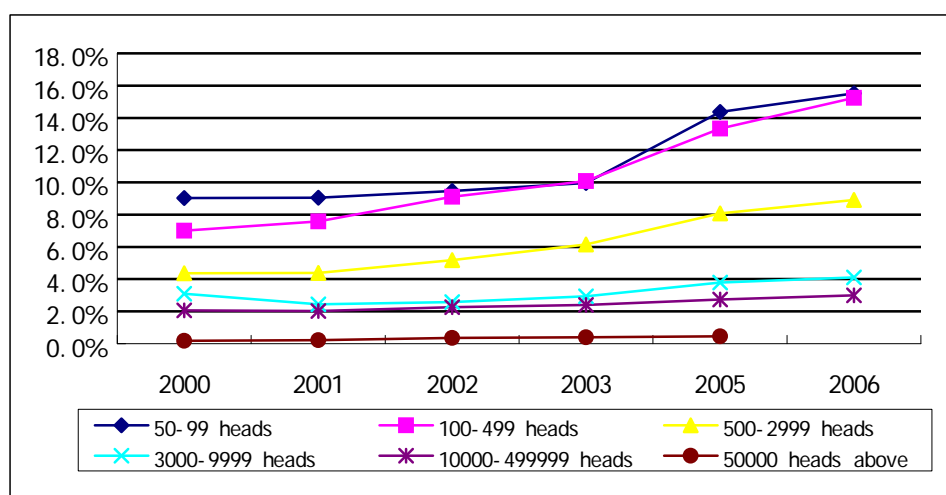
From 2000 to 2006, in terms of different raising scales, the slaughters share of 100-499 heads farmers has risen from 7% to 15% and then the share of 50-99 heads farmers, which was stable before 2003, has grown rapidly. The larger-scale operations(500-2999 heads), also showed an increasing trend. In short, the slaughters proportion of farmers (50-3000 heads) increased rapidly and it has gradually become the main body of China's pig raising industry, coming to nearly 40% in 2006 (Table 2-6 and Figure 2-2)

Table 2-6 Production by large-scale farmer (50 head or above per year sloughed)

	2000	2001	2002	2003	2005	2006
Slaughters above 50 heads (0000heads)	13550.08	14122.93	16598.2	18907.41	28257.6	31846.4
National slaughters (0000heads)	52673.3	54936.8	56684	59200.5	66098.6	68050.4
Share	25.72%	25.71%	29.28%	31.94%	42.75%	43.00 %

Source: Annual Statistics of the Chinese Livestock Industry

Figure 2-2 Slaughters share of different scale farmers from 2000 to 2006



Source: Annual Yearbook of the Chinese Livestock Industry

Advantages of large-scale farming have appeared gradually. With the transformation from small and scattered household breeding to large-scale operations, breeding

management has become more standardized, breeding technology has improved, and comprehensive productivity capabilities have grown. Now, the scale of breeding operations is playing an important role in cost-saving, standard management, anti-risk capability, and quality safety.

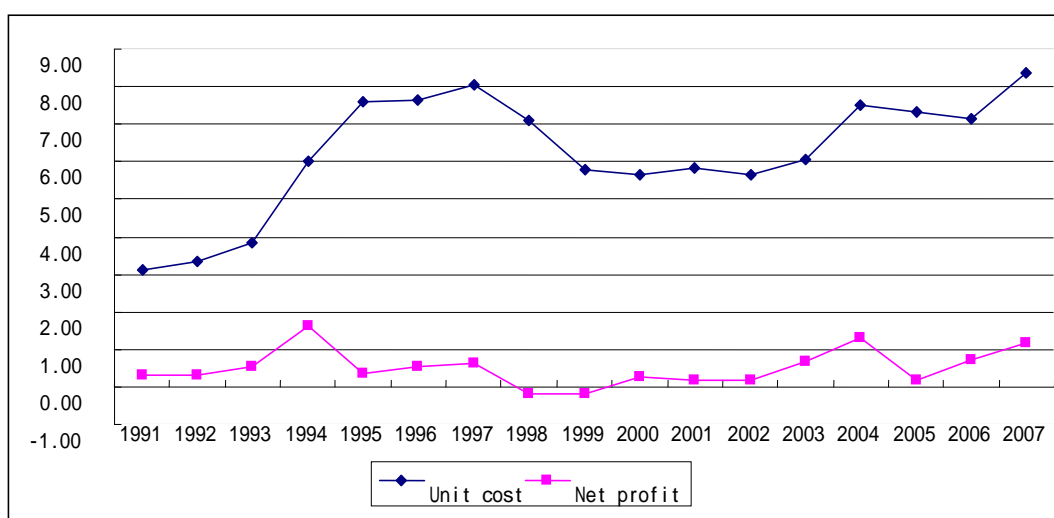
2.4 Cost-benefit analysis of live pigs operations

Since reform and liberalization, China's pig production has grown stably and the structure of production cost has changed significantly.

2.4.1 Changes of pig operation costs since the 1990s

The cost of pig farming has increased continuously while profit has fluctuated from 1990s(Wang Jimin, 1999). Pig unit costs (the total cost of live pigs per kg) rose from RMB 3.1 per kg in 1991 to RMB 8.04 per kg in 1997 with an annual growth rate of 17.2%. From 1998, it began to decline and continued until 2003. From 2004, unit costs again began to rise and had an annual growth rate of 8.5% (Table 2-7). Net profits of pig farming operations have fluctuated distinctively. Net profit from 1991 to 2007 was RMB 0.5 per kg, peaking in 1994 and bottoming out in 1998. Operational losses primarily occurred in 1998 and 1999, while profits of RMB 1 per kg were realized for three years, 1994, 2004, and 2007. Net profit of RMB 0.5-1 per kg occurred in six of the years examined and firms having net profits fall below RMB 0.5 per kg happened in seven of the years (Table 2-7).

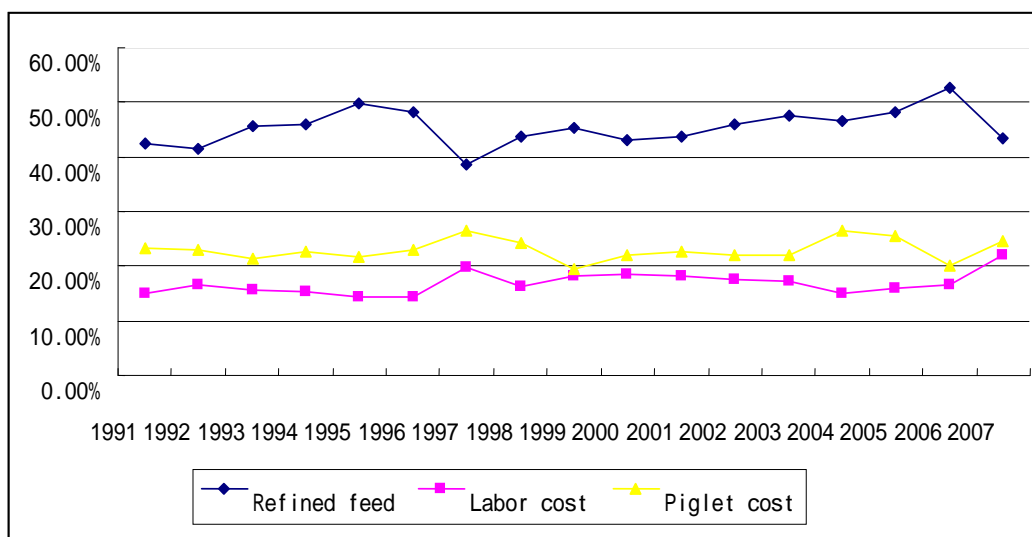
Table 2-7 Change of cost and profit of pig operations



Source: Annual Compilation of Agricultural Production Costs and Profits

As we can see from this figure, the proportion of labor cost have risen, but feed and piglet costs have remained relatively stable. Pig production costs are composed of feed costs, labor costs, and the cost of piglets. Among the three, the proportion of feed costs was the largest, amounting to 43.25% in 2007. Piglet and labor costs followed with 24.43% and 21.92%, respectively. These three cost components account for 89.61% of total cost. The changing trends of proportions of feed and piglets cost have a negative relationship, but the trend of labor costs was not significant (Table 2-8). The price of pigs in 2007 rose too fast, covering up the rising trend of feed costs and making the proportion of feed costs decline.

Table 2-8 Proportion Change in Costs



Source: Annually Compilation of Agricultural Production Costs and Profits

Costs and benefits of scale breeding households are higher than slightly backyard-breeding households because feed and piglet costs are higher. Proportions of feed, piglets, and labor of scale breeding households are 54.72%, 26.21%, and 7.41%, respectively. Comparatively, proportions of feed, piglets, and labor of backyard-breeding household are 43.21%, 22.34%, and 19.6%. The breeding technology and intensity level of scale breeding households are not much different from that of backyard-breeding households and market mechanisms were not completely formed before the 1990s, so advantages of scale breeding households have not been reflected. Since the late 1990s,

efficiencies in scale breeding households have risen mainly because of good quality, high prices, and technology efficiency.

2.4.2 Factors affecting costs of pig operations

The price of pigs and pork has continued to rise since 2004, reaching RMB 15.47 and 24.25, respectively, per kilogram in June 2008. Price increases in inputs, however, have caused the profits of breeding operations to decline. Some of these factors that have affected the costs and benefits of pig-farming operations are detailed in the rest of this section.

Global decreases of grain production and soaring oil prices have driven the cost of feed up substantially. In the course of pig production, feed accounts for more than 50% of meat costs. Changes in feed prices have a great impact on production and, therefore, the price of pigs. In 2006, global cereal output was 1.985 billion tons, a decrease of 33 million tons than in 2005. With the soaring price of oil, some countries have begun to use corn processing to produce ethanol fuel. As the relationship between supply and demand changes, the international market prices of grain will continue to rise. The international market futures prices of maize and soybean were up 60% and 40% in June 2007. In China, corn prices reached RMB 1.65 per kilogram in July 2007, an increase of 16.2% from July 2006 (Wang Mingli, 2007). The increase of feed costs has led to a significantly rise in pork prices.

Epidemics have led to further increases in costs through the increase of piglet costs and losses animal deaths. Since the second half of 2006, blue ear pig disease broke out in the main producing area of live pigs. Although the mortality rate of live pigs was not high, the health of piglets was greatly affected and survival rates dropped to only 15-25%. This directly resulted in further shortages of supply and higher prices. At present, the price of piglet has reached RMB 35 per kilogram. Disease has also led to lower rates of slaughtering, animal losses, and increases in the costs of disease prevention.

Industrialization and urbanization has exacerbated the rise in pig production costs by pushing labor costs higher. As China's industrialization and urbanization continues to accelerate, some farmers leave to go to the cities for work. As a result, the number of breeding farmers has been reduced. The high wages of workers increases the opportunity costs of raising pigs. Labor costs per head of live pigs were RMB 39.91 in 2003, rising to RMB 56.07 in 2004 and RMB 59.17 in 2006. Labor cost, so far, has become the main factor affecting cost increases.

3. Hog Integration Development Status and Problems

3.1 Development of China's animal husbandry and hog integration

In course of China's industrialization of agriculture, the animal husbandry industries began the process first and were the fastest to grow. In 1981, the industry took the lead in the establishment of the first integration joint venture (Ruogai Integration Joint Venture) in Sichuan Province, which tried to change the livestock production conditions, processing and marketing were separated since the planned economy era, and led a primary development of the integration of animal husbandry. Subsequently, the state began allowing collectives with permits and individual traders to deal directly and repealed the beef, mutton, and eggs pro-unification purchase system, which laid the foundation for animal husbandry integration or industrialization. Integration in China is an operation and management system in livestock sector. Generally, there are more than one or a feed, veterinary drug producers, farmers, processors of livestock and sellers of its production making a combination through signing contracts or possession of shares. Their purpose is to meet market needs, combine to withstand market risks, reduce costs and increase profits. The combination is similar to manufacturing enterprises, its parties like the different links of their production. They must obey the requirements of the contracts and provide the production or services for each other to provide products, and cooperate closely to maximize their profits.

Up until the mid-1980s, the number of county livestock integration enterprises had reached more than 600, some of which became livestock enterprise groups. From 1985, a comprehensive national animal products liberalized market was created. From this measure, key animal husbandry households and professional organizations sprung up, livestock production and operations showed a multi-component coexistence, multi-channel distribution patterns appeared, and throughout the country, large numbers of livestock integration enterprises were developed. This helped to solve contradictions between scattered farmers and ever-changing markets.

According to preliminary estimates, there were 11,000 animal husbandry integration enterprises by the late 1980s. The output value of those enterprises reached RMB 12 billion, which accounted for 16-17% of the animal husbandry output value. More than 100 integration reform experimental units were created, which have achieved great success. In the 1990s, the industrialization of animal husbandry gradually entered a

period of rapid development along with the industrialization of agricultural development in China. Diverse forms of animal husbandry organizations and a large number of animal husbandry leading enterprises emerged. According surveys by the Ministry of Agriculture of 1,650 counties (cities, districts) of 28 provinces and autonomous regions, at present, there are 500 leading agricultural enterprises and more than 30,000 agricultural industrialization organizations of which the industrialization of animal husbandry accounted for about 50%(China Veterinary Department, 2004). The extent that animal husbandry has become industrialized is far greater than other agricultural sectors and this has played a great role in the development of livestock production.

Hog is the main livestock in China and there is a close relationship between the development of hog industrialization and the development of animal husbandry industrialization. Hog industrialization has made great achievements through each stage of these developments. There are large processing enterprises in the hog industry, such as Shuanghui Group in Henan Province, Yurun Group in Jiangsu Province, Jinluo Group and Delisi Group in Shandong Province, Kunpeng Group in Beijing, Huazheng Group in Jilin Province, and Tieqi Group and Lishi Group in Sichuan Province. Shuanghui Group is a large meat-based food-processing organization that slaughters 15 million hogs and produces over 100 million tons of meat products annually. It is the largest meat-processing base in China and ranked 154 in the top 500 Chinese enterprises in 2006. Yurun Group is the large-scale food production enterprise based on pork products, which is the first batch of "national-level integration of leading agricultural enterprises". In 2007, Yurun Group slaughtered 15 million hogs and its sales had reached RMB 31 billion. Yurun Group has also benefited 3 million peasants who earned nearly 6 billion RMB from selling their products or being employed. Jinluo Group was founded in 1994 and is a comprehensive, large-scale enterprise based on meat production and processing. It is one of the largest hog slaughtering and meat processing enterprises, annual slaughtering and processing 10 million hogs and 45 million chickens, and has a yearly production capacity for meat and meat products of nearly 2 million tons. Developing leading hog producing enterprises, hog farming cooperatives, and professional associations promotes effectively the development of the integration of hogs in China.

3.2 Developing Mode of the Hog Integration

3.2.1 "Company + Farmers" mode

By use of a "company + farmers" mode of operation, thousands of households can be integrated with large-scale production. This mode of operation has an integrated company as the axis with which farmers establish close contacts in order to cooperate in hog farming. The company provides seed, feed, medicine, technology, and marketing, along with pre-production, production, and post-production services. Companies are linked with farmers in order to conduct a version of industrialized large-scale production, with both sides can complementing each other in regards to capital, labor, space, technology, and other fields. For example, the "Shuanghui" group in Luohe is centered in its strong abilities in processing, cold storage, and sales. Through integration with farmers into an economic community and through production and marketing contracts with farmers, the enterprise and farmers commonly form a new integrated group of production and management. This move has promoted the output value of agriculture, aquaculture, slaughtering, and processing on the order of achieving RMB 1 billion, RMB 4 billion, and RMB 2 billion of output value in each of those fields, respectively. It has also helped to promote the engagement of 2.46 million farmers in cultivation, breeding, processing, and marketing.

3.2.2 “Company + Base (Animal Raising Village) + Farmers” mode

Through companies creating a base and then the base being linked to farmers, a "small-scale, large groups" mode of operation has emerged. This has linked the standardized production modes of the hog-feeding, livestock, and poultry fields with the pork products processing base. Yurun group, founded in 1993, is composed of non-public enterprises and has now become one of the China's largest manufacturers of low-temperature meat products. Since 1997, Yurun Group has invested over RMB 500 million to build a 10,000 hogs base including a breeding base and 11 hog model fields and has also invested more than RMB 50 million to improve and transform workshop and slaughtering facilities. In 2005, it's based slaughtered 10 million pigs and processed 250,000 tons of meats while the organization continued to increase investment. At present, the total amount of investments comes to RMB 2.5 billion in Lianyungang, Maanshan, and Shenyang. The group also plans to spend 2 to 3 years on constructing, reconstructing, or expanding hog slaughtering and meat manufacturing projects of it's base. The project is expected to transfer about 15 million laborers, help farmers increase profit to approximately RMB 600 million, increase agricultural output values by more than RMB 30 billion, and provide a boost of around RMB 1 billion for transport and

packaging industries. In recent years, Yurun has also opened bases around other parts of the country, utilizing the "company + base + farmers" mode of industrialized operations, which has greatly promoted the development of China's pig industry.

3.2.3 “Company+ Association (Cooperative Organization) + Farmers” mode

This mode was first implemented in the Qingzhu village of the Xiangshui town in Xiangtan County. It is also known as "Qing-Zhu mode" and is regarded as a bridge between the company and farmers. This mode adopts large-scale production and intensive management to achieve ecological agriculture, high-efficiency agriculture, orders agriculture, and market-oriented agriculture. The association is the core of this mode with the farmer being the base and the company acting as support. Its development objective is to increase farmers' income; a win-win situation for all parties including the company, the association, and farmers. The basic mechanism of the "Qingzhu model" was that the association signed a common security pork production and sales contracts with Xiangtan Weihong Food Co. Ltd., Handley (Xiangtan) Feed Company, and Beijing Agricultural University Group Pig Breeding Farm. Members were to provide ore-production, production, and post-production services, namely the "seven reunification" services of purchase, sales, intake of new varieties, epidemic prevention, training, feed, clearing, and loans. 17.5 hogs per capita, or 28,000 hogs, were slaughtered in Qingzhu Village in 2004. This mode solved the deficiencies of the "company + farmers" mode by enhancing the quality of hogs, improving efficiency of the hog farming industry, and greatly increasing the income of farmers; factors to which leaders at all levels have great concern and pay close attention. Japanese experts made a special trip to examine the “Qingzhu mode”, which has a lot of promotional value. Delisi Company is currently aiming to build 5 million hog, integrated industrial system in Shandong. Moving from the "company + farmers" to the "company + farmers cooperatives", integration in food processing, feed production, breed improvement, vaccination, and quarantine of hog slaughtering processes has been perfected.

3.2.4 Commonwealth of hog farming, associations or cooperative organization modes

Pig-raising union organization is of self-service and a certain division and voluntary participation by the pig-raising farmers. In addition to pig-raising households, full-time or part-time staff were engaged in feed processing, transport of hogs, marketing, and

information and technology services, which formed a combination top-bottom and complementary supporting service system to achieve an integration of operations. Faced with the vagaries of the market, pig-raising households urgently need to set up a bridge between small-scale farmers and large markets. Consequently, the "Commonwealth of pig-raising farmers" mode, which led the majority of pig-raising organizations and households to voluntarily participate in the formation of coalitions, came into being. Five national and provincial pig breeding farms have formed industry associations in Zhengyang County, Henan province. The association frequently invites the provincial animal husbandry experts to give lessons about raising pigs, in addition to technical guidance, to the members. The association provides members services with regard to feed, vaccination, and sales. The pig-raising households who join the association can eliminate some of the worries inherent in pig farming. The association registered a "Zhengliang" collective trademark licensing in 2001, which has now developed into more than 1,000 members. There are many similar associations throughout the country. With the "Farmer Cooperatives Law" coming into force on July 1, 2007, hog industry cooperatives have rapidly develop in China. In 2008, the largest hog farming cooperatives currently established were in Taiyuan city of Shanxi Province and incorporates a composition of more than 32 hundred-scale hog farms.

3.2.5 "Operating Integration of Company Development" mode

In this operational mode, the company is independent of all pig production and business activities, but shares in the profits and risk with professional pig-raising farmers. It is easy to improve varieties and promote new technology using this mode, but of the downside is often found in the company having to rely on itself to develop and strengthen. This mode also requires better breeding conditions, in which the risk of disease has a greater impact.

3.3 Main Problems of Integration Management

With the development of pig farming integration and the gradual expansion of the pork market, meat processing enterprises, large-scale hog farming enterprises, feed processing enterprises, intermediary market organizations, and slowly growing enterprises can be a bridge to the hog production base, professional animal husbandry household, and the market. This bridging allows the distribution of benefits to be more reasonable in the hog

production, processing, and sales. Business modes of hog production, supply, and sale are gradually maturing. The integration of modes incorporating different characteristics has allowed the pig-farming industry to implement trans-regional and cross-industry restructuring. It has significantly enhanced market competitiveness and expansion. The further development of integrated organizations will greatly accelerate the change in pig farming from quantity to quality and promote hog industry production levels and structural optimization. The rise of the large-scale hog industry, specialization, and regional levels of integration have helped drive the feed industry, food processing industry, and other related industries to develop vigorously. Although we have had some success, we still face problems and restricting factors because the pig industry is still newly developing and lacks experience.

3.3.1 Imperfect inner-integration distribution of benefits

Contracts tended to not be standardized between enterprises and farmers. Some enterprises are often powerful by virtue of their own economic advantages and often create contracts establishing business-friendly terms, damaging the interests of farmers. Additionally, both sides do not always observe the credibility of the other party or of an agreement. When the products are high-priced and easy to sell, farmers often break the terms of a contract. In contrast, farmers are usually willing to sell raw materials to enterprises, but these enterprises are not bound by terms within the original contract to buy. Even if they are willing to buy, they often force down the grade and price, which results in serious damage to the interests of farmers. Finally, the cost of recourse is generally very high, so if one side breaks a contract, compensation is usually hard to come by. All of these factors can lead to contradictions and conflicts within the integration of organizations.

3.3.2 Ambiguous advantages of leading enterprises, the low integration

Although leading livestock enterprises have the frontrunner position in the integration of agriculture resulting from 20 years, they face fierce competition in both domestic and foreign markets. Many problems remain because these are small-scale enterprises, the quality of products is poor, they are restricted by backward management systems, and they are not very competitive. Weak technology innovation systems and insufficient capacities of the large leading enterprises also cause problems. Many large enterprises still rely on an extensive expansion modes and neglect new technology and new product

research, which cause them to be weak in the face of market competition, in their own brand names, and in terms of product advantages. In business management, there are also some failures. The introduction of modern management systems has not been timely, property rights are not clear, and the issue of decision-making is not scientific. Companies still rely on traditional, family-style management approaches to manage group companies, so their long-term development has been greatly affected. Also, the degree to which the group is integrated is very low. Some enterprises lack stable raw material bases and some enterprises have poor marketing channels. Those enterprises need to continue to improve the ability and means to explore domestic and foreign markets.

3.3.3 Institutional factors affect the further development of integrated operations

Most countries in the world have adopted integrated agricultural management, while agricultural sector management systems are divided in China, disconnecting production, processes, and sales, and separating trade, industry, and agriculture. There are 13 departments of agricultural management, production, and circulation. This decentralized management structure has even violated farmers' operational autonomy and does not respect the wishes of farmers, using executive orders in a planned economy. This approach lacks regional characteristics and creates difficulty in exploiting comparative advantages through pursuing integration speed, sightless projects, and structural convergence.

3.3.4 Policies are not implemented to support the integration of leading enterprises and organizations

Governments at all levels have formulated a series of policies to develop the integrated management of agriculture, but those policies are difficult to implement. The foremost reason for this is that financial services are not in place. Also, while farmers joining into the integrated management of agriculture have accounted for 25% of the total, farmers who actually participate in various cooperative economic organizations only account for about 4% of the total number of farmers(Zhang Cungen,2007).

4. The main problems of China's pork production industry

4.1 Feed, labor, land and capital constrain pig industry in the long-term

As demand for livestock products, the degree of animal husbandry integration, and scale are increasing, the demand for feed grain and high-quality feed also continues to expand. Because China's land resources are limited, with the growing population, shortage of feed grain will be among the long-term issues that China's animal husbandry is facing. In recent years, with the rise in oil prices and corn being used to manufacture oil, the fight for corn between the energy industry and the feed industry has intensified the shortage of corn supply. Experts estimate that in the future energy and food shortages will be irreversible and food prices will rise rigidly. That will also directly result in feed cost increases for livestock, reducing the cultural benefits of livestock consumption, especially pig.

Along with the acceleration of China's industrialization and urbanization, the cost of the rural labor is increasing and the number of farmers who raise pigs is declining. Currently, China's pig farming still consists of mainly scattered farming. With the transfer of rural laborers who move mostly to city for work, fewer rural households are engaged in pig farming at home. The higher the salary from working in the city, the lower their benefit from farming pigs, thus the amount of sideline aquaculture farmers drops dramatically. In the meantime, the scale of farming is underdeveloped and therefore cannot compensate for the withdrawal of backyard farming households. After a while this will come to affect production and the market supply of live pigs.

In recent years, pig farming has become a high investment and high-risk industry. Financing problems have been troubling farmers because of increasing breeding and production inputs costs along with the risk of disease rising. At present, the pig industry is facing practical difficulties such as fewer loan approaches, high interest rates, and strict loan rules. In accordance with state regulations, animal husbandry land belongs to the rural collective land and cannot be used as mortgage for loans. Farmers cannot easily obtain loans, which prevent farmers from expanding pig production. In recent years, the state has taken strict measures to protect arable land and strengthened the management of land use. In addition to the citizens' attention to environmental protection, these measures have caused land acquisition and processing of animal husbandry to become so strict that it is very difficult for farmers to pass the examination and gain approval of loans. As a result, though farmers know there is a shortage of live pigs and want to expand production, without land and with a lack of funds, there is no way for them to do so.

4.2 Prolonged backward production modes and imperfect infrastructure and technology

In China, pigs are mainly raised by tens of thousands of small-scale households and the level of large-scale production and standardization is low. There exist many problems resulting from small-scale farmers' production not being standardized. This leads to poor production facilities and technology supportive systems that lag behind. Consequently, farmers cannot keep up with the changes of the market and do not have adequate abilities to adjust their production in time to withstand market risks. Another point of focus is on the issue of imperfect technical service systems. The current systems cannot meet the demands of the pig production in that seed breeding systems are imperfect, hierarchical structures are not clear, swine farm infrastructure is weak, breeding technology is not advanced, and the ability to providing good breeds is limited. At the same time, resources of local breeds have not been utilized enough. These imperfect technical service systems also constrain the extension and application of the new varieties, new products, and new technology. Additionally, technical service institutions are not well equipped, grass-roots teams of animal husbandry and veterinary services are unstable, and technical facilities and procedures are incomplete. Veterinary management systems were established on a regional basis, which has brought about ineffective supervision, inspection and testing equipment and tools that are less advanced, and relevant state regulations that are not effectively implemented, leading to poor vaccination and veterinary drug abuse. Imperfect information service networks for production and marketing also cannot meet the developmental needs of the of hog industry in a market-oriented economic system.

4.3 Animal epidemics are under control as a whole, but they occurred frequently in some regions and the risk of major animal diseases still exists

Although the recent deadly infectious animal diseases have been brought under control, hidden dangers from some of the major epidemics still exist. In recent years, China's species of pig plague have tended to become more various and complex, which has added to the 4-5 kinds of originally common diseases such as classical swine fever, Zhu Dan du, lung disease, and piglets Paratyphoid. There are now about 12 different kinds infectious animal diseases in China. This is one recent contributor to pig production fluctuation.

The bird flu epidemic of 2003 scared pig farmers and consumers and resulted in a slump in the production of live pigs. In 2006, the deadly blue-ear disease, with a large-spreading and high mortality rate, brought another shortage in the pork market, lead to very high pork prices in 2007. At present, production has not yet fundamentally recovered and live pig and pork prices still remain high. Therefore, disease epidemics have been seen to seriously undermine the long-term, healthy development of live pig production. Coupled with the rapid development of China's animal husbandry, uniform markets have been taking shape all over the country and have led pig production to circulate in a greater scope. The risk of major epidemics is becoming higher as the flow of live pigs increases. In addition, the current veterinary management system has not been completely arranged, some of the grass-roots level animal epidemic prevention teams are not stable enough, and veterinary infrastructure is still poor so risks from animal disease is still great.

4.4 Residents' demands for pork products become greater, but the safety and quality of pork products cannot be ignored.

In order to ensure the safety of animal products and safeguard people's health, our government has made great efforts in recent years to strengthen animal epidemic prevention and feed safety. Currently, however, the environmental pollution problems associated with pig farming have become a new threat to the safety of pork quality. Because of inappropriate locations of pig farm, pork products may be exposed to "three wastes". These include waste pollution from industrial and agricultural production, transportation, and residential living. The pig production environment is also deteriorating because of nonstandard production technology and poor waste management and waste treatment technologies. The deteriorating environment of piggeries and their surrounding areas not only directly affects the products' quality, but also causes pig diseases. In order to combat disease and purify the environment, veterinary drugs, disinfectants, and rat-killing measures are widely used, leading to further product contamination. Drug residues, excessive use of feed additives, and illegal use of veterinary drugs are the means of causing hidden dangers and reducing the quality of pork products. Animal products processing, packaging, storage, and transportation sectors may also contribute to product contamination.

4.5 Large-scale farmers have developed rapidly, but the treatment of the pollution cannot be delayed

Currently, the number of large-scale pig farms is growing increasingly, farms have been expanding, and the amount of livestock on hand and pork production has increased year by year, but the technology and management of sewage treatment are seriously lagging behind development of large-scale production. At present, the disposal of feces in the pig barns is mostly done by means of flushing and direct discharge. A pig farm with 600 sows and 10,000 fatty pigs being slaughtered per year presents a big source of pollution. It is estimated that farms like this discharged more than 2,300 tons of feces, 6,000 tons of urine, and about 24,000 tons of sewage throughout the year. Arbitrary emissions or inadequate treatment of the pollution may endanger the surrounding resources and the ecological environment, but because of the high treatment costs of the pig waste, farmers are faced with economic difficulties. In addition, excretion pollution of the scattered pig farming in rural areas cannot be ignored and has become a threat to rural drinking water safety in some areas. How to properly deal with this issue is closely related to the pig farming industry's future development.

5. Suggestions on promoting hog industry

At present, China's pig production is entering a new era where both the internal and external environments have changed. Demand for pork is improving, so the hog industry must be based on the current situation and focused on the future. On the one hand, we should strengthen support for the hog industry and ensure the current market supply of pigs; on the other hand, long-term mechanisms of the hog industry should be established. Production mode should be changed and risk-reduction should be enhanced to hedge against cyclical fluctuations and epidemic animal diseases. In general, the benefits stemming from the hog industry should be improved.

5.1 Strengthen the policy support

A series of supporting policies has been promulgated in order to restore and develop pork production since 2007. Financial policies for the hog industry should be published in the form of regulations, which can prevent farmers from having to worry about the

continuity of policy. Financial support policies should focus on more rural roads and other infrastructure construction, which can make circulation and transportation of feed and hogs more convenient. We should strengthen fund compensation for large-scale pig farms and districts. In particular, we should strengthen the standardization of building pig barns and waste processing facilities. At the same time we should make corresponding policies to ease farmers difficulties in obtaining loans, land, and feed, effectively ensuring fund inputs and policy implementation. In the long-term, we should continue to research the production of live hogs and related laws, consolidate and improve the current support policies, and establish sound early-warning systems, information guides, insurance, futures, reserves, and other risk prevention mechanisms for pig production. Establishing long-term mechanisms for hog production will help to ensure the stable development of live hogs.

5.2 Speed up transformation of development mode

We should continuously enhance the intention, the standardization, and the degree of organization of livestock production, improving the modernization level of animal husbandry. We should make various types of standardized scale hog farming the main channel. Starting from an appropriate scale, seed popularization and scientific farming management should be used to regulate feed usage, veterinary drugs, and so on. Implementing standardized and ecological farming would help to gradually raise the level of live hog production and the sustainable development capacity. Encouraging pig-breeding households to build various professional cooperation organizations could raise the overall level of organization. Stable hog breeding households' income could be ensured by encouraging the "company + farmers" organizational form, where the leading role is taken by leading enterprises and an interest-sharing and risk-sharing community is created. Breeding benefits could be increased by guiding and regulating hog-breeding households and other agents, playing the brokers' role in a wide range of channels, creating an information-advantage, helping hog breeding households link with the market, and broaden the market channels. Encouraging and guiding social capital investment in livestock production would help to establish diversified input mechanisms.

5.3 Promote scientific and technological progress

Enhancing the research on key technologies in live hog production should be given a priority consideration. Focusing on improving varieties in order to speed up breeding and

genetic improvement would help to resolve issues such as low production efficiency. Research on nutrition and feed technology for reasonable, economical, and secure feed supplies is also needed. We should be continuing to research environmental control technologies and disease prevention, to solve the threat of epidemics and the impact of waste on environment. Speeding up the conversion rate of animal husbandry and veterinary research would help hog-breeding households solve technical problems and therefore upgrade the technological level of hog industry.

5.4 Strengthening disease prevention and control effectively

In the past few years, highly pathogenic diseases such as avian influenza and blue ear disease have affected some areas and had serious impacts on livestock production. Strengthening the monitoring of the epidemics, completing contingency plans, and improving the emergency capacity of sudden major animal epidemic is vital. Improvements in the processes for quarantines on production and the marketing of animal products could be made possible through the establishment of identification and traceability systems for animal products. Policy measures are needed to strengthen and regulate supervision, inspection, and animal epidemic prevention through the building of “Specified Animal Disease-Free Zones”.

5.5 Raising the level of safety and pork products’ quality

First of all, in order to raise the level of safety and pork products’ quality, quality control mechanisms need to be established for the duration of the breeding process. The establishment of quality monitoring systems is also needed for feed, feed additives, veterinary drugs, and other inputs in order to create a complete system of production where inputs may be banned and restricted. Farmers need to be scientifically educated and guided in the use of feed and medication. We should also establish and improve the quarantine inspection system at all levels by enhancing equipment and improving the detection means in order to enrich detection capabilities. Building modern circulation systems of animal husbandry will help to improve integration of modern circulation systems and minimize the large-scale circulation of live hogs. Continuing to develop various forms of professional wholesale markets will enable the strict regulation of live hog trading and will make supervision of pork markets more efficient.

5.6 Strengthening macro-control and early-warning

Based on recent hog industry statistics, it has become evident that the strengthening of monitoring processes for hog production, circulation, and sales, as well as the establishment of early-warning systems for the pork market, publishing timely market analysis reports, and scientifically forecasting market trends and consumer demand will help to guide farmers' decision-making for production and management with the aim of avoiding market risks. Establishing price protection system for live hogs should be made according to ratio of pork and grain at break-even points, where when the ratio falls below this point, the government can choose to purchase pigs in order to help pig breeding households overcome difficult periods.

References

Agriculture Ministry of China(2005), *11th Five-Year (from 2006 to 2010) Plan for National Livestock Development*

The speech of Sun Zhengcai -Minister of Agriculture “Emphasizing the development of the production of live pigs to ensure its effective supply” at the meeting about live pigs , www.agri.gov.cn ,2007-09-17

Feng Yonghui(2006), “Changing Trend on Regional Layout of Domestic Mass Pig Production,” *Chinese Journal of Animal Science*, 2006(04)

Zhang Cungen(2007), “Integration of China's Pig Production and its Main Modes,” *Journal of Animal Science and Animal Medicine*, 2005(07)

Wang Jimin(1999), “Analysis on China's Pig production costs — Case of Sichuan province,” *Problems of Agricultural Economy*,1999(04)

Hu Hao(2005), “Economic analysis of change in region of live pig production in China - from the natural layout to the economic layout,” *Chinese Rural Economy* ,2005(12)

Wang Mingli(2007), “The problem and its enlightenment exposed by the fluctuation of pig production,” *Chinese Journal of Animal Science*, 2007(22)

China Veterinary Department(2004), “Development plan of animal husbandry integration during 10th Five-Year, ” Economic research on development of livestock husbandry in new century , *China publishing house of agriculture*, 2004