

3 ■ Case Study: Chinese Frozen Vegetable Exports

3.1 Introduction

In late 2001 and 2002, Chinese frozen spinach imported by Japan was found to contain residues of the pesticide chlorpyrifos. In August 2002, the Japanese government issued advisory notices to halt imports of Chinese frozen spinach, but this stopped the imports of all frozen vegetables from China into Japan. In February 2003, the Japanese market was reopened to imports of frozen vegetables from China, though it closed again because new tests revealed continued problems with the same pesticide (Calvin, Hu, Gale and Lohmar, 2006). This incident put food safety at the top of the agenda regarding imports from China to Japan.

This case study focuses on exports of frozen vegetable products from China (with a particular focus on the Japanese market), analyzes the factors associated with the rejections of these products at Japanese ports, and remedial actions taken by producers in China. The remainder of this section provides a brief overview of vegetable production in China and the way in which China has been participating in exports of these products. The next section will closely examine the frozen vegetable sector in China, identify causes for import rejections, and the actions taken by the Chinese government and by producers, processors, and exporters to improve the quality of frozen vegetable exports.

After the Opening-up and Reform policy in the late 1970s, the new economic regime called *Household Production Responsibility System* spread all over rural China by the early 1980s. This decreed that the right to use farmland should be distributed to individual farmers while the right to own farmland was given to each village. This new system, which led to the appearance of numerous small-scale household farming units, stimulated farmers' willingness to produce, which had long been depressed under the Peoples' commune system. By the mid-1990s China achieved almost sufficient domestic food production, which made it possible for China, a country with a huge population to feed, to aggressively open its door to the global agricultural market.

The institutional reforms liberalising the international agro-food trade in the late 1980s led to a rush of foreign investments in the agricultural processing sector, although only authorised trading companies were allowed to participate. Japan, the largest agro-food importer in the world, was the chief investor in coastal China, followed by Republic of Korea, Taiwan Province of China, and Singapore. Japan initially invested in Shandong province – the largest agricultural production region in north

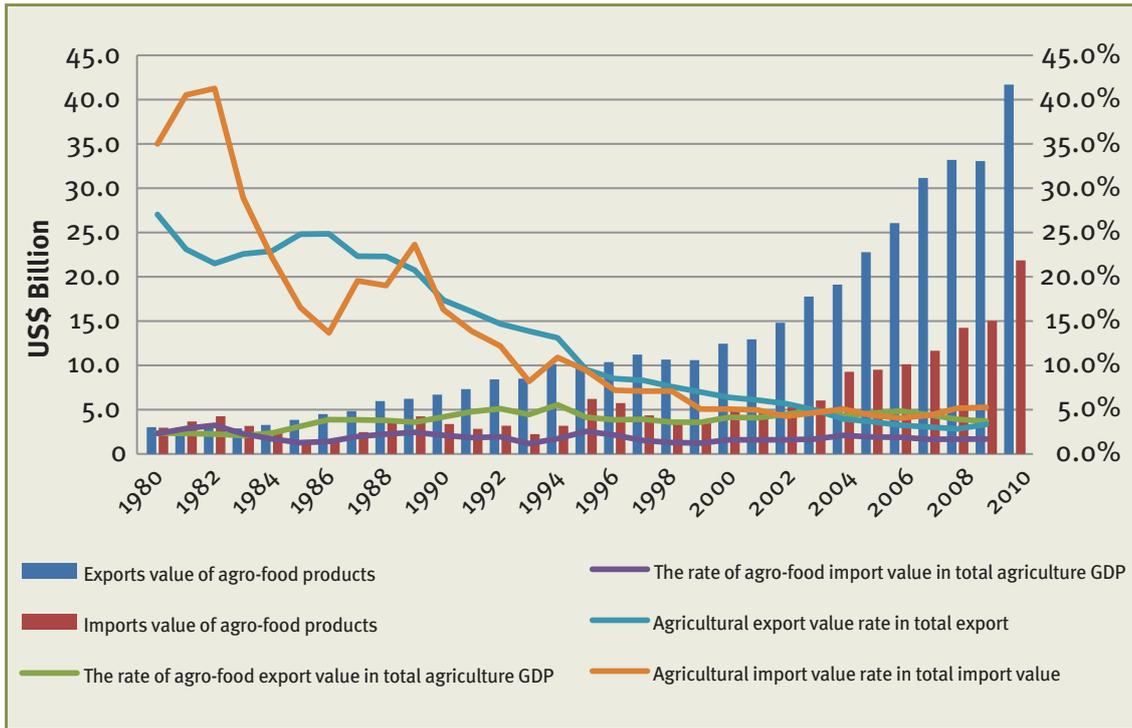
China – and later spread to Jiangsu, Guangdong, Fujian and other coastal provinces endowed with good access to ports. These foreign agribusiness firms encouraged local farmers to grow crops specifically for importers' markets by providing them with a holistic package of production materials including seeds, pesticides and technical assistance, which is the so-called *Development and Import* strategy.

In combination with this development of the food processing industry led by foreign-financed agribusiness, a series of drastic rural institutional reforms, including distribution liberalisation for agricultural products since the 1990s, encouraged further development of agribusiness. Since the late 1990s, one of the main strategies of Chinese agricultural policy has always been the development of agribusiness and food processing industries to add value to agricultural products by utilising the abundance of low-cost labour to ameliorate domestic income disparity between agriculture and other industries. The Chinese government promoted the development of agribusiness and the agricultural vertical integration system by providing lead firms and farmer organizations with tax incentives and subsidies. This policy is specified in the *Agricultural Industrialization Policy*. The main purpose of this policy is to create leading agribusinesses which in turn lead large-scale farmers or local farmers' cooperatives and their member farmers. This policy has contributed to the development of agribusiness since the late 1990s.

Chinese agro-food export value has grown rapidly since the late-1990s, and China's accession to the World Trade Organization (WTO) in 2001 accelerated this growth. Figure 3.1 indicates trends in the value of Chinese agro-food exports and imports during the 30 years from 1980 to 2010. The value of exports in 2000 was US\$12 billion, more than four times that in 1980, about US\$3 billion in nominal terms. In the 2000s the WTO accession accelerated the growth, with the total export value in 2011 exceeding US\$40 billion, 3.6 times that of 2000. While the share of agro-food exports in total agricultural GDP had been stable, at around 3 to 5 per cent over time, the share of agro-food export value in total national export value decreased dramatically from 26.7 per cent to 3.3 per cent in the same time period because of the rapid growth of manufacturing export industries.

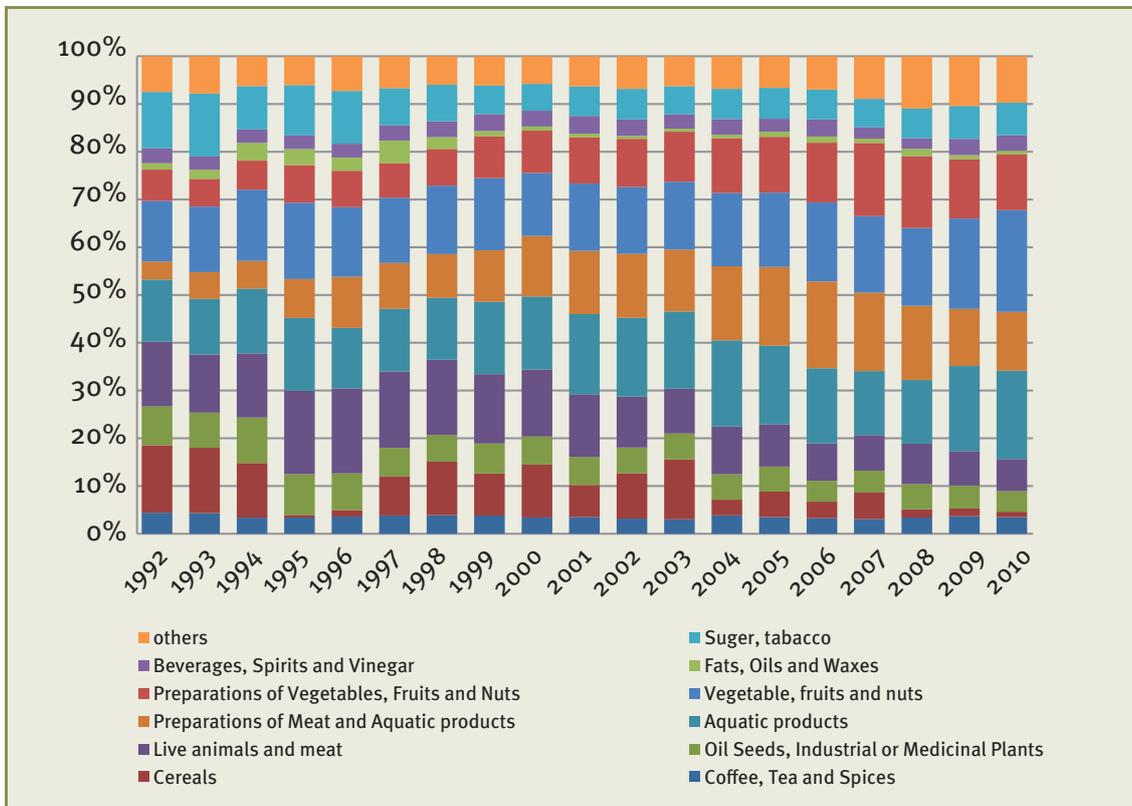
Figure 3.2 shows trends in the composition of agro-food export values from 1992 to 2010. From this figure, it can be seen that the share of raw materials has decreased during this period, while various kinds of processed products grew rapidly. In 1992, raw

Figure 3.1: Chinese agro-food trade trends, 1980–2010



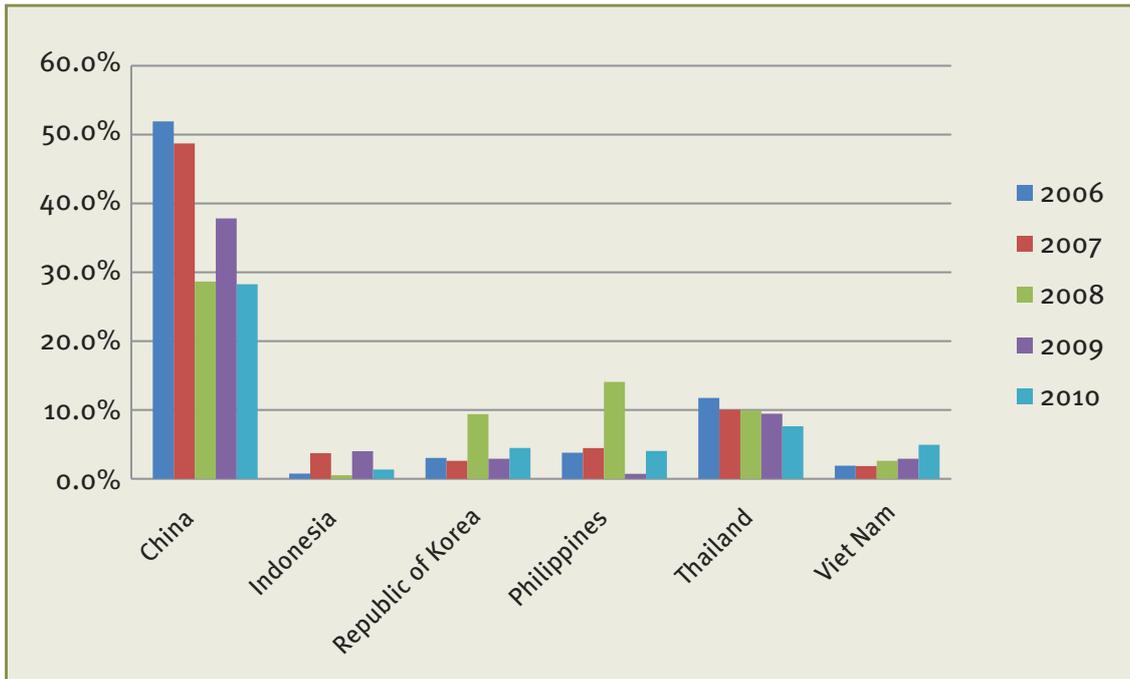
Source: National Statistical Bureau of China, Ministry of Agriculture (China), various years

Figure 3.2: The composition of Chinese agro-food exports (in value terms), 1992–2010



Source: National Statistical Bureau of China, Ministry of Agriculture (China), various years

Figure 3.3: Share in Japanese rejections of Fruit and Vegetable products among selected East Asian countries, 2006–2010



Note: Excludes Brunei Darussalam, Cambodia, Hong Kong (China), Lao People’s Democratic Republic, Malaysia, Myanmar, and Singapore.

Source: UNIDO dataset and analysis, based on Japanese MHLW data

agricultural products including coffee, tea and spices, cereals, oil seeds, industrial or medical plants, live animals and meat accounted for 40.2 per cent of exports. This dropped to 15.7 per cent in 2010. In contrast, the share of various processed products of meat, vegetables and aquatic products has increased. For instance, the sum of fresh vegetables and preparations of vegetables and fruits grew from 19.3 per cent in 1992 to 33.0 per cent in 2010. Within vegetable and fruit exports, the share of the preparations was 33.9 per cent of the values in 1992, peaked at 48.9 per cent in 2007, and then decreased to 35.3 per cent.

The share of fish and other aquatic products has remained stable during this period, at about 12–16 per cent of total export value. The ratio of preparations of meat and aquatic products accounted for 3.6 per cent in 1992, then touched 10 per cent in the late 1990s, peaked at 18.2 per cent in 2006 and then started to decline to 11–12 per cent in the late-2000s. This declining tendency is partly because of the adoption in 2006 by the Japanese government of a *Positive List System for Agricultural Chemical Residues in foods*, which will be referred to in detail later.

As Chinese agriculture deepened its linkage to the global market and became a major exporter in the global agro-food market, a number of disputes regarding food safety occurred. In the 2000s successive serious incidents regarding the safety of Chinese agro-food products occurred. In the Japanese market, imported fruits and vegetables from China are rejected more frequently than those from other East Asian countries (see Table 2.7).

Under pressure from the international community, the Chinese government has placed more emphasis on food safety and has started to establish more efficient and effective controls over the entire food supply chain in China.

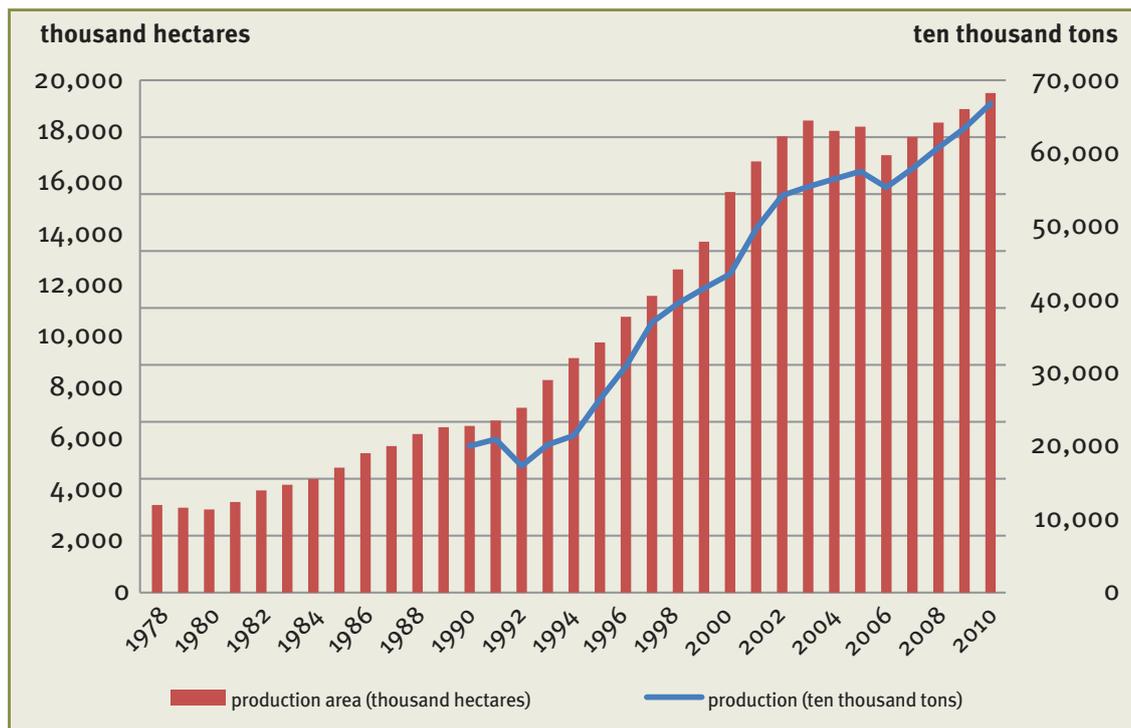
In this chapter and the next, we will analyze two typical Chinese export items, frozen vegetables and eels, as examples of products or value chains with serious food safety problems in the 2000s in the international market. These chapters aim to clarify the basic characteristics of production, distribution and export of each item, how exporting firms manage supply chains to control and ensure the quality, the potential export capacities, and implications for necessary policy actions.

3.2 Production and distribution of vegetables in China

3.2.1 Domestic production of vegetables

Since the introduction of a market economy, the area under production and the output of vegetables in China have steadily increased (see Figure 3.4). The total area for vegetable cultivation was 3,330,000 hectares in 1978. Within 12 years, the cultivation area doubled and the rate of increase accelerated during the 1990s. In 2010, the total cultivation area reached 19 million hectares, nearly six times as large as that in 1978. The quantity of production has also increased very rapidly, to 651 million tons in 2010, which was about 3.8 times as much as in 1978 (195 million tons).

Figure 3.4: Vegetable production trends in China, 1978–2010



Source: Ministry of Agriculture (China), various years

Among vegetables, leaf vegetables are the most popular, accounting for 35.1 per cent of the cultivation area and 36.0 per cent of output. This is followed by solanaceous crops (this includes tomatoes and aubergines) with 14.7 per cent of the total production area and 16.1 per cent of total production. The third variety is root vegetables, accounting for 14.1 per cent and 14.1 per cent, followed by cucumbers and gherkins at shares of 11.5 per cent in area and 12.9 per cent in output, respectively.

The top five production areas in 2009 were located in Shandong, Henan, Guangdong, Sichuan and Hebei provinces. Their shares were 9.5 per cent, 9.1 per cent, 6.2 per cent, 6.2 per cent, and 6.1 per cent of total vegetable production area, respectively. The majority of the main production areas are located in the coastal areas where soils are more fertile and with better access to international markets.

3.2.2 Vegetable distribution system in China for the domestic and global markets

After the introduction of a market economy, the distribution of agricultural products was liberalised in a step-by-step manner. Since 1988, the government has been promoting the establishment of agricultural wholesale markets. According to the 2010 China Agricultural Development Report, more than 70 per cent of vegetables, fruits and aquaculture are now distributed through wholesale markets.

However, there still are still more than 250,000 free markets at the end of 2008, although the number is declining slowly.

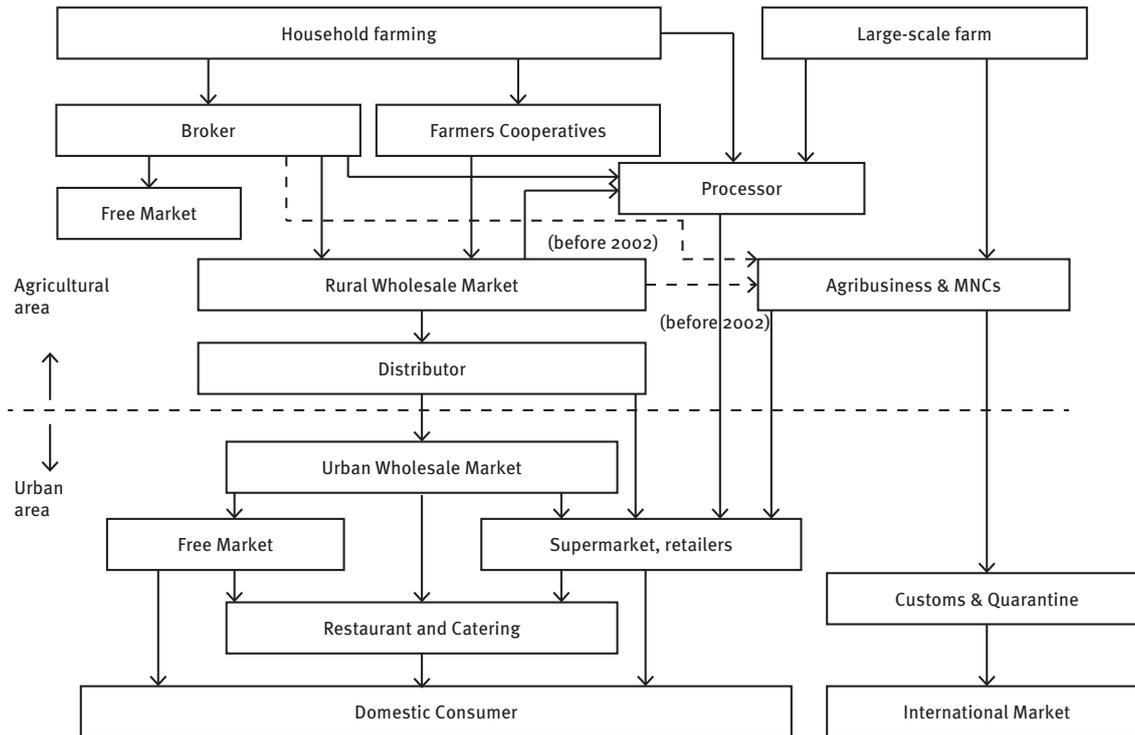
The vegetable distribution system in China since the 1980s is shown in Figure 3.5. Agricultural products for international markets (on the right of the figure), especially the products for developed countries which require higher quality standards, are basically separated from those for the domestic market (on the left) in the process of production, processing and distribution. It should be emphasised that most Chinese vegetables and their products are consumed locally, and in increasing amounts along with income growth, while only a small percentage of the production is exported, though this is a sizeable amount compared with other foreign countries. The major players and their functions in the Chinese vegetable distribution system regarding products for domestic and international markets will be described separately below.

Products for the Chinese domestic market

The main vegetable producers for the domestic market can be divided into two types. The first type are small-scale farmers. According to the Second Chinese Agricultural Census in 2006, the average cultivated land area per household is only 0.55 hectares. There are also large-scale farmers, although their number is still small. This is because the development of contract farming remains limited, partly because of the still underdeveloped food processing industry and farmland rental market. Only 10.8 per cent of a household's farmland was rented from the land market on average and only 12.2 per cent of farmers participate in the farmland rental market.

Most farming households sell their vegetables to Brokers who visit villages in harvest season to purchase their products.

Figure 3.5: Vegetable distribution system for domestic/global markets in China



Source: Authors' own illustration

Some of the brokers are local farmers who entered into the distribution business. The brokers then sell the vegetables to wholesale markets and processors. Some vegetables would be sold to a local free market or fairs for local consumption. Some of the farmers are members of *Farmers' Professional Cooperatives* (FPCs), that will be elaborated later, and sell their products to them, though the shares of vegetables sold through FPCs are rather small currently.

According to the *2010 China Agricultural Development Report*, rural wholesale markets handle vegetables from 60 per cent of the total vegetable production area. About 80 per cent of the rural wholesale markets are located in the east and central areas of China. They work as hubs of horticulture products, and from them these products are distributed to urban wholesale markets, supermarkets and other retailers and traditional free markets in large and medium cities via distributors. Registered wholesale markets are equipped with quality control (safety check) facilities and, according to the *Policy on Market Entrance Permission of Vegetables* based on the *Law of PRC on Quality and Safety of Agricultural Products*, local officials can implement compulsory pesticide residual inspection by random sampling at rural and urban wholesale markets and large retailers that deal with vegetables.

Agribusiness firms engaging in the processing and distribution of food products usually procure their materials from *large-scale farms* on contract, their own farms, or from *rural wholesale markets* (only in the case of the domestic market). The domestic market for processed vegetables is still underdeveloped because only a limited number of agribusinesses are equipped with cold storage and processing facilities. In addition, at this

stage of development, most domestic consumers prefer fresh vegetables and fruits rather than highly processed products such as frozen vegetables and other preparations, apart from younger generations with a high enough income level and living in large cities such as Beijing and Shanghai.

Since the early 1990s, supermarkets have spread throughout large cities in China and the value of supermarket sales of horticultural products already exceeds that for exports, though traditional outlets still remain important (Wang *et al.*, 2009). The Chinese government promoted the conversion of traditional wet markets to supermarkets and the development of direct trade between farms or farmers' cooperatives and supermarkets in order to streamline the current thick-layered distribution system in China to improve efficiency and safety control along the supply chain.

Chinese products for the international market

The year 2002 saw a dramatic change in the procurement system for exports in the agriculture business. This was the year when spinach imported from China was found in Japan to contain excessive amounts of agricultural chemical residues. After the incident, export firms were restricted to the use of materials from registered producers according to the *AQSIQ Announcement on Inspection and Quarantine of Import and Export Vegetables* enforced in 2002. This specified that a vegetable export firm must purchase vegetables from a registered large-scale farm called a *Production Base (PB)* that satisfies certain conditions (PB will be referred to later in this chapter). Before 2002, some exporters bought materials from rural wholesale markets, from brokers, or from farmers directly. After 2002, small-scale

processors and brokers who did not have access to PBs were completely shut out from lucrative export markets.

As for agribusiness firms, only the firms that have import and export licences are allowed to make contracts with foreign traders, though the application processes have become much easier than before. With respect to frozen vegetables and highly processed preparations of vegetables, export agribusinesses have created an integrated quality management system starting from production in PBs, processing, packing and all the way through to the shipping process. The main exporters of frozen vegetables are large-scale agribusinesses who also have large PBs, processing facilities with strict temperature control, and chemical residual inspection facilities.

In 2003, there were more than 13,000 food processing firms engaging in some export activities. Of these, 836 enterprises had annual export values of more than US\$5 million, and 60 per cent of them are vertically integrated from production, processing, and through to export. One of the largest such exporters is A Groups in Shandong province, which originated from a so-called rural township enterprise (TVE) in the 1980s and later grew into a group of companies including dozens of domestic and foreign-invested firms. One-sixth of frozen spinach exports from China are produced by them (Oshima, 2007). In Shandong, foreign investment in the food processing sector is quite active, most being investments from Japan and Taiwan Province of China,

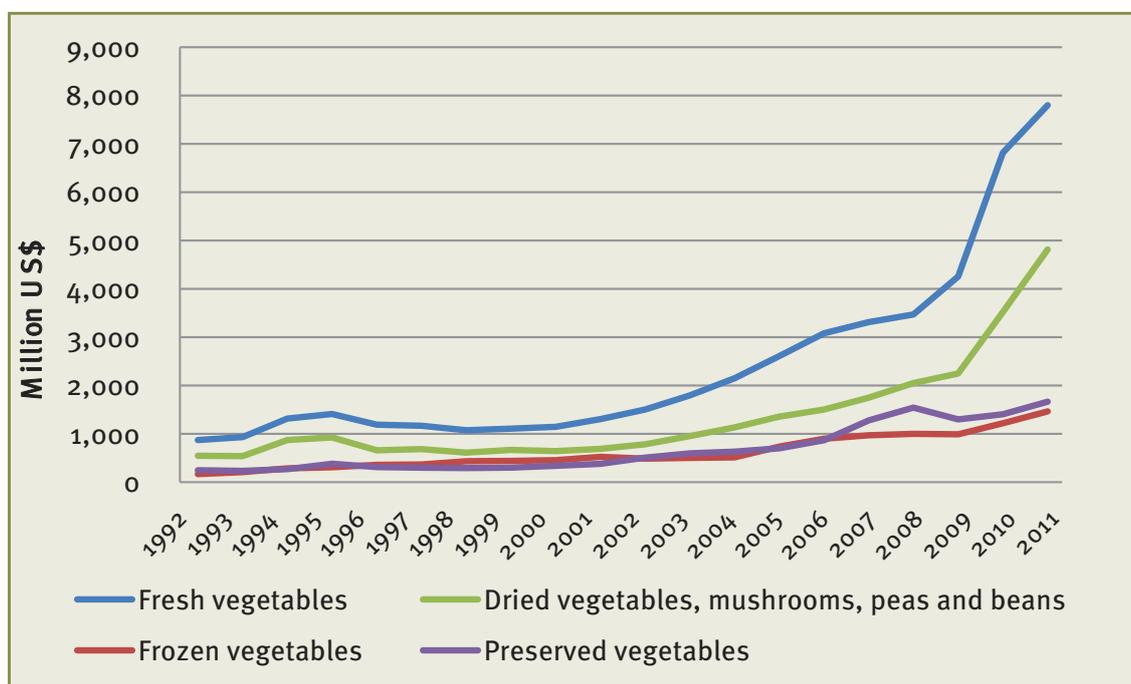
and specialising in export to the Japanese market. At present, exports of frozen vegetables are dominated by such large-scale agribusinesses with PBs that can guarantee the quantity, quality and safety of materials, this being the strongest advantage of such enterprises.

3.3 Exports of Chinese vegetable products

The composition of vegetable products exported from China has undergone several changes since it began in the late 1980s. Initially, Chinese exports consisted of mainly preserved or pickled products. Then the development of domestic infrastructure enabled China to export fresh vegetables in the early 1990s, starting with the vegetables requiring least preservation, such as garlic, ginger or root vegetables, and expanding to a wider range of varieties later. As the main importer, Japan deepened its dependence on Chinese fresh and processed vegetables produced at lower prices. In the mid-1990s Japanese frozen food companies and trading companies invested in Shandong province and other coastal area and started to export vegetables to Japan in accordance with the *Development and Import* strategy.

Figure 3.6 shows the export trends of various vegetable product groups after 1992. Among these products, *fresh vegetables* have remained the major category, growing rapidly during the 2000s,

Figure 3.6: Exports of various vegetable product groups from China (in US\$ value)



Source: UN Comtrade

In this report, the category of Fresh vegetables includes HS codes 0701, 0702, 0703, 0704, 0705, 0706, 0708, 0709, 0714, 0910; Frozen vegetables comprise HS codes 0710, 071490, 2004; Dried vegetables, mushrooms, peas and beans include HS codes 0712.39-010, 0712, 0713; Preserved vegetables include HS codes 2001, 2002, 2003.

with the speed of growth skyrocketing after 2009. *Dried vegetables* have a similar trend to *fresh vegetables*. The growth of *frozen vegetable* exports saw slower growth compared with the above two commodities, growing by 2012 to more than US\$1.4 billion, a level 14 times higher than that in 1992. The share of frozen vegetables has not been increasing since 2006. This is partly because of the decrease in exports to Japan, the biggest importer of frozen vegetables, after the introduction of the *positive list system* in May 2006. The share of each product group in total vegetable export values in 2011 were as follows: fresh vegetables are dominant, accounting for about half of the total value, followed by dried vegetables (31 per cent), preserved vegetables (10 per cent), and frozen vegetables (9 per cent).

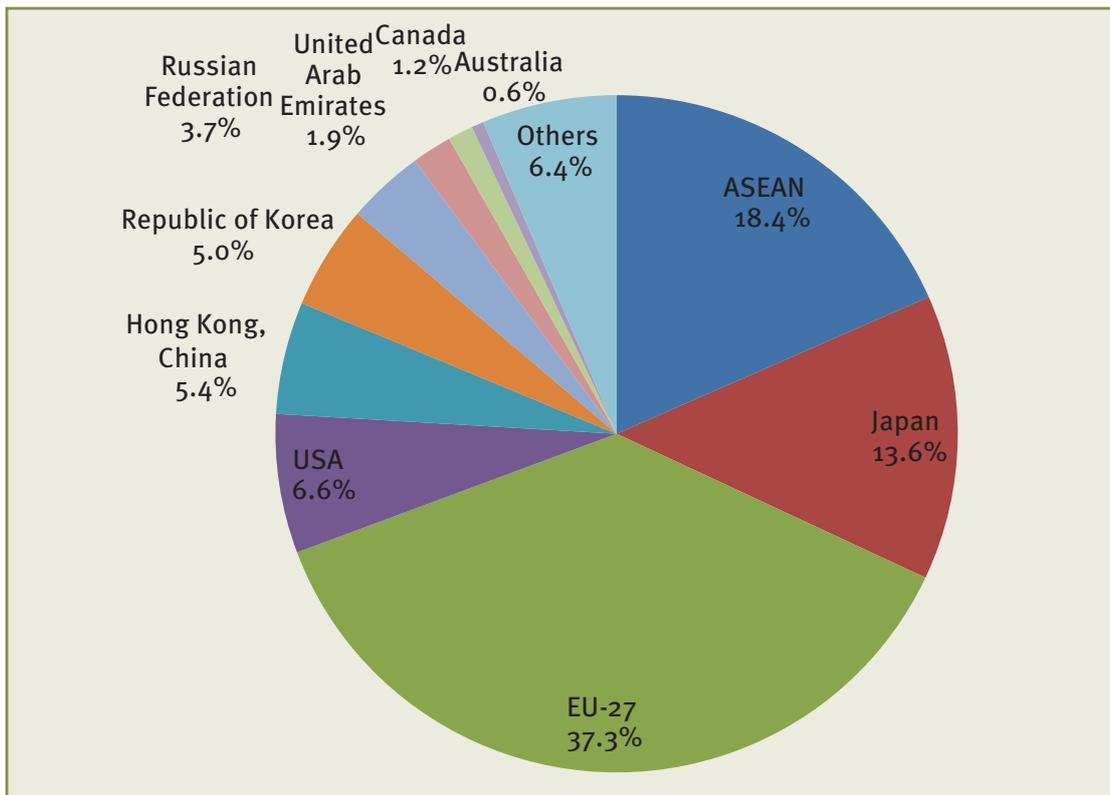
3.3.1 The distribution of major importing countries for Chinese vegetable products

The major overseas market for Chinese fresh vegetables is East Asia, accounting for more than 40 per cent, followed by the EU, the United States, Russian Federation and the Middle East (see Figure 3.7). Japan had been the largest importer of Chinese vegetables – both fresh and frozen – until 2008, although after the introduction of the *positive list system* in May 2006 the value started decreasing.

Japan adopted the *Positive List System for Agricultural Chemical Residues* in 2006. The *positive list system* established maximum residue limits (MRLs) for 799 agricultural chemicals for thousands of commodities, and imported foods cannot exceed these MRLs. If the imported food is found to contain a chemical which is not on the list, it cannot exceed 0.01 parts per million (ppm). This new policy required exporters to apply the strictest quality controls in the world and created a new challenge for Chinese exporters. Only the exporters who had been producing frozen vegetables for Japan for years survived. These firms either had good connections with Japanese customers or had Japanese investors. In most cases, these firms had investments from Japanese frozen food producing companies and trading companies, and they could prepare for the new standard beforehand by collecting the latest information and enjoying technical assistance from Japan.

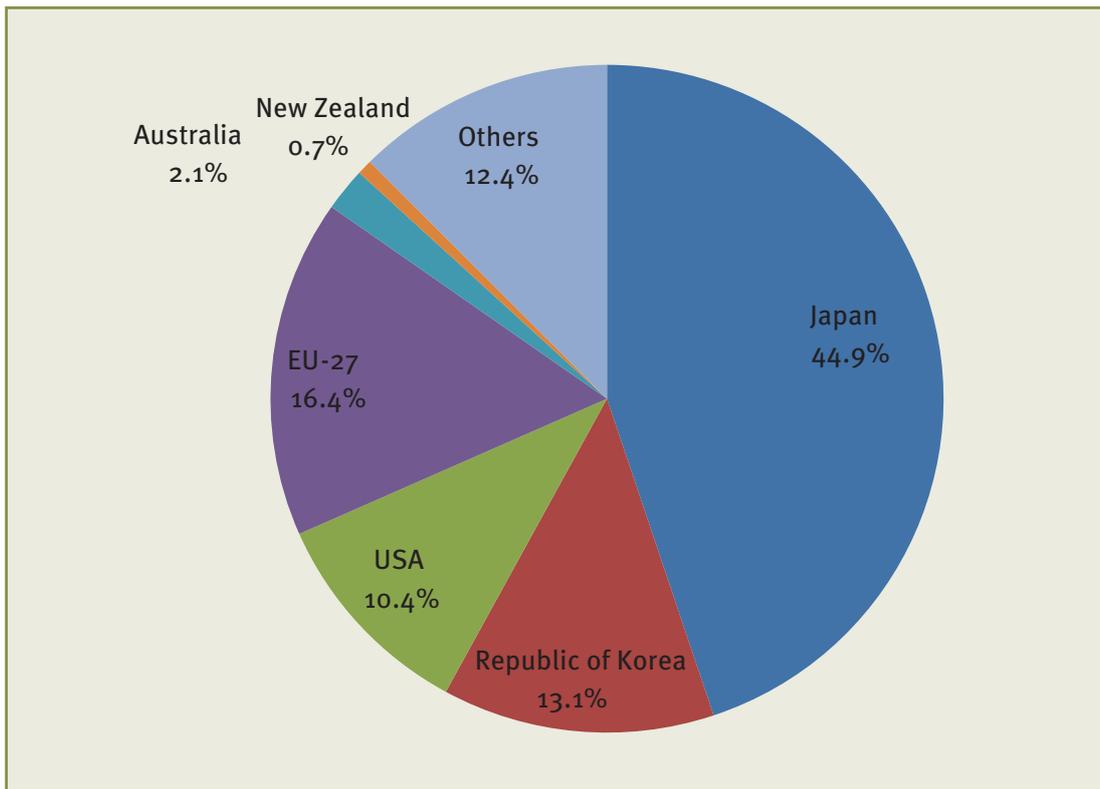
Fresh vegetable exports to new importers – mainly ASEAN countries, especially Malaysia and Thailand – increased dramatically in values as a result of gradual tariff reductions on agricultural products after 2005 under the ASEAN–CHINA FTA (ACFTA) scheme. Russian Federation imports Chinese vegetables through border trade mainly from the three northeastern provinces (Agriculture and Livestock Industries Corporation (ALIC), 2011).

Figure 3.7: Distribution of importers of Chinese fresh vegetables in 2011 (in value)



Source: UN Comtrade database

Figure 3.8: Distribution of importers of Chinese frozen vegetables in 2011 (in value)



Source: UN Comtrade database

As with fresh vegetables, Japan has been the largest importer of Chinese frozen vegetables, although Japan's share has declined from 71 per cent in 2002 to 44.9 per cent in 2011. The second largest importer in 2011 was the EU (16.4 per cent), followed by Republic of Korea (13.1 per cent), and the United States (10.4 per cent). As with fresh vegetables, frozen vegetables are also exported to developing countries, where the standards are less strict. However, the demand for frozen vegetables typically is higher in developed countries than in developing countries.

Since detecting residual agricultural chemicals in Chinese-produced vegetables in 2002, Japan has banned imports from China several times and has introduced stricter standards for imported products. Hence Chinese exporters have diversified their export markets to avoid the risk, some of them shifting to markets in developing countries or even shifting to focusing solely on the domestic market, where quality standards are less strict than for export products. However, more and more prosperous Chinese residents are demanding safer and higher-quality food. This tendency continued after the introduction of the positive list system in 2006.

After the adoption of the positive list system in Japan in 2006, the China Inspection and Quarantine Service (CIQ) required exporters to double-check export commodities by CIQ and by private inspection centres before shipping. Some processors

without any self-inspection facilities have to request inspection by other processing firms' inspection centres or private inspection companies specialised in inspecting export products. The costs of safety inspections have risen as the number of items to be checked increased and the variety of standards diversified. These cumbersome procedures and high costs have forced some firms to shift export markets to those with less strict standards.

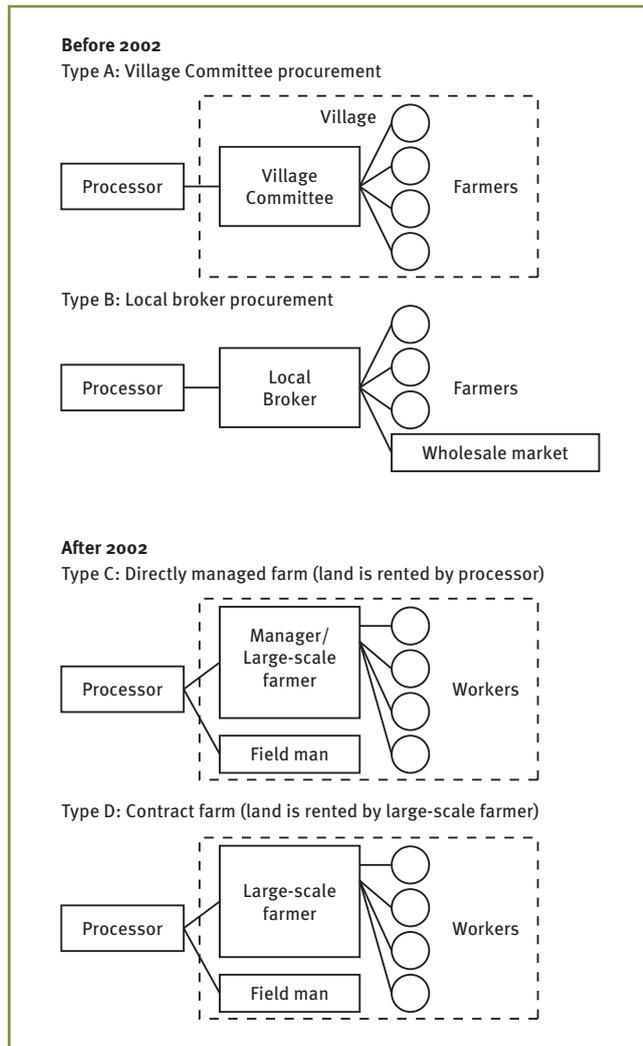
Some exporters, mostly with Japanese or Taiwanese investors, have long engaged in producing products aimed at the Japanese market. Because the requirements and specifications for Japanese customers are so precise, these firms cannot easily change their products and destination markets. As part of this study, various Chinese vegetable producing and processing firms were interviewed in 2012. One of them had Taiwanese investors. Another had investors from Taiwan Province of China, Japan and China. For these two firms, more than 90 per cent of their frozen vegetables are exported to Japan, and the remainder are exported to EU and ASEAN countries. The third firm interviewed – a large domestic group company with investors of various nationalities – shifted their focus to the domestic market by diversifying away from horticulture crops, although one key advantage that this firm possesses is its food safety control system that was transferred by the foreign investor.

3.4 Supply chain management by multinational corporations

The incidents in Japan in 2002 regarding residual pesticides in Chinese frozen vegetables dramatically changed supply chain management by Chinese exporters. After the incidents, the national General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ) directed the China Inspection and Quarantine Service (CIQ) at provincial and city levels to report countermeasure plans for food safety control. Among

banned substances; must manage proper pesticide use; ensure traceability; conduct sampling inspection of chemical residuals; must not purchase vegetables from places other than registered farms; and each registered farm should have a technical extension officer called a *Field Man*, and so on. This system is called the *Production Base*. The costs of ensuring food safety, including land rental fee and inspection fees, became a large burden for exporters.

Figure 3.9: Procurement systems for vegetables for export processors in Shandong before and after 2002



Source: Sakazume, Park and Sakashita (2006), partly supplemented by interviews with three export enterprises in Yantai, Shandong by author in June 2012

various proposals submitted by CIQs, the idea of constructing large-scale farms specialised for export suggested by the Shandong Yantai CIQ was adopted. AQSIQ Announcement on Inspection and Quarantine of Import and Export Vegetables was enforced in 2002 and specified that a vegetable export firm must have more than 20 hectares of farmland, which must be assembled into large plots with no prior contamination by

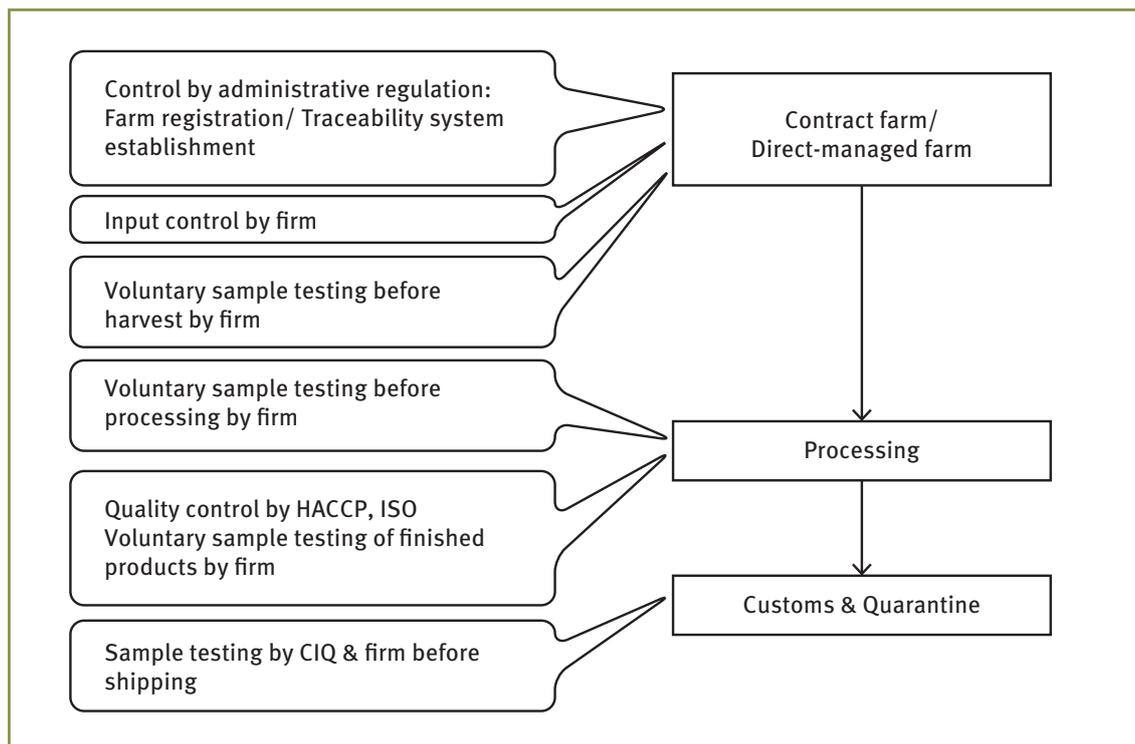
Before the 2002 incident, agribusinesses invested in the processing stage and introduced cold chain facilities. Some large-scale foreign-invested firms obtained global certifications for sanitation management in the processing process, such as Hazard Analysis and Critical Control Point (HACCP) and ISO (International Organization for Standardization), but less attention was paid to the safety of the production and procurement stages.

Figure 3.9 shows the change of procurement system for fresh vegetables for export processors in Shandong province before and after 2002, based on extensive interviews with several export enterprises by Sakazume, Park and Sakashita (2006), partly supplemented by fieldwork by the author in the same area. Before 2002, most agribusinesses procured fresh vegetables from village committees (Type A) or from rural free markets via brokers (Type B). Export processors collected the vegetables through loose production contracts with nearby villages in which farmers produced the vegetables. In this way, production quality control was left completely to farmers and traceability was very weak, though the processors provided basic technical assistance by sending officials to villages. At that time, another procurement method was Type B or local broker procurement from a rural free market. Traceability was not possible with this approach either. Even before 2002, some of the large agribusinesses had directly managed large-scale farms, though the aim of running such farms was mainly to stabilise the quality and quantity of materials, not to avoid the problems associated with residual agricultural chemicals.

After 2002, export materials were required to be produced on authorised plots of land, and export processors abandoned former procurement systems and constructed new systems as Type C and D show in the figure. According to the AQSIQ Announcement on Inspection and Quarantine of Import and Export Vegetables enforced in 2002, all export processors must now use vegetables from registered farmlands of appropriate size and with the right conditions. Because of this requirement, export processors either have to rent land from nearby villages by aggregating smaller plots or contract with large-scale farmers who have their own rented land.¹⁵ In Type C, a processor rents farmland and directly manages the production by providing a manager employed by the firm or a specialised large-scale farmer who is made responsible for daily management of production and quality control based on the firm production plan. The *Field Man* is a technical extension official who is responsible for technical assistance to the manager and workers (usually the

¹⁵ According to the Chinese Land Management Law, farmland is owned by *Rural Collectives*, or municipal villages, except for some land owned by government. Farmers only have the right to use land.

Figure 3.10: Inspection system for export vegetables



Source: Author, partly based on Mori (2009)

villagers). On the one hand, if the manager is provided by the firm, the quality control level tends to be better, so this kind of arrangement is usually adopted for leaf vegetables which require a higher management level. However, in this scheme, the enterprise takes all the risks with regard to production, and the costs for land rental and administration are large. On the other hand, if the farm is managed by an individual farmer, a part of the risk is shared with him by requiring deposits to be paid to the processor, to mitigate against the risk of poor production skills or detection of pesticide residues in the vegetable.

In Type D, production is contracted to individual farmers, and essential technical assistance is provided by the processor. Type D is used when the farmer can afford to rent large enough plots of land and trusts and has a good relationship with the village that the farmer is renting from. This method offers the loosest control over quality and is adopted only for vegetables with lower risk levels, such as root vegetables. In this type, the *Field Man* does not stay on the farm all the time but regularly checks production from each plot when needed.

In all types, most of the production materials such as seeds, pesticides and fertilisers are provided by the processing firm. Many of the former brokers who are now shut out from the export channel have become managers of the newly formed farms, since they are familiar with the required quality controls for vegetables for export and also have a trusting relationship with export firms.

Figure 3.10 shows the flow of a supply chain for vegetable exports and its supply management by the government and firms. All along the supply chain from the farm to the exporting port,

the vegetables are checked voluntarily three to four times by firms. Export processors usually check the vegetables in the PBs before harvest through random sampling. If excessive amounts of chemical residues are found, the processor would not harvest all the plot's vegetables, and would abandon the crop or, if possible, sell it to another market. Some processors check the harvested vegetables again before sending to the processing factory. Third, processed products will be checked before shipment. Finally, local CIQs check the products at the port. Some large export processors in Shandong have already established their own inspection centres for checking product safety. Some of these inspection centres are even authorised by the local CIQ and have the ability to test for all substances targeted by the importing countries to eliminate the risk of being rejected and shipped back after inspection in the destination country.

3.5 Conclusions and policy implications

China has the potential to expand vegetable exports to markets in developed countries, but only if it improves quality and meets importers' standards, although export to developing countries with less strict standards has already increased rapidly. The Chinese government started to deal seriously with food safety problems in both the domestic and global markets in the early 2000s. It aims to improve the quality and thus competitive edge of products to expand exports, which was originally motivated by pressures from importers of Chinese agricultural products. According to the "National plan for the development of vegetable production regions (2009–2015)" issued by the Ministry of Agriculture, five main vegetable production regions for the

domestic market and three regions for vegetable exports were identified and the government is said to support the development of these areas intensively.¹⁶ The plan aims to increase the export and processing rates of vegetables, and to raise the per capita incomes of local farmers by providing necessary support through infrastructure construction and technical extension.

The major hurdle for domestic food processors, most of them small in size, to participating in export activities to markets in developed countries is the large initial investment needed to create a vertically integrated system that enables firms to implement stricter supply chain management. Such vertically integrated systems include: the acquisition of large areas of farmland with suitable conditions and high rental fees; the construction of a processing system specialised for a target market; continuous monitoring of the rules and regulations of importing countries since these often change; and the costs associated with inspections. What is more, rapidly increasing domestic wages and shortage of labour are occurring in the coastal area, making Chinese products less competitive relative to products from other countries. Some domestic processors may feel that shifting their focus to the domestic vegetable market is more attractive.

The transportation infrastructure, especially a reliable cold chain linking production regions to ports, is also crucial for export products that need accurate temperature control. At present, cold chains for frozen vegetable exports in China are all provided by exporters because of the lack of domestic cold chain facilities. The National Develop and Reform Commission issued “Guidelines for the development plan for agro-food cold chain” in June 2010 and started to tackle the reform of domestic cold chains. According to the guidelines, the annual distribution of fresh agro-food products in China was about 400 million tons, while the ratio of distribution by cold chain in horticulture, meat and aquaculture reached 5 per cent, 15 per cent and 23 per cent, and the rate of those chilled reached 15 per cent, 30 per cent and 40 per cent respectively. The availability of cold storage chambers is still not sufficient and only 0.3 per cent of the container trucks are equipped with temperature control facilities. What is worse, the facilities are ageing and urgently need refurbishments.

Finally, domestic firms are limited in their ability to search for suitable customers. As the safety of Chinese food products became one of the most sensitive issues in the international market, an allergic reaction by some foreign consumers is frequently observed. To try to overcome this, most Chinese agro-food exporters targeting the Japanese market have one or two Japanese staff to improve communication with Japanese buyers who were very anxious about their consumers’ suspicions about the safety of imported food. Even though the Japanese market may be exceptionally sensitive and strict, if new domestic processors are starting to consider exporting frozen vegetables, technical support, not only for production and processing, but

also for marketing know-how, is essential. Some policy implications for better management of the quality and safety of export agro-food products in China follow.

◆ *Assistance with the development of large-scale producers and contract farming:* Currently, the development of large-scale farming and contract farming is limited in China, while small-scale family farming remains dominant. To improve the efficiency, quality and safety control of Chinese food, reductions in the number of channels and layers of distribution will be most effective. What is more, this will also bring about better traceability. As we have seen earlier, producers for the domestic and international markets are completely separate and detached from each other. There is only limited production for international markets by large-scale farmers who have contracts with exporting firms. In the domestic market, most family household farmers sell their products directly to local brokers. In the latter case, farmers are not well organised and extension services for farmers on production techniques and knowledge of correct usage of production materials including pesticides and other chemicals, are very limited. Some possible solutions to this problem follow.

◆ *Support for the development of leading firms:* As we have seen in this report, the development of agro-food exporting and processing firms led to the expansion of contract farming and this in turn led to improvement in quality control at the production stage in coastal areas. Empowering small- and medium-sized firms to enter the agro-food business would improve domestic food safety, though contracts between agro-food firms and farmers should be reasonable to protect the income of farmers. Essential technical and financial support should be provided to these new entrants to the international market. However, for some importing countries with specific, strict standards, only large-scale foreign-invested firms specialising in particular products for the targeted market survived after several food safety incidents and policy changes.

◆ *Land market development:* When a firm starts contract farming for export, the most critical problem is how to acquire a large, contiguous piece land that is free of contaminants. Currently, farmland rental market development is not very common in China. Farmers usually lease or rent land use rights at very low prices to other farmers. In most cases, land transactions occur among relatives. Sometimes they usually let the renter cultivate their land for free, although national land policy allows farmers to trade land use rights at a reasonable price based on the market. The reason why landowners are not willing to rent their land use rights to others when agriculture is less profitable than other jobs is that they regard their land use rights as an important insurance and they tend to lend them to those within their personal network, or a reliable person such as a relative. This phenomenon is partly because of the lack of an adequate formal social security system for rural residents, including financial and insurance services. As a result, most large-scale land aggregations are implemented by villages (collectives) that have legal ownership of rural land, and then these aggregated pieces of land would be rented to firms.

16 The three export regions are: 114 cities and counties located in the southeast coastal area including Shandong, Fujian, Zhejiang, Guangdong, Jiangsu, Liaoning, Hebei, Tianjin, Shanghai and Guangxi provinces; 31 cities and counties in the northwest inner regions including Xinjiang, Gansu, Ningxia, Inner Mongolia, Shanxi and Shanxi provinces; 16 cities and counties in the northeast area including Jilin, Heilongjiang and Inner Mongolia.

An intermediate platform to provide information on rent and lending is required for the development of a land rental market, and implementation of a social security system for rural residents is also an emergent and urgent task so that they easily can sell their land use rights.¹⁷

◆ *Technical assistance and information services for farmers:* Current provision of formal agricultural technical extension services in China is very weak.¹⁸ Most farmers are not able to receive such services even for very basic training on how to properly use pesticides or chemical fertilisers. Furthermore, they seldom have the chance to acquire information on the latest variety of profitable crops or how to grow them. The only time farmers come across such information is when they participate in contract farming with large processing firms. In that case, technical extension specialists are typically sent to farmers to teach them and monitor their production processes. The capability of private technical extension services (farmers' cooperatives, for example) still remains weak, and government support is required to both empower public extension services and develop private sector service providers.

◆ *Financial support for large-scale farming:* Large-scale farming for international markets is a rather risky business in China at present because of the unstable price of agricultural products, weather variability, high land rental prices and frequent changes of import countries' standards. Large-scale producers should be supported with rural finance services like long-term or low-interest loans.

◆ *Investment in cold chain facilities:* Investment in cold chain facilities is necessary for further export development because currently export firms have to invest in these themselves, increasing production costs. To maintain product quality and prevent port rejections because of bacterial and microbial issues, construction of an infrastructure for proper temperature control throughout the supply chain is crucial and urgently needed.

◆ *Strict control of pesticides and other production input materials:* While basic regulations on materials such as pesticides and fertilisers exist, the distribution channels for these materials are complex in China and completely uncontrolled in most parts of China. Farmers usually buy their production materials from nearby shops or unspecified brokers, some of may sell illegal, poisonous or inferior quality materials. Some farmers are even willing to buy banned pesticides for immediate results so that they can sell their products at higher prices by improving their appearance. Official strict control on these materials with credible enforcement, as well as punishment for violators, is required.

17 The need to reform and establish a national social security system in China has been identified as a major issue for a long time (see for instance, World Bank, 1997). This issue is made more urgent by a rapidly ageing population. If the current fertility rate continues, the Chinese population is expected to peak in 2026 and start to decline thereafter. While other countries – mainly advanced countries – are facing problems associated with an ageing population, the problem facing China is more severe since she will be faced with this problem at a relatively low income level (*The Economist*, 2012). For the current discussion on pension reforms in China, see World Bank and DRC (2012).

18 For a review of this, please see Gao and Zhang (2008). Hu *et al.* (2009) find that separating commercial activities and extension services from the provider greatly improves the actual delivery of extension services to farmers. In addition, more inclusive agriculture extension services are found to be more effective in China (Hu *et al.*, 2012).