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Development of Dairy Industry in China

by

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1. Introduction

The Chinese dairy industry is in transition from a traditional centrally planned to a more market-oriented sector.

The consumption of livestock products has increased dramatically over the last two decades due to the increase in per capita income, in addition to the increased demand for the direct consumption from an increasing population. As one of the most important livestock sectors, the dairy industry has undergone different stages of shortage and surplus. At present, the improvement of efficiency in both dairy farming and processing and manufacturing will be very essential to sustain the dairy resource utilization, and to meet new challenges from the changing market situation. In fact, in the dairy sector there is magnificent room for improvement of efficiency by analyzing the market structure, restructuring the industrial segments, and improving the management and use of more technological innovations. However, only very limited investigation has been conducted on these areas.

The improvement of efficiency is affected by, among other things, the scale effect of small-scale livestock holders, processors and manufacturers. A restructuring strategy taking into account small-scale features will be crucial. The same is the case with development of appropriate technology and management systems.

The quality and variety of dairy products has to be emphasised. The mono-structure variety and the low quality of increasing amounts of dairy products have depressed the price and caused surplus in some areas. Farmers also suffer from fluctuating incomes from milk production, which for many farmers is a major income source.

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This paper is about the recent development of different segments in the Chinese dairy industry. The main issues under consideration are the development stages of the dairy industry, the present consumption situation for dairy products, challenges facing the future development, restructuring strategy and some policy considerations.

2. Development stages of dairy industry in China

The whole process since 1949 could be divided into three stages (see Table 2.1): (1) First stage or shortage period (1949-1978); (2) Second stage or high-speed development period (1979-1992); (3) Third stage or adjustment period (1993-present).

Table 2.1 Statistics of the number of dairy cows, milk production and consumption

Year	No. of dairy cows (thousand)	Dairy milk production(thou sand tonnes)	Total milk production(thou sand tonnes) ^a	Per capita milk consumption (kilograms)
1949	120	Na	217	0.40
1978	475	883	971	1.02
.....				
1980	641	1141	1367	1.39
1985	1627	2499	2894	2.77
1986	1846	2899	3329	3.15
1987	2164	3301	3788	3.53
1988	2222	3660	4189	3.84
1989	2526	3813	4358	3.87
1990	2691	4157	4751	4.16
1991	2946	4644	5243	4.53
1992	3139	5031	5639	4.81
.....				
1993	3450	4978	5625	4.75
1994	3843	5288	6089	5.19
1995	4172	5764	6728	5.68
1996	4470	6294	7355	6.16
1998	n.a.	6621	7445	6.40

^aTotal milk production includes the milk from cows, goats, etc.

Source: CDCA 1996 and MOA 1999

2.1 The main characteristics of the first stage are unreasonable policies, inadequate input and shortage of supply. Although the consumption demand for dairy products was not high, due to the low level of residents' income, the consumption was restricted to the aged and infants in urban areas because of insufficient supply. On one hand, private cow-raising and private investment in the dairy industry was restricted. On the other hand, state and collective farms were inefficient and with limited investment. This was because of an inadequate price policy and property system which resulted in long lasting low prices for dairy products, high costs for labor supervision and low incentives.

2.2 The second stage began with permission given for private cow-raising and the first herds of private cows created in 1979. This later brought about the great development of

the Chinese dairy industry. The main characteristics of this stage are multiple sources of investment in the dairy industry, overall expansion of factor inputs and high rate of growth of total output. The annual growth rates during those 14 years for dairy cows, milk production and dairy products were 14.35%, 13.40% and 16.87% respectively. Given the consumers' income level and consumption preferences, their demands for dairy products were fully met in terms of both quantity and variety, although the per capita annual consumption of dairy products in 1993 was only 4.75 kilograms. The fast growth of the dairy industry during this period was mainly due to the following factors: (1) Some effective policy measures aimed at encouraging private cow-raising, increasing the farm-gate manufacturing milk price, stabilizing the consumers' price of fresh milk, providing dairy farmers with lower-price feed and lower-interest-rate loans for buying dairy cows through government support, which improved the enthusiasm for investment in the dairy industry from producers, processors and manufacturers. (2) Effective scientific research and technical extension, especially in the breeding of dairy cows. (3) International dairy projects especially with WFP and the EEC made a considerable contribution by providing funds and other necessary help for the development of dairy industries in about 20 large and medium-sized cities.

2.3 The third stage began in 1993 with a surplus of milk powder and the following lower growth rate in the number of dairy cows, milk production and dairy products. This marked a new development of the Chinese dairy industry. Since the market for dairy products was fully open, the control for both farm-gate price of manufacturing milk and the retail price of pasteurized fresh milk has been removed in many areas, and the support policy for low-priced feed and low-interest loans has been phased out. On the one hand, many small-sized dairy-processing enterprises are under pressure and in crisis. On the other hand, a lot of new companies including many influential foreign ones have begun to join the competition. The domestic market for both fresh milk and dairy products has been saturated, although the annual per capita consumption of milk products is very low, compared with many other countries. The main features of this stage are unprecedented market prosperity and strong overall competition. Therefore, both producers and manufacturers are facing readjustment and restructuring.

3. Present situation of dairy products consumption

3.1 Average for whole China

Among the livestock foods consumed by Chinese residents, pork and other meat are the main part. In 1998, the per capita meat consumption was 40.1 kilograms, of which 65.7% was pork, 11.2% was beef and mutton, 23.1% was poultry meat. The per capita egg consumption was 10.7 kilograms, while per capita consumption of aquatic products was 9.8 kilograms. In contrast, the per capita consumption of dairy products was only 6.4 kilograms (see Table 3.1).

Since the late 1970s, the consumption of dairy products in China has increased dramatically (see Table 3.2), although the present consumption is still low, compared with many other countries.

Table 3.1 Chinese consumption of livestock and aquatic products in 1998

Products	Per capita consumption (kilograms)	Total consumption (thousand tonnes)	Per capita production (kilograms)
Meat	40.1	50050	43.1
Pork	26.3	32870	28.4
Beef & mutton	4.5	5620	5.9
Poultry meat	9.3	11560	8.8
Egg	10.7	13330	17.5
Aquatic products	9.8	12300	Na
Milk products	6.4	7980	6.6

Source: MOA 1999

Table 3.2 Trends in the annual per capita consumption of livestock and aquatic products

Year		Milk	Meat	Egg	Aquatic	Total
1978	Amount(kg)	1.02	8.9	2.03	3.5	15.43
	Proportion(%)	6.48	57.68	13.16	22.68	100
1998	Amount(kg)	6.4	40.1	10.7	9.8	67
	Proportion(%)	9.55	59.85	15.97	14.63	100
Change	Amount(kg)	+5.38	+31.2	+8.67	+6.3	51.57

Source: MOA 1999

As shown in Table 3.2, the per capita consumption of dairy products has increased by 5.38 kilograms, or more than 5 times over the last two decades. Actually the growth rate in the first decade was much higher than that in the second decade. Besides the low base level at the beginning, there are two main explanations for this. One is the steady growth of other animal products in the second decade, the other is the remarkable reduction of net imports of dairy products in the second decade.

3.2 Consumption in urban areas

At present, urban areas are the main consumption markets for dairy products with the large share of 80.3% in 1998, also larger than that of any other animal product (see Table 3.3).

Besides the growth quantitatively, the consumption pattern of the urban residents has changed considerably. On the one hand, more and more attention has been paid to nutrition and variety, on the other hand, fast and convenient dairy products have been popular because of the change of work and lifestyle and the development of tourism. The demand for dairy products in urban areas is expected to grow remarkably in the near future.

Table 3.3 Consumption of livestock and aquatic products in urban areas in 1998

Products	Per capita consumption (kilograms)	Total consumption (thousand tonnes)	Proportion of the total consumption for China (%)
Meat	69.4	26000	51.9
Pork	42.1	15770	48.0
Beef & mutton	9.1	3410	60.7
Poultry meat	18.2	6820	59.0
Egg	17.9	6710	50.3
Aquatic products	19.2	7190	58.5
Milk products	17.1	6410	80.3

Source: MOA 1999

3.3 Consumption in rural and pasture areas

In the vast rural areas, relatively very few dairy cows have been raised except where forage and feed resources are abundant. In most rural areas close to large cities, farmers raise dairy cows mainly for a living. The consumption share of dairy products in rural areas is much lower than that of any other livestock product (see Table 3.4).

Table 3.4 Consumption of livestock & aquatic products in rural areas in 1998

Products	Per capita consumption (kilograms)	Total consumption (thousand tonnes)	Proportion of the total consumption for China (%)
Meat	27.5	24050	48.1
Pork	19.6	17100	52.0
Beef & mutton	2.5	2210	39.3.
Poultry meat	5.4	4750	41.0
Egg	7.6	6630	49.7
Aquatic products	5.8	5100	41.5
Milk products	1.8	1570	19.7

Source: MOA 1999

It can be seen from Table 3.3 and Table 3.4 that the per capita consumption of dairy products in urban areas in 1998 is 9.5 times that in rural areas. The low consumption of dairy products by farmers could mainly be explained by consumption habits in addition to the lower income and poorer delivery conditions.

In the pasture areas of China, which cover 120 counties with over 10 million inhabitants, milk and dairy products are one of the most important foods. For example, the per capita consumption of dairy products in 1994 was 69.7 kilograms in Tibet and 44.6 kilograms in Qinghai.

4. Challenges under the market-oriented economy and the changing demand

Since 1993, the Chinese dairy industry has been facing the fact that the growth of the consumption of dairy products is lower than the growth of production, processing and manufacturing capability, which causes difficulty and bankruptcy of many related dairy enterprises and risk for many dairy farms and households. Behind the superficial phenomenon of insufficient demand and fluctuations are some deep conflicts and challenges facing the Chinese dairy industry.

4.1 Conventional dairy farming versus modern industry

The modern dairy industry is based on effective dairy farming. Unlike the dairy sector in many western countries, dairy farming in China is characterized by a large number of small-scale holders in rather mixed farming systems, although there are an increasing number of specialized dairy households in almost all parts of China. All dairy farms, whether big or small, are mainly oriented to market demand other than home consumption. There are mainly three types of dairy farms: (1) state and collective dairy farms, usually relatively large and with different services of mixed quality; (2) small-and medium-sized private farms, usually specialized, but poorly managed; (3) mixed farms with crop farming and other activities. The latter type of farm represents the typical farm situation in China. The pattern of ownership and herd size distribution varies considerably between areas.

Over the last few years there has been a significant move towards the privatization of milk production. Especially since 1992, the state and collective herd has decreased while the private herd has increased considerably in many areas. According to the statistics in 1995, more than 70% of the dairy cows were raised by individual households with the average size of 7.3 cows per household, compared to the average herd size of 235.7 cows in state dairy farms (see Table 4.1). There are a range of factors affecting development of dairy farming in China: small scale which increases service cost and risk; poor management which affects both quality and quantity of production; lack of appropriate technology, extension and marketing services; lack of marketing incentives due to the traditional consumption pattern.

Table 4.1 Average herd size and production of different types of dairy farms in China for 1995

Types of farms	Herd size (No of total dairy cows)	Herd size (No of mature dairy cows)	Milk production (kilograms per mature cow)
State	235.7	126.5	4174
Collective	53.7	24.7	4790
Individual	7.3	4.1	2379
Average	11.1	5.3	3225

Source: CDCA 1996 and information supplied directly by the CDCA

4.2 Small-scale versus uncertain market

Since the 1980s, a large number of dairy companies and factories have been established, most of which are small factories which process less than 100 tonnes of fresh milk per day. These small factories cannot keep their equipment and techniques up-to-date, in addition to the poor management. Needless to say they are aware of the importance of developing new products and forming an effective and steady industrial chain from the production of milk to manufacturing and marketing. As a result, these factories are separated from the industrial chain and can only provide some low quality and uniform products, most of which are wholemilk powder.

The small-scale dairy processing factories have been connected with the very large number of small-scale dairy farms and households, as mentioned above. Over the last decades, more than 300 thousand individual dairy households have played (and will play in the future) an important role in the fast development of the Chinese dairy industry. However the small scale of individual dairy households, which deters the further development of the dairy industry, should not be ignored. The scattered small-scale dairy farms are not cost-effective, and the quality of manufacturing milk cannot be guaranteed, which lowers the competitiveness of many dairy products and factories. What is more, the small scale makes it difficult for dairy farmers to meet both natural and market risks, which definitely lead to big fluctuations and other disastrous effects in the dairy industry.

4.3 Traditional product supply versus present consumption demand

Under the planned economy, dependence of enterprises on the government led to a mono-structure for dairy production. Today, consumers' demand is different and diversified. Comparing the quantitative difference between China and other countries in terms of per capita consumption of dairy products just isn't enough to draw a significant conclusion on the dairy market. It is no longer the price but the quality and variety that are among the most important factors for consumers to choose dairy products. So, the development of products and markets is more important than the promotion and selling strategy, which has been proven by the success of some leading Chinese dairy groups like Yili, Guangming, Sanyuan and Sanlu.

4.4 Conflicts of interest between production and post-production

Over a long period, the industrial chain of the Chinese dairy industry has been split, which means the disintegration of production, processing, manufacturing and marketing in the dairy industry and leads to conflicts of interest among different interest groups. The regional monopolies in the purchase, processing and distribution of manufacturing milk provide the processors with pricing rights, which usually lowers the producers' interest. This situation might also cause irrational allocation of resources in the dairy industry if there were no sound coordinating mechanism. In fact, the present small scale and low level of efficiency in the dairy industry has been caused to a great extent by the interest conflicts and disintegration of the industrial chain.

4.5 Domestic industry development versus open market

Since the mid-1980s, a number of foreign dairy companies and joint ventures have been established in China. Meanwhile, foreign dairy products have been imported on a large scale. According to the statistics from 1987 to 1995, China exported on average 33 thousand tonnes of dairy products annually, which was only half the level of imports. The large levels of introduction of foreign capital and technology in the dairy industry and import of foreign dairy products have proven helpful for improving techniques and management, and in increasing the supply of dairy products to meet the demands of different consumer categories. On the other hand, they have caused big impacts on the Chinese dairy industry and market. Taking only the case of Beijing, in the big supermarkets, 62% of the milk powder was imported or produced by joint ventures in 1997, while the percentages were 100%, 76% and 84% for butter, cheese and UHT milk respectively.

5. Alternative strategy: restructuring

5.1 Consumption—from mono-structure to diversification

As mentioned above, we cannot correctly predict the future consumption demand of dairy products just by considering the present per capita consumption in China which is much less than that in Western countries. But consumption habits can be changed to some extent. Taking the case of Japan, the per capita consumption of dairy products increased from less than 10 kilograms to 68 kilograms within about 30 years, due to the successful development of their dairy market. Even in Taiwan, the present per capita consumption of dairy products comes to about 17 kilograms, compared to 6.4 kilograms in Mainland China. In fact, even in China, the mix of food has changed substantially in recent years in response to changes in dietary behavior and international market opportunities. According to the information from the Sino-Canadian symposium on the dairy industry in 1997, the estimated 17-kilogram per capita consumption of dairy products by 2020 was viewed as the basis of the development of the Chinese dairy industry. Therefore, the main issue is the development of new products and markets according to a much more diverse demand and away from mono-structure.

In the near future, more attention should be paid to the steady supply and development of new dairy products in the large and medium-sized cities. This should be accompanied by a gradual change of consumption behavior and market structure. It should be realized that the substantial development of the Chinese dairy industry depends on consumption prospects in the rural areas and small towns. In fact, the rural dairy market has a lot of potential. Taking the example of Mianhu township, which is located in Guangdong province with about 30 thousand inhabitants, the annual per capita consumption of milk and dairy products is about 25 kilograms, even more than the average of urban areas.

5.2 Production—from extensive to intensive

The small scale of individual dairy farms, which contribute more than 70% of the dairy cows in China, leads to extensive management problems and low efficiency and productivity. The annual milk yield was only 3225 kilograms per cow according to the

statistics in 1995, compared to 7316 kilograms in the USA in 1994. Small scale extensive dairy farming is not good for the development of new breeding and raising techniques, and the application of advanced dairy machines and equipment, which affects the quality of manufacturing milk and therefore the competitiveness of dairy products. Taking the case of the state dairy farms in Beijing, the milk production cost per kilogram in 1997 was 2.08 Yuan (about US\$ 0.25), which is higher, not only than that in many Western countries, but also than the farm-gate price (1.90 Yuan). A similar situation can be seen in some suburban areas with the average profitability and rate of return for dairy farming lower than the average for broadacre farming.

The urgent task in the future is to intensify and modernize dairy farming by industry rationalization with the accumulation of capitals, improvement of production conditions, adjustment of the industrial structure, construction of dairy production bases and improvement of management.

5.3 Processing and manufacturing—from separation to rationalization

With the implementation of a more open market and increased competition in the dairy industry, a surplus of dairy products has appeared, and consumers are becoming more demanding in terms of both quality and variety. Therefore, concentration of ownership and merger of the processing and manufacturing factories in the dairy industry is becoming necessary to adapt the sector to the changing market situation. In fact, merger activity over the last decade has already seen the emergence of a small number of large processing/manufacturing companies like Wandashan, Sanlu, Yili, Pengcheng and Sanyuan etc., which are enabled to take advantage of the resulting economies of size to reduce unit costs and improve efficiency, equip themselves with modern machines and technology. In this way, they have proven to be more competitive.

Apart from reconsidering the mix of manufactured dairy products in response to changes in dietary behavior and international market opportunities, further efforts should be made, especially in the following areas: encouraging factories to merge to form larger groups; enlarging the production scale for lower cost and higher efficiency; increasing machines and equipment for milk cooling and maintenance of freshness; improving techniques for quick checks and control of milk quality and production processes; paying more attention to environment protection.

5.4 Industrial chain—from split to integration

The dairy industry mainly consists of the following segments: farming, processing and manufacturing, transport and sale. Over a long period, these segments have been split, which has caused many conflicts and low efficiency. About ten years ago, vertical integration of the dairy industry emerged as a result of the reforms and the development of a market-oriented economy. At present, integration is mainly aimed at improving the linkages between the raw milk producers and the processors and manufacturers.

With the development of the Chinese dairy industry, integration will be diversified. On the one hand, more and more large dairy groups will be integrated with dairy farmers and the milk production base on the basis of reciprocal interest. On the other hand, state dairy farms or other competitive farms or organizations, like cooperatives, will play a major role in the integration process by linking the industrial chain. In the future, vertically integrated companies will participate in more segments or stages within the dairy industry in order to reduce unit costs or risks.

6. Policy consideration

6.1 Price and tax policy

Pricing of manufacturing milk is one of the most sensitive issues in the development of dairy industry, which for a long period had been decided by the government. But, if the price were completely decided by the market, dairy farmers' interest would be negatively affected. Farmers' organizations like cooperatives in Western countries have not been effectively established yet in China, so the scattered small-scale dairy households are not strong enough for bargaining. Reasonable prices should be studied and recommended, and producers, processors, consumers and related researchers should be represented and included in pricing management and supervision. Meanwhile price differentials between grades, seasons and even regions are still to be considered.

Tax reductions and exemptions for both producers and processors have been in practice in some areas, which is still necessary, at least in the near future. On condition of accordance with the WTO agreement on agriculture, some support measures could remain operative for the development of domestic dairy industry.

6.2 Technological innovation

Apart from the large state dairy farms in some suburban areas where the milk yield reached 7000 kilograms per cow, most private dairy farms are inefficient with much lower per-cow yield and low quality fresh milk. At present, one of the most urgent things is to improve breeding, feed and raising techniques. A new system of dairy technological innovation should be considered.

Meanwhile, technological innovation in processing and manufacturing segments are becoming more and more decisive to meet the challenges and the changing market demand facing the Chinese dairy industry as mentioned above.

6.3 Investment and risk management

The further development of the Chinese dairy industry depends to a large extent on additional input, especially in the construction of a modern dairy farming base, development of infrastructure, and technical progress both in dairy farming and in processing and manufacturing. Besides direct government investment, policies on dairy development funding at both national and local levels, using low or non-interest loans,

risk management funds, price insurance, etc. These areas should be given more attention in the near future.

6.4 Full and effective utilization of dairy resources

Two categories of resources which are still to be developed for the future development of the dairy industry are feed and cattle.

Forage and feed is the basis for dairy farming. For non-pasture suburban areas where most of the manufacturing milk is produced, the main fodder resource is straw and chaff. Each year there are over 0.6 billion tonnes of straw and chaff available in China, about one fifth of which is produced in suburban areas of large and medium-sized cities. At present, only 30-40% of this resource is treated and used as feed. Besides, there is still a large amount of other fodder resources like by-products from oil-processing of cottonseed and rapeseed to be utilized as refined feed.

In China, dairy cattle consist of cows, goats, ox, buffalo and yak, etc. According to the statistics in 1996, there are 4,470 thousand cows, 4,873 thousand dairy goats, 139,813 thousand other dairy cattle with very low per-unit milk yield. The milk yield and share from cattle other than cows is still to be increased.

6.5 Coordination and service

In the development of the dairy industry, many recurring problems need to be coordinated by organization and management. Among the most often discussed problems are use of capital, feed supply, breeding, processing of dairy products, equipment purchase, product development, organization of integration, multi-ownership coordination, farmers' organization, dairy technique research and extension, quality supervision, and marketing information and training etc. Therefore more services should be provided. At present, organizations involved at different levels are agricultural or farm bureaus, dairy cow associations, dairy cow research institutes, dairy product research institutes, dairy companies, etc. These organizations and services should be strengthened in the future.

6.6 Consumption promotion and propaganda

Consumption behavior could be changed to some degree by dissemination of relevant knowledge and information. To improve the food structure and nutrition and increase the demand for dairy products, the government needs to put emphasis on 'guiding the consumption' of dairy products by initiating different national projects like the milk program for school children. In China, there are over 0.2 billion school pupils, who are the largest consumer group for dairy products. Therefore, this program could be expected to have a strong influence through effective organization and management. Similar programs could be phased in in the future.

7. Concluding comments

This paper is an overview of the development of the Chinese dairy industry. While a great change has taken place to the Chinese dairy industry over the last five decades, there remains magnificent room for improvement of efficiency through restructuring. To deal with the new challenges from the changing market situation, the production, processing and manufacturing of dairy products should be more market-oriented and rationalized. At the same time, government involvement in the dairy industry should place more emphases on the policies in taxation, investment, technological innovation, utilization of dairy resources and related services.

References

- Chinese Dairy Cow Association (CDCA) 1996, *Production Statistic Yearbook*, Beijing.
- Fang, Y. 1999, 'China's dairy farming: situation and prospects', *China Dairy Cows*, 1999(6).
- Li, Y. 1998, 'On the integration of the Chinese dairy industry', *Proceedings of China Dairy Science Symposium*, Beijing.
- Li, Z. et al. 2000, 'Consumption of livestock products in China', *Chinese Rural Economy*, 2000(7).
- Liang, Y. et al. 1999, 'China's milk market', *Modern Animal Husbandry*, 1999(1).
- Liu, Z. and Zhang, Z. (eds), 1998, *Experience in Dairy Industry*, China Agronomy Review Press, Beijing.
- Lu, Y. 1998, 'Thinking about the dairy farming in China', in Liu, Z. and Zhang, Z. (eds), *Experience in Dairy Industry*, China Agronomy Review Press, Beijing.
- Ministry of Agriculture (MOA), *China Agricultural Statistic Data (1978-1999)*, China Agriculture Press, Beijing.
- Shi, Y. 1995, 'Some issues on development of dairy farming', *China Dairy Cows*, 1995(4).
- Xiong, H. et al. 1994, 'Problems of traditional dairy industry', *China Dairy Cows*, 1994(6).