

Dutch agricultural development and its importance to China

Case study: Agriculture in Chongming - an overview

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Project code 61534

July 2002

Report 6.02.05

Agricultural Economics Research Institute (LEI), The Hague

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The Hague, Agricultural Economics Research Institute (LEI), 2001

Report 6.02.05; ISBN 90-5242-745-3; Price € 10.00 (including 6% VAT)

37 p., fig., tab.

This report presents an overview of agriculture (here including fishery) on Chongming Island, a county of Shanghai municipality. Agriculture and its development since the market reform at the end of the 1970s are analysed as part of the local economy. Special attention is paid to the development of the production sectors in agriculture. The supplying and processing industries are included in the analysis. The role of the government in agribusiness is also highlighted.

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Preface

'The experience of Dutch agricultural development and its importance to China' is a joint research project of the Institute of Agricultural Economics of the Chinese Agricultural Academy of Sciences (IAE-CAAS) in Beijing and the Agricultural Economics Research Institute (LEI) of Wageningen University and Research Centre in The Hague. The Chinese Ministry of Agriculture, the Dutch Ministry of Foreign Affairs (Asian Facility) and the Dutch Ministry of Agriculture, Nature Management and Fisheries are financing the project.

The main objectives of the project are:

- to reveal the causes of the large differences in agricultural productivity between China and the Netherlands, and to find ways to improve the efficiency of Chinese agriculture;
- to analyse the developments in Chinese agriculture with special reference to market opportunities for Dutch agribusiness.

This report is one of the results of the project. It provides an overview of the development of agriculture (which here includes fishery) on Chongming Island, a county of Shanghai municipality. Agriculture is analysed as a part of agribusiness and against the background of the development of the local economy as a whole. Also the role of the government in the transformation process towards a socialist, market-oriented agricultural sector is highlighted. The report was written by the Chinese co-ordinator of the project - Professor Li Weimin of the Institute of Agricultural Economics in China - and Mr Li Gang, of the same institute.

Two related reports are being published: *Mission report: Shanghai, Wujiang and Chongming* (LEI memorandum 00.19, 2000) and *Case study: the evolution of Dutch greenhouse horticulture* (LEI report 6.01.11). In the latter report, a comparison is made with horticulture on Chongming Island.

The managing director,



Prof. Dr. L.C. Zachariasse

Summary

1. Chongming is an island located in the Yangtze River estuary. It is growing in size but its population is declining. At the moment, it can be reached only by ferry. The GDP per capita is the lowest of the counties/districts of Shanghai municipality. With a share of 25% in GDP, the agricultural sector plays a more important role in the local economy than it does in Shanghai's other counties/districts. Although agricultural production is increasing rapidly, it is not doing so as rapidly as the economy as a whole, and so the share of the agricultural sector in the local economy is gradually slowing down.
2. The increase in agricultural production is to a large extent a result of the market-oriented reform and the introduction of the household responsibility system. At the beginning of the reform the guideline of Shanghai municipal government was that all counties should ensure self-sufficiency for their rural residents and guarantee supplies of 'shopping-basket products' (i.e. vegetables, meat, etc.) to the urban population. As a result of the reform, the agricultural producers were granted more decision-making rights and nowadays production decisions are made more according to market situation and profitability.
3. The most important sectors within agriculture are crop farming and fisheries, with a share of 49 and 28% in production, respectively. The share of animal husbandry accounts for only 21%. The share of crop farming has been relatively stable since 1985, due to among other things the increase in the production of vegetables. The share of fisheries is growing and that of animal husbandry is declining, and has been since 1995. Production resulting from animal husbandry is growing steadily, but not as much as the total output of the agricultural sector.
4. Since 1956 the area of farmland has increased by an average of 140 ha per year. This land is very suitable for agricultural production. In the 1950s state-owned farms and army-run farms were established on the new land; however, these farms are now undergoing institutional reform. Privately run farms are growing in both number and size.
5. Both the rural and the agricultural population are declining due to the job opportunities in Shanghai and the growth of the non-farm industries in Chongming. Nevertheless, almost 80% of the population still lives in the rural area and over 60% of the rural labour force works in agriculture. However, many farmers are part-time farmers who work in the city or in a Town and Village Enterprise (TVE). On average more than half of the farm household income comes from non-farm activities. The average size of a family farm is 0.27 ha.

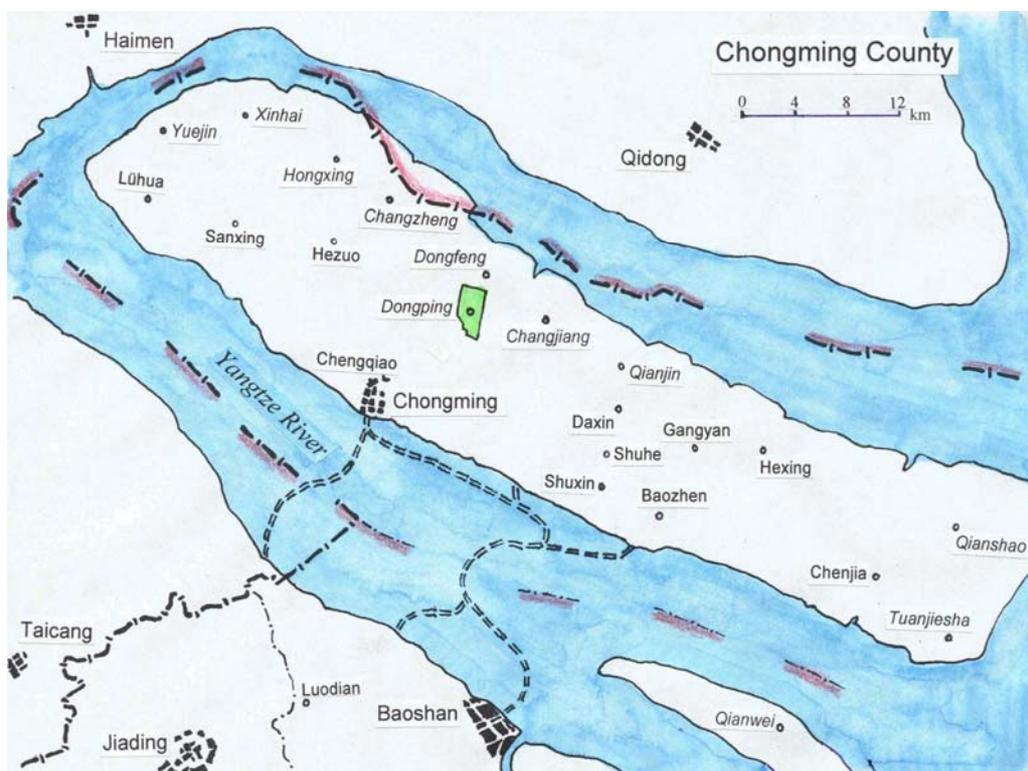
6. The policy of the Chongming government is to reduce the area of products which do not have a comparative advantage (e.g. grains) and to promote the production of special products, such as vegetables, white goats, fish products, river crab, etc. In 2000, the share of grains dropped to 46% of total farmland, while the output of export-oriented products is rapidly increasing.
7. Not only are the farms small, but they are divided into many pieces. The government of Chongming is encouraging skilled farmers to take over land from other farmers by recontracting.
8. Since the reform, three major changes have taken place in arable production, particularly during the 1980s. First, the number of crops per ha (the multiple-cropping index) fell from 2.46 in 1980 to 1.26 in 1990. This was mainly due to the reduction of the area of the low yielding rice. Second, the area of rape-seed increased due to relatively high prices and the area of naked barley (a local variety) shrunk. Third, the labour-intensive production of cotton almost disappeared and was replaced by more profitable cash crops.
9. The production of vegetables - the most important cash crop - is booming, and has been since the beginning of the 1990s. In 2000 the area of vegetables was more than five times that in 1990 and the output value per ha was over 80% higher. Also, production in plastic tunnels increased. The number of varieties grew rapidly. The distribution and the transportation system were improved. The county plans to develop vegetable processing facilities in order to increase 'green' food production, enhance the production of specialities and create brand names.
10. The production of flowers - mainly gladiolus and narcissus (including bulbs) - is limited. Half of the area consists of production under plastic. Part of the production under plastic is based on contracts between production bases and individual farmers. Flowers and bulbs are mainly sold to the Shanghai market.
11. The conditions for fruit production are not favourable. The most important product is the tangerine, a convenient product for storage and transportation.
12. The production of tree seedlings is expanding continuously (from 110 ha in 1980 to almost 360 ha in 2000). There are 17 specialised producers, most of them owned by the county. The products are used for greening the environment, which nowadays is an important policy objective.
13. The annual production of pigs recovered in the course of the 1990s after a decrease in the 1980s. The production in 2000 was 270,000 animals. Almost all pigs are produced by large enterprises or specialised households. At the beginning of the 1990s, Chongming County set up 28 pig farms with over 1,000 pigs each to stimulate production. Most of these pig farms have been re-formed into private enterprises. The quality of the pig meat produced has been greatly improved.

14. Chongming County has established 21 enterprises for the production of eggs. All have over 10,000 layers, and 14 enterprises have as many as 30,000 layers. The production of poultry consists mainly of ducks. Both the production of eggs and that of ducks experienced a sharp increase.
15. The number of milk cows increased until 1991 but has decreased since. About 75% of the more than 2,000 milk cows are kept on 11 state farms, each with 100-150 cows. The competitive position of the dairy sector is weak. Most of the milk has to be transported to Shanghai, as there is no dairy factory on Chongming. Some dairy companies in Shanghai provide home delivery in Chongming County.
16. In line with government policies to promote white goat production, Chongming County has set up a company for the production, processing and marketing of such goats. The number of goats has increased to 500,000. There are 500 specialised producers, and thousands keep a few dozen. The production needs special skills, which are not always available.
17. Fishery is an important and rapidly growing agricultural sector. This holds in particular for aquiculture in fresh water: the production area increased from over 20 ha in 1980 to almost 500 ha in 2000. Aquiculture accounts for about two-thirds of the total fish output in tons. However, there are some problems such as outdated facilities and a lack of processing capacity.
18. The number of state farms owned by the county dropped to 113 in 2000; most of these are aquiculture farms (73). Other important groups are state farms related to animal husbandry (35) or nursery (15). Problems of these farms are among other things the small scale of production, traditional way of management, outdated facilities, mostly no processing capacity in the county, and a lack of knowledge to develop new markets.
19. Ten former state farms owned by Shanghai municipality or the army were turned into companies and brought together in the Shanghai Non-gong-shang Group. However, these farms still have some social tasks like health care, education, etc. The farms are also engaged in activities other than farming, e.g. industry, construction and services. Probably most of these farms will be transferred to Chongming County and become independent companies.
20. Chongming County owns a co-operative, which is responsible for the supply and marketing of fertilisers, pesticides and plastic film. The Chongming government has 30 service stations, which guarantee the timely delivery of fertilisers and pesticides and help to reduce production costs. In addition the Chongming government owns a seed company, which is responsible for the supply and distribution of seed. The company also has a breeding base. A new project is the breeding of vegetable seeds.

21. Shanghai Municipality and Chongming County have subsidised most of the agricultural mechanisation in recent years. Mechanisation level of harvesting is higher than in sowing. Some farm mechanisation stations have set up their own farms.
22. There are only a few processing industries for agricultural products, and most of these are small. Most of the enterprises are collective or state-owned. However, the processing of local specialities (e.g. white goat) is developing quickly.
23. As a whole, the market for agricultural products is now open to both collective and private companies. However, the county government still plays an important role. It has set up free markets on Chongming Island, established markets and retail shops in Shanghai, and founded a distribution association. More products are marketed through contracts.

1. Overview of Chongming

Chongming Island, which is situated in the estuary of the Yangtze River (which debouches into the East China Sea), is located to the north-east of Shanghai and is bordered by Changshu, Taicang City of Jiangsu province, Baoshan district and Pudong district of Shanghai Municipality. The island covers 1,100 km², is 78 km long (west to east) and between 13 and 18 km wide, making it the third largest in China. One of the features of this island is that it is continuously expanding to the north and east, due to the silting effects of the Yangtze River. Chongming is the only county¹ in Shanghai Municipality.



The county accounts for 1/6 of the total area of Shanghai Municipality and 1/20 of its population. There are eight state-owned and two army-owned farms on the island, occupying around 23% of its total area. These farms are beyond the jurisdiction of Chongming County.

¹ Other counties in Shanghai's suburban area had been changed into 'districts' by 2001. Hence Chongming is now the only county of Shanghai Municipality. For convenience and purposes of comparison, we use 'counties' or 'county/districts' to refer to the county-level units in Shanghai.

There are no hills on the island, though the terrain is a little higher in the northwest. The island has plenty of water resources: water covers 10,800 ha, accounting for 12.9% of total area. There are 32 small rivers running across Chongming, so drainage has been the main task to prevent floods. The climate is characterised by relatively high temperatures and humidity, and an average annual precipitation of 1,023 mm, though there are considerable differences between years. The frost-free period lasts 229 days. The island has four distinctive seasons. The natural conditions are favourable for agricultural production, although it is often hit by typhoons and other natural disasters in the summer.

As an island, the main means of transportation to the outside is by ferry. Transport facilities have improved significantly since 1980. There is a plan to construct a deep tunnel and a long bridge to connect the main part of Shanghai and Chongming, then northward to link Jiangu's relatively poor northern area. There are 47,000 ha of farmland in Chongming, which is the largest suburban county of Shanghai. In 2000, the population was 653,700 and the population density was 599 per km², the lowest in Shanghai's suburbs. Rural population accounted for 73.8% of the total, or 482,567 persons. There were 192,702 rural households, down 4.3% from 1999. The rural labour force comprised 290,000 workers, of whom 180,000 were agricultural workers (62% of the total). The population of Chongming has been declining since 1995, and the natural population growth rate has been negative for many years.

In 2000, the GDP of Chongming was 5.4 billion yuan, representing an increase of 6.2% (at constant price). Per capita GDP in Chongming was 8,716 yuan (1,056 USD), up 8.2% from 1999. As table 1.1 shows, GDP of Chongming was the lowest of all suburban counties of Shanghai, but Agricultural Value Added (AVA) was the highest in Shanghai Municipality.

- Agriculture - 1.34 billion yuan (+ 4.6%), 24.8% of GDP.
- Industry - 2.02 billion yuan (+ 8.7%), 37.4% of GDP.
- Services - 2.04 billion yuan (+ 7.2%). 37.8% of GDP.

Table 1.1 Two indicators of selected suburban counties/districts of Shanghai (x 100 million yuan)

Indicator	Minhang	Nanhui	Jinshan	Chongming
GDP	179.10	119.75	71.28	53.99
AVA	4.04	11.90	6.55	13.39

In 2000, the gross output value of agriculture (GOVA) of Chongming increased by 1.9% and amounted to 3.25 billion yuan. The breakdown in GOVA is as follows:

- Crop farming: 1,540 million yuan (- 5.8%), 47.4% of GOVA;
- Fishery: 1,180 million yuan (+ 12.4%), 36.3% of GOVA;
- Animal husbandry: 510 million yuan (+ 5.9%), 15.7% of GOVA;
- Forestry: 20 million yuan (+ 70.9%), 0.6% of GOVA.

There are many agricultural specialities in Chongming, such as freshwater crab, anchovy, eel, white goat, Chinese cabbage and asparagus. As previously industrial development was controlled (and is thus less developed), air and soil pollution is much less than in other parts of Shanghai. Chongming has the necessary ecological conditions for bio-agricultural production. There is a bio-food production zone in Chongming, which was approved by the State Development Planning Commission on 1 January 1997 as an agricultural development project at the national level. The total area of this development zone, which is located in the northern part along the Yangtze River, is 32,000 ha.

2. Main features of agricultural and rural development

2.1 Crop farming remains basic, while the importance of fishery is growing rapidly

Owing to the successful reform of economic the system, and especially the transformation to a market economy in 1992, Chongming's agriculture and rural economy has developed rapidly since 1980. The rural economy has increased 16 times and agricultural output value 5.1 times. With the development of the rural economy and the agricultural sector, the agricultural production structure has changed. The gross output value of agriculture has grown steadily, as table 2.1 shows.

Examining the structural changes, crop farming has been the most important part in agriculture, making up around 50%. However, the share of field crops (e.g. cereals and cotton) has declined because they have relatively low profitability. Meanwhile, the production scale of vegetables and some specialities increased significantly.

Animal husbandry in Chongming is less developed and its share remains small. Since 1990, animal production has accounted for only 21%, although its output value has steadily increased.

Fishery has developed at a higher rate than animal husbandry, and its share in agriculture went up year by year, from 23% of 1990 to over 28% in 2000 (at constant price of 1990).

The output value of forestry output fluctuated: it dropped by 1.5 million yuan between 1990 and 1995. The change in shares of the four above-mentioned sectors was caused by different development speed and market factor.

Table 2.1 Gross output value of agriculture and its structure a) (x million yuan)

	1980	1985	1990	1995	2000
GOVA in million yuan	165.53	292.06	739.01	994.20	1,322.25
GOVA of crop farming	115.24	148.20	356.53	504.22	649.25
% in GOVA	38.70	50.80	48.24	50.72	49.10
GOVA of animal husbandry	53.61	109.21	201.78	218.05	282.04
% in GOVA	18.00	37.40	27.30	21.93	21.33
GOVA of fishery	7.53	27.86	169.79	262.59	372.72
% in GOVA	2.50	9.50	22.99	26.41	28.19
GOVA of forestry	1.20	4.67	10.84	9.34	18.24
% in GOVA	0.40	1.60	1.47	0.94	1.38

a) The data for 1990, 1995, 2000 are calculated on the basis of 1990 prices. There is a disparity between agricultural output value and its components due to elimination of one item from the original statistical data and the sum of percentages unnecessarily amounts to 100%

2.2 Exploiting newly-formed beaches for agricultural uses

As the island is situated in the Yangtze estuary, thousands tons of silt and mud carried by the river accumulate on its beaches. As a result, the island is continuously growing. A large part of the land can be used for crop farming after reclamation; the rest is used for fishery or animal grazing. Since 1956, Chongming's area of farmland has increased by an average of 140 ha per year (from 45,538 ha in 1990 to 46,983 ha in 2000). This situation differs from most other areas, where the amount of farming land is decreasing because of the process of economic development. In addition to eight state-owned farms and two army-run farms, two towns and four farms (forestry nursery, aqua farm, livestock farm and seed-breeding farm) have been established on the new land.

At the beginning of the 1990s, Chongming exploited 1,833 ha of land in the east of the island and established Tuanjiesha Farm, which has become the base for the production of high-quality rice. The exploitation of the mudflats also contributed to the development of some villages. For example, Yingdong village of Chenjia town accelerated its economic growth by making good use of about 266 ha of mudflat to develop the production of special livestock and fishery. As a result, the per capita net income of this village reached 8,000 yuan in 1996. The village Qianwei in Daxin town, which was established on the beach, is the first 'ecological village' in China.

2.3 Agricultural labour force is shrinking

As a suburban county of Shanghai, Chongming has benefited greatly from the rapid development of Shanghai's economy. In particular, a favourable condition has been to have more job opportunities for rural labourers. In addition, the development of local non-farm industries in Chongming provided favourable conditions for the transferring of rural labourers. Under these circumstances, both the rural and the agricultural labour force are continually shrinking. However, due to inconvenient transportation and a lack of information, the urbanisation of Chongming is slow, and thus the speed of transferring rural and agricultural labourers is also slow.

As table 2.2 shows, Chongming's rural labour force comprised 370,300 persons in 1980, of whom 269,300 were engaged in agriculture, representing 72.72% of the entire rural labour force. By 2000, the rural population had declined to 482,600, accounting for 78.2% of the total population of 617,000, implying that the urbanisation level is still low. The rural labour force comprised 290,200, of whom 181,000 were engaged in agriculture, meaning that 62,370 were rural labourers, a drop of 88,300 since 1980. Of the rural labour force, 5,091 were industrial workers, 18,492 were engaged in construction, 10,014 in transportation and storage, 6,770 in services and 17,813 in other forms of work. The percentage of the rural labour force engaged in non-agricultural industries increased, which indirectly promoted the development of other industries in rural areas, although the transfer speed of the rural and the agricultural labour force was not high. However, many farmers went to work part time in the city or a TVE. On the whole, agriculture still occupies a predominant share of the rural labour force, which means that non-agricultural industries are underdeveloped in rural areas and the operation size of farmers is still small.

Table 2.2 *Changes in rural and agricultural labour force (x 1,000)*

Year	Rural labour	Agricultural labour	Percentage	Others	Percentage
1980	370.3	269.3	72.72	101.0	27.28
1985	360.4	201.3	55.85	159.1	44.15
1990	333.6	158.2	47.42	175.4	52.58
1995	315.3	161.9	51.35	153.4	48.65
2000	290.2	181.0	62.37	109.2	37.63

2.4 Farm income increasing, while share from agriculture decreasing

As in other areas of China, farmer households in Chongming are the principal forces of agricultural production. Since 1980, owing to the reform, decentralisation and the development of non-agricultural industries, the income of farmers in Chongming has increased continuously. The change of rural economic structure made farmers' income structure more diversified. Moreover, there are more chances for farmers to find jobs outside Chongming, especially in Shanghai proper. The income from other non-agricultural jobs has risen remarkably.

According to a survey of 100 rural households in 2000, in these households there were 240 semi-employed and 158 fully-employed agricultural workers. On average, each household had 0.27 ha of farmland, 5.5% more than the previous year. Average farmer household income was 16,084 yuan, while per capita income was 5,139 yuan. Of the total income, 8,725 yuan were from the work in an enterprise and 5,176 yuan from agricultural activities, that is, crop farming 2,692 yuan, livestock production 983 yuan and fishery 210 yuan. This implied that the income from non-agricultural industries was higher than that of agriculture, and crop production is still important for farmers to stabilise their income, as shown in table 2.3.

In 2000, per capita net income in rural area was 4,364 yuan, which was 3.37 times that in 1990 (1,293 yuan) and 14.45 times that in 1980 (302 yuan). In 2000, the income from agriculture was 1,241 yuan, accounting for 24.16% of the total.

Table 2.3 *Changes in rural income, per capita (yuan)*

Year	Per capita income	From agriculture	Percentage	Per capita net income
1980	819	497	60%	302
1985	1,765	902	51%	604
1990	1,902	963	50%	1,293
1995	3,572	1,265	35%	3,095
2000	5,139	1,241	24%	4,364

2.5 Adjusting the agricultural production structure in favour of local specialities

In recent years, the supply surplus of many agricultural products has become an important issue in Chinese agriculture. Under such circumstances, it has been difficult for farmers in Chongming to sell all their agricultural products, in particular, wheat and maize. To resolve this problem, the Chongming government has implemented some new policies to encourage farmers to adjust their agricultural production structure. These policies have two aims: to reduce area of products without comparative advantages, and to accelerate the development of certain special products.

In 2000, the farming area of specific products amounted to 36,700 ha, and the ratio of grain to cash crop decreased from 55.1:44.9 in 1999 to 46:54. Owing to the significant shrinkage of planted area, grain output was down to 299,000 tons, or 12.1% less than the previous year. In the process of agricultural adjustment, the output of export-oriented products rapidly increased. The output of vegetables, white goat and many other special products increased. At the same time, mitten crab, river eel etc. saw a fast growth in 2000. The breeding area of river crab was expanded to 6,600 ha, and 250,000 white goats were sold to Shanghai.

2.6 Development in scale economy

Introduction of the household responsibility system has created more incentives for farmers, and as a result agricultural output is growing rapidly. However, some aspects of the new farming system have had negative effects. First, egalitarianism. Because every household has many small plots of land, mechanising farm work is difficult. It is impossible for the farmers to acquire economy of scale. In view of this unfavourable situation, the Chongming government has set up several experimental districts for cereal production in an attempt to achieve better economic results. The skilled farmers are encouraged to take over more land by recontracting. In 1997, there were 456 large cereal production households in Chongming, which contracted a total of 960 ha of farmland, accounting for 3.4% of all area under cereal crops in the county. The area with relatively large scale production reached 20,900 ha, i.e. 4.7% of total farmland or 7.5% of land under cereal crops.

There are three forms of cereal production with larger scale management: 1) household operation, which is the main form, accounting for 50%; 2) collective, accounting for 49%; and 3) joint operation, namely operated by two or more families, and accounting for only 1%.

Larger size in farm management improves labour productivity and promotes specialisation in and the mechanisation of agricultural production. This has resulted in higher incomes for the large-size operators than average-size ones. For example, a farm household in Luhua town contracted 11 ha of farmland for cereal production, from which his family earned a net income of 12,000 yuan per capita.

3. Agricultural production structure

In general, Chongming's agriculture, forestry, animal husbandry and fishery sectors expanded steadily as a result of the reform and the process of opening up, combined with continuous adjustment and optimising of the agricultural production structure. At the beginning of the reform, Chongming adjusted its agricultural production structure in accordance with the guideline of Shanghai municipal government, which stated that all counties should ensure grain self-sufficiency for their rural residents, and the suburban area should guarantee the supply of shopping-basket products¹ to the urban population.

However, as the process of market-oriented reform gains momentum, agricultural producers have more decision-making rights in their operation. More production decisions are made according to the market situation and profitability, which is followed by significant changes in agricultural production structure. As for crop farming, farmers in Chongming continue to stabilise grain production, cutting down cotton and increasing the output of various kinds of cash crop.

The area under grain crops increased until 1990, and then decreased; the same applies to cotton acreage. In contrast, the area under rape-seed and other cash crops has expanded. With respect to animal husbandry and fishery, pig production remained stable, while the output of eggs, cow milk and freshwater fish grew rapidly. The production of cow milk has shrunk since 1995, due to various unfavourable factors (see below).

3.1 Field crops

Thanks to the relatively sufficient reserve of farmland (and the fact that the land area keeps increasing), the area under crops continuously increases. We can see the following trend in Chongming (table 3.1):

- the area devoted to wheat, single-crop rice and rape-seed increased considerably, particularly during the 1980s;
- the area under cotton and naked barley is decreasing;
- single-crop rice covers only half the area devoted to all grain and bean crops.

¹ Basket products are vegetables, meat, eggs, fish and other foods, but not staple grains, such as rice, wheat flour, etc.

Table 3.1 Output and area of main field crops in Chongming (ha, x 1,000 tons)

Year	Wheat		Single-crop rice		Maize		Cotton		Rape-seed	
	Area	Output	Area	Output	Area	Output	Area	Output	Area	Output
1980	1,484	5.94	832	3.76	7,621	32.34	13,927	8.00	5,036	10.41
1985	2,679	9.79	10,571	61.43	6,055	40.07	10,232	3.79	9,774	18.65
1990	8,348	28.83	27,851	195.52	8,236	52.92	1,910	1.21	16,305	32.69
1995	7,868	30.68	26,964	204.26	6,826	49.15	287	0.25	16,282	31.88
2000	10,727	43.44	24,073	189.94	5,073	36.67	209	0.21	14,977	28.08

In the past, due to insufficient grain supplies, all regions in China aimed at achieving self-sufficiency in grain. The share of grain was very high. A three-crop system (triple-cropping) was practised in Chongming in the 1960s and 1970s. The high multiple-cropping index had some positive effects on total grain output; however, it was costly and unprofitable for producers, and hence the farmer's income was low. This system prevailed until 1978. In total, 23,300 ha were allocated for late (autumn) rice, or 85% of the total grain area, which created a labour shortage in the busy season. As a result, the rice yield was low. That cropping pattern was changed in 1985. Farmers in Chongming replaced triple-cropping by doubling-cropping. The area under triple-cropping dropped from 70.7% to 5.3% in 1985. As a result, the multiple-cropping index fell from 2.46 in 1980 to 1.26 in 1990. The direct result of this system was the higher yield per ha from smaller areas under autumn rice. Total outputs of rice rose steadily, with total area of 25,800 ha and a yield of 7,650 kg/ha in 1995.

After 1985, the area of wheat increased due to a relatively high price, while the production of naked barley¹ gradually shrank. In 1985, the area devoted to naked barley was 14,950 ha, while that devoted to wheat and barley was 2,679 ha and 1,505 ha, respectively. The area of rape-seed expanded from 5,000 ha in 1978 to almost 15,000 ha in 2000, with a total output of 28,082 tons. The main reason was the relatively high market price. The record high output of grain in Chongming was 330,000 tons in 1997, but went down to less than 300,000 tons in 2000.

Chongming was once one of China's cotton production bases. Until 1985, the area under cotton was 13,000-16,000 ha. Since then, however, the cotton area has been on the decline due to the reform of the pricing system and the market situation. In addition, cotton is a very labour-intensive crop and its price fluctuated sharply in some years, so farmers felt high risk. This led to a rapid reduction of the cotton area, from 14,000 ha in 1978 to 287 ha in 1995 and 209 ha in 2000. Cotton has been replaced by other more profitable cash crops. Chongming County plans to develop organic farming by growing more high-quality 'green' foods. Priority will be to quality grain varieties, local specialities, and vegetables and other cash crops.

¹ A special variety of barley is grown in the Yangtze Delta area, which is different from varieties in the northern China. Local people call them - naked barley together with wheat and common barley as 'Three-wheats' ('San-mai' in Chinese; 'san' means 'three' and 'mai' means 'wheat'). Chongming almost stopped naked barley production since 1990 because of low profitability.

3.2 Vegetable production

Since 1985, Chongming has adopted a series of measures to promote vegetable production. These include transforming collective production into farmer contracts, changing mandatory tasks into 'guidance plans', and a changeover from state monopolised purchase and marketing to free transactions in market. These reforms have contributed to the development of vegetable production. Vegetable production has gone through the following stages:

1. The total vegetable area in Chongming was less than 6,700 ha before 1994. The county produces mainly Chinese cabbage, which took up almost 3,300 ha. The main purpose was to meet local demand (cabbage was especially for the winter season).
2. Between 1994 and 1997, according to a plan of the municipality, 813 ha was devoted to the production of 'high-grade' vegetables (total area increased to 13,330 ha) and the infrastructure for vegetable production was improved.
3. Since 1998, vegetables are a priority in the county as the municipality has set a more flexible policy to encourage a restructuring of the production mix in suburban districts. Total vegetable area in Chongming exceeded 30,000 ha in 2000, and output amounted to 712,500 tons (table 3.2).

Table 3.2 *Vegetable production in Chongming*

	Area (ha)	Output (tons)
1980	3,277	119,990
1985	2,438	68,695
1990	5,919	144,930
1995	16,985	413,633
2000	30,436	712,539

In 1990, vegetable output value per ha was only 15,000 yuan, while it increased to 27,750 yuan in 2000. The area of vegetables grown in plastic tunnels increased quickly, from only seven ha in 1990 to 169 ha in 2000. Many more kinds of non-traditional vegetables - including cauliflower, asparagus, winter gourd, white beans and many varieties of mushrooms - are grown. Despite unfavourable weather in 2000, the vegetable yield was 23.4 tons per ha, down only slightly from the previous year. The production of 'specialities' - especially mushroom and asparagus - grew rapidly. In 1978, the area devoted to mushroom amounted to 55,000 m², with a total production of 280 tons. As the demand for mushrooms increased, the area increased to 530,000 m² in 1984. Mushrooms are also salted, dried and canned for export. Chongming is the first county in China designated as a 'National Green Food Production Area'. Its vegetables are produced with biological methods, in accordance with the 'green' food standards. However, problems still exist. The farmers want more specific or high-quality varieties for export. Sometimes, unfavourable weather conditions have negative effects on vegetable production.

At the same time, the Chongming government established a service system for vegetable production and distribution. The distribution system includes a free market and a wholesale market. In the past decade, in addition to three local wholesale markets, the Chongming government has established a wholesale market and 10 vegetable shops in Shanghai proper.

In terms of transportation and marketing in Chongming County, the vegetable distribution associations have been equipped with 24 trucks and work in co-operation with vendors from other provinces, so that there are no major difficulties with the timely marketing of vegetables.

As the transportation and distribution system is being improved, the future of vegetable production in Chongming is very promising. The county plans to: a) develop vegetable processing; b) enlarge production according to 'green' food standards; c) enhance the production of specialities; and d) create own name brands for its vegetables.

3.3 Flowers and fruits

Flowers

In 1985, Chongming was designated by Shanghai municipal government as one of the main production bases of horticulture. Horticultural production in Chongming includes bulbs, cut flowers and bonsai (vegetables are usually excluded). The total area of horticulture has reached 107 ha. Plastic tunnels account for half of it. The operators include horticulture production bases (e.g. Dongping Forest Nursery, Chongming Nursery, Hexing Forestry Nursery) and private farms, with an average size of 0.2-0.3 ha.

The most important horticultural product is gladiolus (about 67 ha). Chongming's gladiolus has a competitive edge and about 70% of gladiolus in Shanghai market comes from Chongming. Narcissus is another famous product of Chongming, and has a good market in many cities. The fragrance of Chongming's narcissus is famous in this area, and was described in literature over a century ago. It was reported that Chongming narcissi, in terms of their aroma, were comparable to the British rose at the world market. They remain one of the three best narcissi in China today and enjoy a good market share in the domestic market. There are many new varieties of narcissus here.

In addition, Chongming has successfully introduced many good bulb varieties from the Netherlands (e.g. lilies, irises, hyacinths) and these are growing well. Chongming can produce 800,000 bundles of cut flowers from 200,000 narcissus bulbs, with a total output value of 4 million yuan (USD 485,000). The bulbs used for production almost cover demand. Cut flower and bulbs are mainly sold to Shanghai market. For example, Hexing town has 19 flower shops in Shanghai. Three trucks transport flowers to Shanghai every day in the busy season.

In recent years, some flower production bases have begun to contract with individual farmers. These bases are investors in the plastic tunnels, which they rent out to farmers. The farmers pay rent and are responsible for other production cost. For example, Hexing Horticulture Centre rents tunnels to farmers for 500 yuan per year. If flowers are grown on open land, the income would be 30,000 yuan per ha, and the income from each tunnel (about 200 m²) may reach at 2,000 yuan.

Fruits

The natural conditions of Chongming are not favourable for fruit production. Few fruits were produced locally before the 1980s and the growth rate was slow. Later, especially between 1985 and 1994, fruit production began to develop rapidly. Fruit farms in Luhua town and Chenjia town recovered rapidly, and the area increased from 264 ha in 1985 to 984 ha in 1994. In this period, fruit output increased from 2,000 to 5,000 tons. Tangerine has developed at a higher speed than other kinds of fruit since 1990, because it is convenient for storage and transportation. At present, the area devoted to tangerine is over 80% of the total fruit area.

In Chongming in 2000, the area under fruit trees came to 1,069 ha and output was 29,429 tons. Fruit production is very concentrated in Chongming. Luhua town has planted almost 580 ha of fruit trees, with a fruit output of 21,450 tons in 2000. Its area and output accounted for 54 and 73% of the county's total, respectively.

3.4 Animal husbandry

Animal husbandry in Chongming has grown at a high speed since 1980, because price and marketing policies have become more flexible. At the same time, the increase of income per capita and consumers' change of diet also contributed to the development of animal husbandry. During the period 1980-2000, the output value of animal husbandry increased at an annual rate of 6-10%. Nevertheless the share of animal husbandry in agriculture remains quite small: just 21% in 2000.

After 1996, Chongming adjusted the livestock structure to comply with the principle of 'increasing the number of goats and stabilising the breeding of pigs and poultry. Development of animal husbandry in Chongming has the following features:

- pig and poultry are the mainstay;
- the number of milk cows is small and continues to decrease;
- the production of specialities (e.g. white goat and rabbit) is developing rapidly, but the size is limited.

At present, most pigs, chicken and milk cows are raised on relatively large farms. Altogether, 28 pig farms, 14 poultry farms, and 11 dairy farms had been established in Chongming County by the end of 1990. This was done according to the Shanghai municipal plan to improve supplies of shopping-basket products. As a result, the pig farms have the capacity to produce over 300,000 animals a year for the Shanghai consumers. The larger ones are able to provide more than 3,000 pigs a year. Some of the poultry farms are specialised in egg production. Fourteen egg farms keep over 30,000 layers each.

The majority of the farms have now been re-formed into private enterprises; only five are still owned by the state or a collective. It seems that the individual management tends to be more effective and to reduce production cost. The cost of eggs, for example, is steady at four yuan per kg, and the cost of each 100 kg of additional live weight of a pig is steady at 270-320 yuan.

Table 3.3 Output of main animal products in Chongming

Year	Pigs sold (x 1,000)	Poultry sold (millions)	Eggs output (tons)	Goat sold (x 1,000)	Milk cows (head)	Milk (tons)
1980	343.0	1.40	1,302	68.0		1,701
1985	298.9	1.09	2,681	26.7		10,399
1990	290.1	2.73	7,775	94.9	5,773	16,574
1995	243.7	4.16	12,679	170.1	3,601	12,028
2000	270.4	6.01	13,716	250.2	2,250	9,340

Pigs

After a decline in pig production in the first half of the 1980s, the price of pigs was liberalised in 1985 and a contract system for the purchase of pigs was introduced. However, there were some problems with the contracts. The purchase companies set special dates for purchasing the farmers' delivery, changed the purchase prices frequently (and mostly downwards), and the feed costs rose time and again, which made pig farms unprofitable. As a consequence, pig production decreased even further, by over 36% between 1985 and 1994. To promote pig production, the Chongming government instituted preferential policies and helped to establish 28 farms, each with over 1,000 pigs, by means of special loans from the municipality of Shanghai.

These measures brought about some recovery of the pig sector (table 3.3). An important change is that the share of pigs with better meat quality has increased from 40% to 85% in 2000. About 98% of the pigs are provided by large enterprises or specialised households.

Poultry and eggs

Poultry (mainly ducks) and egg production have developed quickly (table 3.3). Since 1978, Chongming has established 21 enterprises raising over 10,000 layers; 17 of these are run by the towns and four by the villages. The yield per bird is 16.5 kg of eggs a year.

Few ducks were raised in Chongming before 1990. Chongming experienced a sharp increase in duck production during the 1990s. It is estimated that over 6 million ducks were sold to Shanghai in 2000. The share of collective-run duck farms has decreased considerably.

Cattle and dairy

Traditionally, cattle were used only as draught animals in Chongming. The number of cattle declined gradually to 1,400 in the late 1970s and early 1980s, with a record high of 5,300 heads in 1983. The reduction of the number of cattle was mainly a result of mechanisation in agriculture and higher feeding cost.

At the end of 1950s, there were only tens of milk cows. But as income level per capita went up, the demand for milk rose significantly, thus the Shanghai municipal government worked out a series of policies to develop milk production. As a result, milk production in Chongming increased quickly after 1981, and the number of milk cows increased to 4,350 in 1985, and 6,300 in 1991. The highest milk output was 20,000 tons in

1992. But in recent years, milk production has declined because of following reasons:

- competition has become more severe in suburban areas of Shanghai;
- consumption has been limited in Chongming; most local residents are not used to drinking milk;
- there is no dairy processing factory in the county and marketing chains are poor. It is necessary to transport milk produced to the outside (mainly to Shanghai). In addition, transportation is not convenient or effective by the ferry; and
- big enterprises in Shanghai have begun to set up milk supply bases in other provinces.

The above factors had some negative effects on the production and marketing of milk, and milk production has declined gradually. In 2000, there were only 2,250 milk cows in Chongming, with a milk output of 9,350 tons, down from the record of about 20,000 tons in 1992. At present, 567 dairy cows are kept by individual farm households. Other cows are raised by 11 farms, which belong to the state farms. Their size is 100-150 cows. The main variety is Dutch Black and White with a yield of 4.5 tons per year. The competition in the fresh milk market is becoming more and more severe, and some dairy companies in Shanghai (e.g. Bright Company) provide home delivery even in Chongming County.

Goats

Chongming white goat is a local speciality. In 1978, the Ministry of Agriculture designated this county 'the production base of white goat'. According to Shanghai's 1994 Animal Husbandry Development Programme, the number of white goats would increase to 60,000 heads in 2000 and 350,000 goats per year will become available for the market.

In order to promote goat production, the county's Agricultural Committee set up the Shanghai Yingyang Food Company in October 1994. This company is engaged in the production, processing and marketing of the goats. In 2000, the number of goats amounted to 500,000, and 250,000 were sold to Shanghai. The production is concentrated in seven towns, each of which has more than 10,000 goats. The farm households have difficulties raising a large number of goats, as that requires special skills. There are only just over 500 specialised households that sell more than 100 goats a year each, while thousands of households keep several dozen goats.

Trends

The following is expected to occur:

- first, the tradition of raising pigs will be maintained, so this sector will be stabilised;
- second, white goat production will massively expand;
- finally, the processing and marketing of livestock will be strengthened to produce more profit.

However, Chongming is confronted with many negative factors for the development of animal husbandry, such as lack of marketing organisations and high dependence on enterprises in other counties. Under these circumstances, Chongming not only loses the added value of processing, but must also face the competition of other counties. So the

processing and marketing of livestock products must be improved by taking appropriate measures.

3.5 Fishery

There are four major reasons why Chongming is in a favourable position to develop its fisheries: it is rich in water resources, it has many fish varieties, it has a relatively large breeding system, and its development is supported by the government. At present, fishery in Chongming County consists of traditional fishing and breeding of 'speciality fishes' (i.e. high-value and precious species), freshwater aquaculture, and catching. The output value of the above-mentioned fisheries in 2000 was as follows. Traditional fishing: 300 million yuan; speciality fishery: 25 million yuan; aquaculture (mainly crabs) 515 million yuan; and catching in river and sea: 339 million yuan.

Chongming County has seven fishing villages with 2,600 fishermen, six fishing stations, 281 seagoing fishing boats and 276 boats for the Yangtze River. There are 70 freshwater fishery or aquaculture farms in the county.

Fishery developed at a higher rate than animal husbandry in Chongming. Its share in agriculture surpassed that of animal husbandry in the 1990s and continues to increase. The main way of fishing before 1980 was catching, both in fresh water and in the sea. As the fish resources became scarcer, Chongming began to develop aquaculture in rivers and the sea. The area of freshwater fish farming was only 21 ha in 1980, while it was almost 500 ha in 2000. Total fish production approached 69,000 tons, of which fish from aquaculture accounted for about two-thirds of the total in 2000 (see table 3.4).

Despite this development, there are some problems, including the depletion of aquatic resources, outdated facilities and poor maintenance, low profitability of ways of traditional catching in the river and the sea, lack of processing capacity, environmental concerns, and so on.

Table 3.4 Fishery production in Chongming

Year	Total output of aquatic products (tons)	Aquaculture in fresh water		
		Area (ha)	Output (tons)	Output value (million yuan)
1980	9,234	21	4,362	--
1985	20,287	51	10,862	--
1990	32,797	243	19,810	93.27
1995	53,764	420	33,736	346.16
2000	68,865	496	45,998	957.33

3.6 Forestry

Forestry is a less important sector on this relatively flat island. Most of the trees are grown in 'economic forests'. The share of forestry in agriculture was only 4.1% in 2000. As the Fifth Forestry Resources Survey conducted in 1999 shows, the forest area on Chongming is about 3,000 ha, accounting for 3.6% of the total area. The area of bamboo is 906 ha. Bamboo is an important construction material and can be used in the handicrafts industry (knitting, carving, etc.). The output value of forestry was 13.1 million yuan.

Within the forestry sector, the nursery of tree seedlings play an important role. The seedlings are sold within the county or to Shanghai. They are used mainly for greening the environment. As the demand for seedling trees is increasing steadily, the area has also been expanded continuously (table 3.5). The number of nurseries increased from eight in 1985 to 17 in 1999, and almost every town now has a nursery. In 2000, the nursery area reached 357 ha. In addition to specialised nurseries, many farmers are engaged in the production of seedling trees.

Table 3.5 *Economic forest production in Chongming (ha, tons)*

Year	Area (ha)	Under seedling trees	Output
1980	279	110	1,668
1985	254	202	2,295
1990	587	223	3,910
1995	1,030	213	9,976
2000	1,069	357	29,429

4. State farms and their reform

4.1 Current situation

There are two kinds of state-owned farms on Chongming island: those belonging to Chongming county, and those belonging to Shanghai Municipality through the Nong-gong-shang Group (an agribusiness company).

Farms of the county

Before 1978, Chongming had four state-owned farms. After the reform, however, it was difficult for these farms to cope with the changed market, and so they were turned into smaller, privately run, household farms. As a result, by the end of 1988 there were 28 pig farms (>1,000 pigs each), 14 poultry farms (>10,000 birds each), a breeding stock farm, 31 dairy farms and a mink farm. Tuanjiesha Farm was established in 1992 and is specialised in arable crops; it is to become a production base of 'green' food (see below, 'case study'). There were also 99 aquaculture farms (including two shrimp farms).

Today the county has 35 farms engaged in animal husbandry: nine pig farms, 14 layer hen farms (over 30,000 hens each), 11 dairy farms (over 1,500 cows in total, i.e. 100-150 cows on average), and a breeding farm (as artificial insemination services for pigs and cattle). The total sales per pig farm is 1,000-3,000 animals per year. The main problem is the small scale, although some farms have enlarged their production scale.

Of the above-mentioned state farms, only five have remained in the hands of an enterprise run by the state or a collective. Others have been reorganised and turned into privately or collectively run enterprises. Most have since shown better performance.

The county also has 15 nurseries and 73 collective-run aquaculture farms. At present, the problems in these farms in Chongming are as follows:

- small size and traditional way of management. The farmers lack financial capacity to expand their business.
- poor maintenance and outdated facilities. For example, some freshwater fishponds were built by the local government in the 1980s. Since the reform, contractors have paid more attention to short-term profitability and are reluctant to invest in infrastructure.
- there is no close linkage between production, processing and marketing. Farmers mainly produce primary products only, without any processing in the county. They have their own salesmen, but these lack the skill or knowledge to develop new markets.

Farms of Shanghai and the army

In Chongming, there are eight farms that belong to Shanghai Municipality and two army-run farms. These were set up in the 1950s and 1960s as livestock farms (table 4.1). In the beginning, the farms were under the administration of the municipal State Farm Bureau;

later, their administration was transferred to Shanghai the Nong-gong-shang Group, and the farms became companies. However, the farms still perform some social functions.

All these farms produce many kinds of product rather than specialising in just one. They are engaged in industry, construction, services, and agriculture (including crop farming, animal husbandry, fishery, and others). They produce grains, and have nurseries and one or two dairy farms.

The share of agriculture in the total income of the farms decreased in the process of economic development. This trend was not evident before the reform. Agriculture was then the priority of every farm. But in the process of reform, all farms began to establish industrial and service enterprises. Non-farm industries developed quickly. The fixed assets of all farms averaged about 150 million yuan.

Table 4.1 Basic data of the state farms in Chongming, 1997

Farms	Population	Farm land, ha	Value added, million yuan	Agriculture, million yuan	Grain, tons	Per capita income, yuan
Yuejin	7,108	1,130	119.52	13.18	29,264	9,220
Qianshao	4,050	3,253	78.19	5.15	17,183	8,300
Changjiang	17,201	2,159	148.15	23.95	952	8,000
Changzheng	7,180	1,321	15.42	3.22	13,100	7,600
Xinhai	13,126	2,163	56.65	12.01	20,047	6,700
Dongfeng	12,202	1,544	- 4.25	25.43	17,075	6,690
Hongxing	6,846	844	- 10.26	5.49	9,717	6,560
Qianjin	6,966	1,288	14.30	16.55	17,875	5,980

Other than in the common rural area, the population of the state farms is continuously declining. The reason is that the workers were recruited from Shanghai proper when the farms were set up. As the policies became more flexible, many workers went back to Shanghai and more migrant workers from other provinces came to Chongming. They work mostly in industrial and service enterprises, nurseries and dairy farms. Some migrant workers have rented farmland for crop production. For example, some farmers from Zhejiang province rented land for watermelons in Changzheng Farm. According to the manager, the land was rented through a general contractor, who rented again to the farmer-contractor for only one year. The land rent was 9,000 yuan per ha. After the harvesting of the watermelon, harvested, the general contractor may re-rent the land to others.

Every farm has a department responsible for the input supplies. All companies in the farm draw up a purchasing plan for the necessary means of production. The department buys and distributes these means according to the plans of each company. This reduces production costs because a large quantity of some goods can be bought at a discount.

At present, the main difficulty faced by these farms is the shortage of money. This is not connected with the new market situation: the farms benefited from diversified enterprises, which were set up a decade ago. But that did not last long as the market was changing quickly. Projects to adapt to the changing market required considerable funds, and many farms are in serious debt.

Another problem concerns institutional aspects: the state farms are not really companies because they must play some role of governmental agency, mainly to deal with certain social affairs, such as health care, education, etc. That is a common phenomenon in the state-owned institutions.

There is also the problem of finding enough workers, because the pay is so low. Many farm workers leave to find a better job. One worker, for example, said his wage was only 500 yuan per month, so he left the farm and can now earn over 1,000 yuan per month.

In the near future, these eight farms will probably be transferred to Chongming County, after which they will be reorganised and become independent companies.

4.2 Case studies: two farms

The author chose two farms for a case study: Tuanjiesha Farm - which belongs to Chongming County - and Changjiang Farm, which belongs to Shanghai Nong-gong-shang Group.

Tuanjiesha Farm

At the beginning of the 1990s, the county reclaimed 1,847 ha of beach land, of which 720 ha were allocated to crop farming. In 1992, this became Tuanjiesha Farm, the youngest crop farming area of Shanghai.

The farm was designated by the municipal government as a grain production base in 1995. The following year, the farm grew 680 ha of rice, 388 ha of wheat and 33.3 ha of barley. The total grain output was 7,000 tons, of which 95% was sold to the state. In 1999, the gross output value was 12 million yuan.

The farm made efforts to improve its technological input and is now equipped with many agricultural machines. In 2000, over 95% of the farm work was done with machines. The farm enlarged the irrigated area, and all cropland can now be irrigated with electric pumps. In order to dry grain on time, the farm imported a set of US-made equipment at a cost of 4 million yuan.

With the prospects of further development, the farm has decided to make itself Shanghai's 'green' food production area. The farm will improve technology and push the integration of quality grain production, processing and marketing. The output of 'green' food will grow and the linkage with enterprises will be enhanced.

Changjiang Farm

Changjiang Farm belongs to Shanghai Nong-gong-shang Group. Its registration capital was 119.5 million yuan. It is the most populous farm in Chongming (17,200). It has 2,159 ha of farmland, making it the third largest of the eight farms. This farm's business is not limited to agriculture, but includes industry, supply and distribution, and commerce. In

terms of agriculture, the farm produces a special variety of rice, many kinds of fruits, animal products (milk, pork, etc.) and aquatic products (crabs).

The farm produced 952 tons of grain in 1997, which was among the lowest of all eight farms. It has two dairy farms, each with 750 cows. One of the dairy farms has 93 ha of land for feed crops, and the feed can be produced on the farm. The farm employs 74 workers and 20 casual labourers. They have 500 milking cows. The cows are Dutch varieties and produce about 6,800 kg per cow. The cows are grazed in the fields, but are brought in for milking. The total sales of this dairy farm came to 730 million yuan, with a profit of 500,000 yuan. The milk produced is sold to a Shanghai company (Yingte Dairy). At present, the farm has a re-form scheme. If that is passed, the farm will be transformed into a shareholding company, with Changjiang Farm holding 20%, the operators 10% and Shanghai Dairy Company 70% of the shares.

Its industry sector includes various types of apparatus and instrument, electronic components, and farm tools. Its most important enterprise is Shanghai Deke Electronic Component Company, which is one of the largest enterprises producing the same product in China. In addition, the farm operates housing, real estate and retail shops in Shanghai.

5. Production inputs, processing and marketing

5.1 Input supplies

According to the functions and the marketing and operating system, the means of production in China can be classified into general inputs, seed and agricultural machinery.

General inputs

Agricultural inputs - such as fertilisers, pesticides and agricultural plastic films - are managed by the supply and marketing co-operative of Chongming.

Since 1990, the use of fertiliser has declined, and thus so have sales of fertiliser, except for a slight fluctuation in some years. The sales of fertiliser decreased from 142,000 tons in 1990 to 137,000 tons in 1995, and to 128,000 tons in 2000.

In 2000, the sale volume of pesticides was 2,168 tons, and that of agricultural plastic films 356 tons. In 1995, the sales were 1,939 tons and 214 tons, respectively. Thus the use of pesticides is decreasing while the use of agricultural films is increasing. This trend is consistent with the trend of shrinkage of grain area and expansion of the area under cash crops, especially vegetables.

Table 5.1 *Agricultural production inputs*

Year	Total machine power, kW	Fertiliser used, tons	Pesticide used tons	Agricultural plastic films, tons
1980	226,007	119,000	886	116.2
1985	248,802	145,000	897	153.4
1990	250,883	147,000	926	196.5
1995	208,358	137,000	979	236.5
2000	217,193	128,000	956	248.6

Since 1978, Chongming government has organised extension workers and supply and marketing groups in order to improve the technical services in the rural area. Today, there are 30 service stations covering most villages, which have produced good economic results. For example, the stations help to reduce production costs and guarantee the timely delivery of fertilisers and chemicals, especially those purchased from other areas. Since the 1980s, the amount of goods purchased from outside has doubled, with annual purchases standing at 40 million yuan.

Seed

The Chinese government has stipulated that only registered seed companies can supply and distribute crop seeds. The Chongming Seed Company supplies seeds to the county. This seed company has introduced and bred some high-yielding and quality varieties. It also set up a breeding base for selecting new varieties of rice, cotton, rape-seed and hybrid maize. After Chongming introduced hybrid maize in 1979, the yield increased from 4.5 to more than 6.7 tons per ha. In order to increase the yield and improve the quality of rice, Chongming induced a new variety from Zhejiang province in 1985, and a year later extended it to a large scale. Later, the county selected a new variety on the basis of another high-yielding, quality rice variety. The sown area covers 93.8% of all rice in the county. A brand name has been registered for the marketing of the new rice variety. The breeding of vegetable seeds has become a new project in recent years.

The seed breeding system in Chongming comprises a county-run breeding base, county-designated bases and joint township-run bases. The Chongming Seed Breeding Farm is the largest county-level centre in Shanghai Municipality. It has 100.7 ha of land, of which 70% is used for breeding. Since 1986, the county has established some county and town joint bases for breeding, and has become one of the important sources of high-yielding varieties for the most important crops in Chongming.

Agricultural machinery

Chongming is a favourable place in which to use machinery to increase labour productivity. In recent years, Chongming has invested large amounts in agricultural mechanisation. The municipal and county government provides 40% of the funds, and the town, village and operators provide 60%. For example, in the period 1995-97, the total investment was 29.27 million yuan, which bought 500 medium-size tractors, 410 combine harvesters, 90 ditchers, 200 wheat sowers and 215 manure spreaders. By 2000, the total power of agricultural machines had reached 217,193 kW: 53,879 kW for ploughing and cultivation, 33,165 kW for irrigation and 52,860 kW for harvesting (of which 598 kW was for combine harvesters). In 2000, the mechanised farming area in Chongming had reached 32,840 ha, of which 46,983 ha were irrigated area by electric power. Sprinkler and dripping technology is used in an area of about 40 ha. The machine-sown area was 1,517 ha (267 ha of rice, 1,250 ha of 'three wheats'). The machine-harvested area was 23,040 ha (12,580 ha of rice, 9,884 ha of wheat). The data indicate that the mechanisation level in harvesting is higher than sowing. The share of machine-cultivated land is 86% of total land, which is above the average level of Shanghai Municipality. There is a link between agricultural mechanisation and a larger scale of farm operation. In the recent years, some farm machinery stations have set up their own farms. They rented some farmland to grow crops and provide agricultural services to other farms. These stations are in Chengqiao Town, Tuanjiesha Farm and others.

5.2 Agricultural processing

Agricultural processing industry is underdeveloped in Chongming County. There are only a few processing enterprises in the county, and the size of these enterprises is small (most

agricultural products are sold as raw material). Most of the enterprises only process grains, oil seeds and livestock products with low value added. For example, Chongming produced 2,898 tons of rice, 9,614 tons of wheat flour, 26,391 tons of vegetable oil and 2,266 tons of mixed feed. There are seven enterprises in the county processing grain and feed, of which two are collective and five are state-owned enterprises. The county owns the two vegetable oil processing enterprises. There are four meat processing companies, of which two are shareholdings, one is county-owned and one is a TVE. Others include seven cake and candy factories and five are alcohol and beverage processing factories. There are over 80 town- or village-run textile enterprises in the county. The TVEs are the main outlet for the surplus of rural labourers, although they are not directly linked with agricultural production. In addition to traditional agricultural processing industry, the processing of local specialities has developed quickly in the recent years. For instance, to promote the production of white goat, the Chongming Agricultural Committee set up Shanghai Yingyang Food Company in October 1994. This company has integrated the production, processing and distribution of white goat products. These products - which won a gold medal at the Second China Agri-Expo in Beijing - come in many forms and packages.

5.3 Purchasing and marketing of agricultural products

Before the reform, almost all agricultural products were under state control. The state-owned enterprises monopolised the whole chain of marketing. It was allowed to sell only a few products at free market. As the reform process continues, the supply and marketing system of agricultural products is becoming more flexible. The purchase and marketing of agricultural products (with the exception of a few kinds of grain and cotton) was controlled by the state. As a whole, the market is now open to collective and private companies.

In order to invigorate the local market, the Chongming government opened a number of free markets. Now each town has at least one free market. There are now 46 in the county, with a transaction value of 290 million yuan in 2000, up from 75 million yuan in 1990.

In addition, the county government has set up several wholesale markets and 10 retail shops in Shanghai. There are outlets for vegetables, aquatic products, processed food, alcohol and flowers in the urban area. They have established co-operative relations with the companies downtown through contracts. The county founded an agricultural distribution association in 1999, uniting over 180 individual members and 20 group members. It plans to enlarge the scale to expand the business. The linkages between production, processing and distribution have been strengthened. More farm products are marketed through contracts. The Chongming Grain and Oil Company is the only organization allowed to purchase and market grain and oil. The company has 25 branches and a grain and oil trading company. The company purchases over 100,000 tons of grains and sells 110,000 tons of grains and oils a year. The export of agricultural products is very limited in Chongming. The export value of food was 28.5 million yuan (= USD 3.45 million) in 2000, up from 25.8 million yuan (USD 3.16 million) in 1999. The main export product is salted vegetables, for export to Japan.

6. Conclusions

1. Chongming Island belongs to the municipality of Shanghai; however, it is rather isolated and can only be reached by ferry. This of course is a disadvantage when it comes to marketing agricultural products. Chongming's land is fertile and suitable for many crops. It has good water resources for fishery. Chongming has a sizeable agricultural population and the farms are small.
2. Chongming has adopted two main approaches to increasing labour productivity in agriculture and farm income. The first is to reduce the agricultural labour force by moving farmers to other sectors mainly on Chongming or in Shanghai. This development took place in particular in the 1980s; afterwards the trend was even upwards. During the period 1980-2000, the agricultural labour force shrank by more than 30%. Also, an increasing number of farmers work only part time in agriculture. As agricultural population still accounts for a large percentage and agricultural income is relatively low, a further decline of the agricultural population might be expected. The second approach is to intensify agricultural production and crop mix adjustment according to comparative advantage. In this respect can be mentioned the introduction of higher yielding varieties and other activities to increase yields per ha and per animal and further, the expansion or introduction of labour intensive agricultural sectors. Between 1990 and 2000 the volume of agricultural production increased by almost 80%.
3. Agricultural income still lags behind and productivity can be further improved. For the future, a further increase in agricultural production might be expected, but there will be more emphasis on the quality and safety of the products. In addition a further decrease of the agricultural labour force will be necessary in order to enhance labour productivity by making use of economies of scale and to improve the income of the remaining farmers.
4. Major changes have taken place in the agricultural production structure as a consequence of the introduction of more market-oriented policies (such as the household responsibility system) and the changes in demand due to increasing per capita income. Although the share of crop farming in agricultural production (about 50%) is rather stable, the composition of crop production changed considerably. The production of vegetables is nowadays by far the most important subsector. The production in plastic tunnels has increased, as has the number of varieties. The transportation and distribution system have been improved. It might be expected that in the years to come the production of vegetables will increase further, particularly vegetables that are produced according to 'green' food standards, and that the processing of vegetables will be developed. The production of cut flowers, bulbs and

trees is also increasing; however, these sectors are far less important than the vegetables sector.

5. The share of animal production is decreasing. This is partly due to the more or less stable production in the pig sector and the decreasing production in the milk sector. On the other hand, the production of poultry, eggs and goats has increased. The decline in the number of milk cows is remarkable considering that the demand for dairy products in Shanghai is increasing. A part of the explanation might be that Chongming lacks a milk processing industry. Another factor is the low efficiency of milk production. It is expected that particularly the production of white goat will be further increased. The processing and marketing of livestock products must be improved in order to compete with other counties. An exception is the processing and distribution of white goat, which is developing quickly.
6. Fishery is a booming sector, and freshwater aquiculture is growing fast. The fishery sector is more important than the animal sector. Nevertheless, the sector has some problems with poor maintenance, outdated facilities and a lack of processing capacity.
7. The traditional processing industry is underdeveloped. There are only a few processing enterprises, and they are small in size. As a consequence most agricultural products are sold as raw material. However, the processing of local specialities has developed rapidly in recent years. Developing the processing industry (and improving the product chain from producer to consumer) could create employment and improve the competitiveness of Chongming's agribusiness.
8. Agribusiness is still in a period of transition towards a more market-oriented economy. The role of the government is still substantial. The government owns an important number of farms. These farms have an important share in, for instance, the production of milk, trees and fish. It is expected that in the future most of these farms will become independent companies. In addition, the government plays an important role in supplying inputs to the farmers (e.g. seeds, fertilisers, pesticides, plastic film and some other services, in which the government has a near monopoly). The government also plays an important role in subsidising mechanisation. Finally, the government is involved in processing and marketing. Most of the limited number of processing enterprises are collective or state-owned. The county government has set up wholesale markets and retail shops on Chongming Island and in Shanghai.