

# Response of local producers to agro-food port rejection : the case of Chinese vegetable exports

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Nanae YAMADA\* and Shuyan SUI\*\*

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**JEL classification:** F23, L66, Q13, Q17, Q18

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# **Response of Local Producers to Agro-food Port Rejection: The Case of Chinese Vegetable Exports<sup>1</sup>**

Nanae YAMADA<sup>2</sup> and Shuyan SUI<sup>3</sup>

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This paper analyzes the factors associated with the rejection of products at ports of importer countries and remedial actions taken by producers in China by taking as an example one of the most competitive agro-food products of China: frozen vegetables. This paper provides an overview of the vegetable production and distribution system in China and the way in which China has been participating in exports of these products. Later sections will examine in detail the frozen vegetable sector in China, identify the causes of port rejections, and the actions taken by the Chinese government and by producers, processors and exporters to improve the quality of frozen vegetable exports.

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## **Introduction: An Overview of Chinese Agro-food Trade**

After the opening-up and reform policy in the late 1970s, a new economic regime called Household Production Responsibility System spread throughout rural China in the early 1980s, under which the rights to use farmland were distributed to individual farmers while the property rights of farmland were given to each village.<sup>4</sup> This new system, which led to the appearance of numerous small-scale

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<sup>1</sup> The research conducted for this paper is a part of the IDE-UNIDO joint research on trade compliance in Asia.

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<sup>4</sup> See for instance, Hu, W. (1997) and Krusekopf (2002) on the details of land rights reform and Wang, Hui et al. (2011) for some of the problems associated with land use rights.

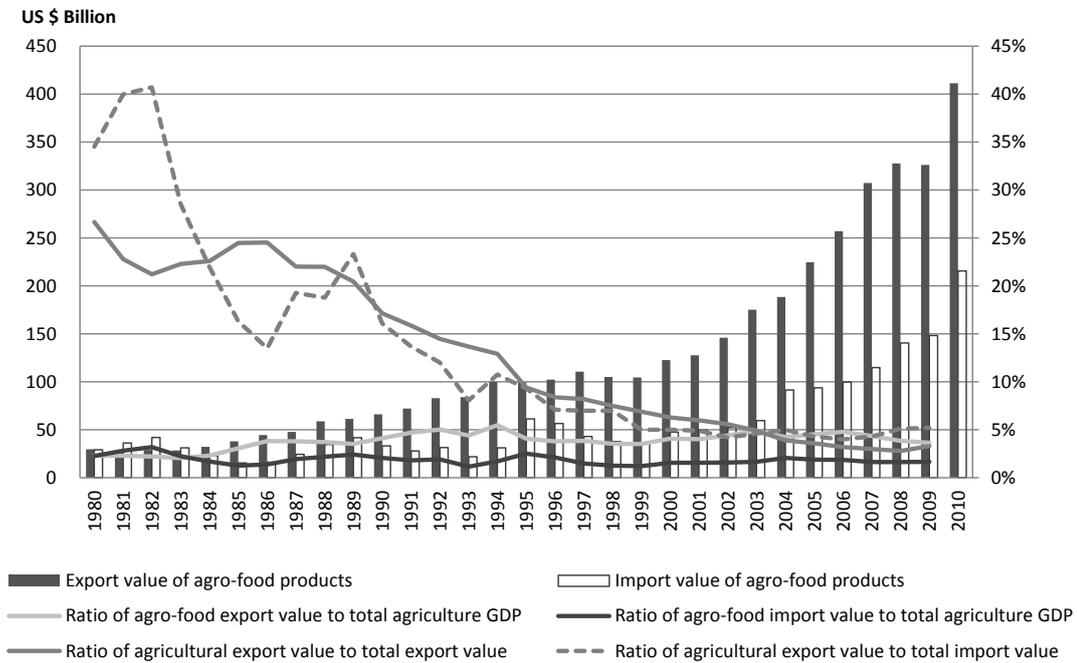
household farms, stimulated farmers' willingness for production which had long been suppressed under the collective farming system. By the mid-1990s China had almost achieved food self-sufficiency, enabling the country, which has a huge population to feed, to aggressively open its doors to the global agricultural market.

The institutional reforms to liberalize international agro-food trade in the late 1980s led to a rush of foreign investment in the agricultural processing sector, although the trade was only allowed for authorized trading companies. Japan, one of the largest agro-food importers in the world, was one of the pioneering investors in coastal China, followed by South Korea, Taiwan, and Singapore. Japan invested early in Shandong province, the largest agricultural production region in north China, then 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 specialized for importers' markets by providing them with a complete package of production materials including seeds, pesticides and technical assistance, or the so-called Development and Import Strategy.

In combination with this development of the food processing industry led by foreign-financed agribusinesses, a series of drastic rural institutional reforms including liberalization of the distribution of agricultural products in the 1990s encouraged further development of the agribusiness. Since the late 1990s, one of the main strategies of Chinese agricultural policy has been to develop the agribusiness and food processing industries to add value to agricultural products by utilizing the strength of abundant cheap labor to ameliorate the disparity in domestic incomes between agriculture and other industries. The Chinese government promoted the development of agribusiness and a vertically integrated agricultural system by providing lead firms and Farmers' Professional Associations (FPA) which are described later with tax incentives and subsidies. This policy is specified in the Agricultural Industrialization Policy, the main purpose of which is to create leading agribusinesses which in turn lead large-scale farmers or local FPAs and their member farmers. This policy has contributed to the development of agribusiness since the late 1990s.

The value of Chinese agro-food exports grew rapidly after the late 1990s, and China's accession to the WTO in 2001 accelerated this growth. **Figure 1** indicates the trend of Chinese agro-food exports and imports by value during the thirty years from 1980 to 2010. The value in 2000 was US\$12 billion, more than four times that in 1980, which was about US\$3 billion in nominal terms. Accession to the WTO in 2001 accelerated the growth, with the total value of exports in 2011 exceeding US\$40 billion, 3.6 times that in 2000. During this time, the ratio of agro-food exports in total agricultural GDP remained stable at around 3 to 5%. The share of agro-food exports in total national exports by value decreased dramatically from 26.7% to 3.3% in the same period as the manufacturing export industries grew.

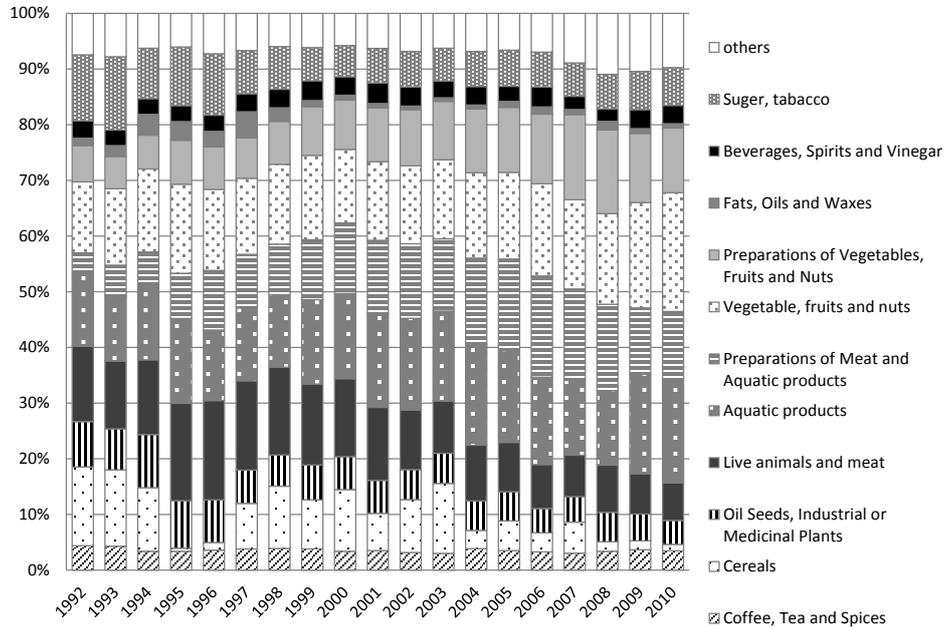
**Figure 1: Trend in Chinese agro-food trade (1980–2010)**



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

**Figure 2** shows the trends in the composition of agro-food export values from 1992 to 2010. The figure shows that the share of raw materials decreased during this period, while that of various processed products grew rapidly. In 1992, raw agricultural products including coffee, tea and spices, cereals, oil seeds, industrial or medicinal plants, live animals and meat accounted for 40.2% of exports, a figure that dropped to 15.7% in 2010. In contrast, the share of various processed meat, vegetable and aquatic products increased. For instance, the sum of fresh vegetables and preparations of vegetables and fruits grew from 19.3% in 1992 to 33.0% in 2010. Within vegetables and fruit exports, preparations accounted for 33.9% of the value in 1992, peaked at 48.9% in 2007, and then decreased to 35.3%. The share of fish and other aquatic products remained stable during this period at 12% to 16% of total export value. Preparations of meat and aquatic products accounted for 3.6% in 1992, reached 10% in the late 1990s, peaked at 18.2% in 2006 and then started to decline to 11–12% in the late 2000s. This decline is partly because of the adoption of the positive list system for residual agricultural chemicals in foods by the Japanese government in 2006, which is described in detail later.

**Figure 2: The composition of agro-food exports (1992–2010)**



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

As Chinese agriculture deepened its links with the global market and became a major exporter in the global agro-food market, a number of issues regarding food safety occurred, with a succession of serious incidents regarding the safety of Chinese agro-food products in the 2000s.<sup>5</sup> Under international pressure, 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.

<sup>5</sup> Major safety incidents concerning Chinese food products that captured global attention included: excessive levels of the residual pesticide Chlorpyrifos were detected in Chinese-made frozen spinach in Japan in 2002 and the Japanese Ministry of Health, Labour and Welfare (MHLW) temporarily banned the import of vegetables from China; Malachite green, which is believed to be carcinogenic, was discovered in imported Chinese eels in Korea and Japan; imported Chinese-made frozen dumplings were found to contain toxic substances in Japan in 2008; the so-called milk scandal, in which milk and infant formula were found to be adulterated with melamine, which causes serious kidney problems, reportedly affecting 300,000 victims in 2008; in 2012 Chinese gelatin capsules were found to contain excessive amounts of chrome and the Ministry of Public Security of China confiscated more than 77 million capsules from factories and drugstores, nine were arrested and 45 people were detained in connection with the incident; gutter oil, which is an illegal cooking oil refined from sewage and leftover or used oil from restaurants, reportedly accounted for about 10% of all cooking oil in the domestic market in 2010. Although some of these incidents affected only the domestic market, the outrageousness of the incidents, the sheer scale of damage, and the pervasiveness of such problems have significantly damaged the safety reputation of Chinese agro-food products in international markets.

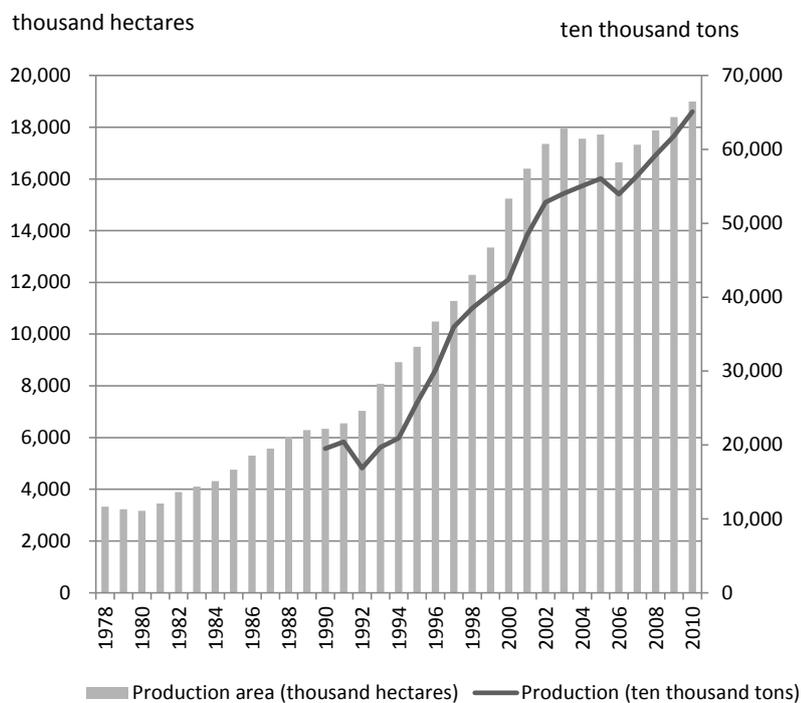
In this paper, we will analyze a typical Chinese export product, frozen vegetables, that experienced serious food safety problems in the 2000s in the international market. This paper aims to clarify the basic characteristics of the production, distribution and export of frozen vegetables, how exporting firms manage supply chains to control and ensure quality, the potential export capacities, and policy actions required.

### Production and Distribution of Vegetables in China

#### *Domestic Production of Vegetables*

Since the introduction of a market economy, the production area and the output of vegetables in China have steadily increased (see **Figure 3**). The total area of vegetable cultivation was 3,330 thousand hectares in 1978. Within 12 years, this area doubled and the rate of increase accelerated in the 1990s, reaching 19 million hectares in 2010, nearly six times that in 1978. The production volume has also increased rapidly, reaching 651 million tons in 2010, 3.8 times that in 1978 (195 million tons).

**Figure 3: Trend of vegetable production in China (1990–2010)**



Source: Ministry of Agriculture (China), various years

Among vegetables, leaf vegetables are the most widely produced variety, accounting for 35.1% of cultivation area and 36.0% of output. This is followed by solanaceous crops (which include tomatoes and aubergines) with 14.7% of total production area and 16.1% of total production. The third variety is root vegetables, which accounted for 14.1% and 14.1%, followed by cucumbers and gherkins with 11.5% of area and 12.9% of output.

The top five production areas in 2009 were the provinces of Shandong, Henan, Guangdong, Sichuan, and Hebei, which accounted for 9.5%, 9.1%, 6.2%, 6.2%, and 6.1% of total vegetable production area, respectively. The main production areas are mostly located in coastal areas where the soils are more fertile and which have better access to international markets.

#### *Vegetable Distribution System for the Domestic and Global Markets*

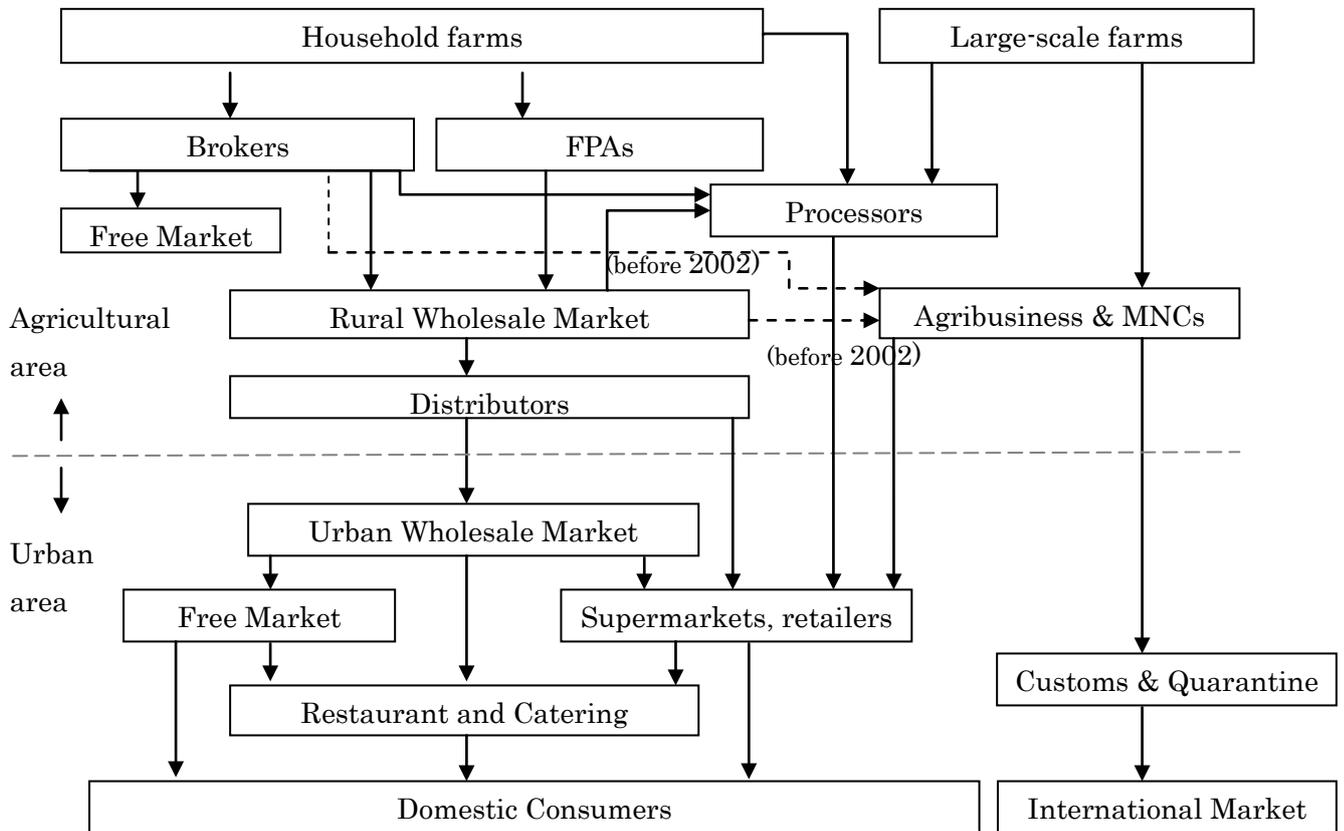
After the introduction of the market economy, the distribution system for agricultural products was progressively liberalized, beginning with the main subsidiary agricultural products such as horticultural crops, meat and eggs in the late 1970s to early 1980s. Government controls on the distribution of grains such as rice and wheat remained until they were abolished as late as 2004. Beginning in the 1980s, rural free markets, which had long been closed during the planned economy period, were liberalized, while free markets for agro-food products were newly established in urban areas. At that time the free markets mainly dealt with products for local consumption within a fairly limited area. As the demand of urban consumers for agro-food commodities diversified, more extensive distribution networks to connect producing areas with consuming areas were required.

The Shopping Basket Program started by the Ministry of Agriculture in 1988 promoted the establishment of agricultural wholesale markets, which are divided into comprehensive wholesale markets and special wholesale markets. The latter were developed mainly in producing areas and played an important role in distributing crops and other agricultural products to urban areas. Since this policy was started, such wholesale markets have become the major channel for subsidiary crops. According to the Ministry of Agriculture (2010), more than 70% of vegetables, fruits and aquaculture products are distributed through wholesale markets.

As for the size of special wholesale markets, small-scale markets are still dominant. At the end of 2008, the number of special wholesale markets with sales of more than one hundred million RMB reached 921, with total annual sales of 7,939 hundred million RMB, 1.4 times and 2.6 times larger than in 2004 respectively, though these large-scale special wholesale markets accounted for only 20.2% of the total agricultural wholesale market by number. The breakdown of these wholesale markets by product specialty is as follows: cereal markets 10.7%, livestock markets 12.1%, aquaculture markets 14.3%, vegetable markets 30.4%, and dried fruits and nuts markets 13.9%. Although such large-scale special wholesale markets have grown, the number of small-scale local free markets remains large, with more than 250,000 at the end of 2008, though the number is

declining slightly.

**Figure 4: Vegetable distribution system for domestic/global market in China**



Source: created by author

The distribution system of vegetables in China since the 1980s is shown in **Figure 4**. Agricultural products for international markets (on the right of the figure), especially those for developed countries which require higher quality standards, are basically separated from those for the domestic market (on the left) in the processes of production, processing and distribution. It should be emphasized that most Chinese vegetables and vegetable products are consumed by domestic consumers, and consumption is increasing in line with income growth, while only a small percentage of production is exported, though the amount is sizeable viewed from the perspective of other countries. The major players and their functions in the Chinese vegetable distribution system regarding products for domestic and international markets are described separately below.

*Products for the domestic market*

The main vegetable producers for the domestic market can be divided into two types. The first type is the small-scale farmers. According to the second Chinese agricultural census in 2006, the

average cultivated land area per household is only 0.55 hectare. The second type of producer is the large-scale farmers, although their number is still small. This is because the development of contract farming is still limited, partly because the food processing industry and farmland rental market remain underdeveloped. Only 10.8% of a household's farmland is rented from the land market on average and only 12.2% of farmers participate in the farmland rental market.

Most farming households sell their vegetables to brokers who visit villages during the harvest season to purchase their products. Some of the brokers are local farmers who entered into the distribution business. The brokers then sell the vegetables to wholesale markets and processors. A proportion of the vegetables is sold to the local free market or at fairs for local consumption. Some of the farmers are members of FPAs, and sell their products to them, though the share of vegetables sold through FPAs is now rather small. Chinese farmers are not well organized and have little bargaining power against the brokers who are armed with better market information. To protect farmers' welfare from such brokers, the government has encouraged farmers to establish FPAs, a kind of farmers' organization for cooperative production and marketing, which were finally formalized by the Farmers Professional Association Law in 2008. Some of the FPAs sell their products to agribusiness on a contract basis for the domestic market. Although FPAs covered about 40% of farmers by 2010, the capabilities of FPAs remain weak. Many of them do not have the capability to strictly control and manage the production processes and quality, which are essential skills needed for contract farming for export.

According to the Ministry of Agriculture (2010), rural wholesale markets handle vegetables from 60% of the total vegetable production area. About 80% of rural wholesale markets are located in the east and central areas of China. They serve as hubs for horticultural products, from where 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 for Vegetables based on the Law of the PRC on the Quality and Safety of Agricultural Products, local officials can carry out compulsory pesticide residue inspections 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 under contract, from their own farms or from rural wholesale markets (only for the domestic market). The domestic market for processed vegetables is still underdeveloped because relatively few agribusinesses have 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 except for the younger generation with high enough incomes living in large cities such as Beijing and Shanghai.

Since the early 1990s, supermarkets have spread throughout large cities in China and sales of horticultural products by supermarkets already exceed exports, though traditional venues remain important (Wang, Honglin et al. 2009). The Chinese government has promoted the conversion of traditional wet markets to supermarkets and the development of direct trade between farms or FPAs and supermarkets in order to streamline the current multi-layer distribution system in China and thus improve efficiency and control safety along the supply chain.

#### *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 in Japan imported from China was found to contain excessive amounts of residual agricultural chemicals. After the incident, export firms were required to use materials from registered producers according to 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 registered large-scale farms satisfying certain conditions; these farms are called Production Bases (PB), and will be described later in this paper. 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 the ability to form PBs were shut out from lucrative export markets completely.

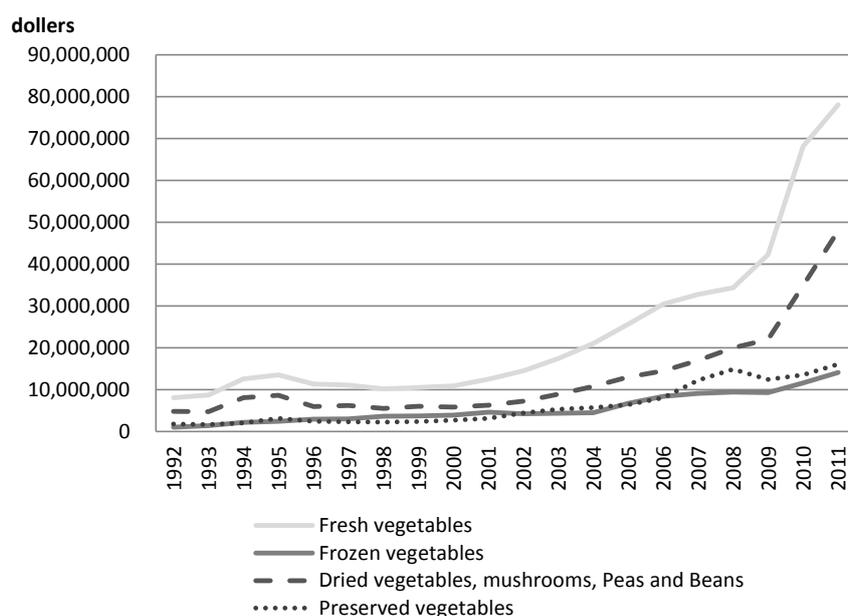
As for the agribusiness firms, only those firms that have import and export licenses are allowed to conclude contracts with foreign traders, though the application process has become much easier than before. With respect to frozen vegetables and highly processed preparations of vegetables, export agribusinesses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

In 2003, there were more than 13,000 food processing firms engaging in some export activities. Of these, 836 enterprises had annual exports of more than US\$5 million, and 60% of them are vertically integrated from production and processing to export. One of the largest exporters is A Groups in Shandong province, which originated from a so-called rural township enterprise (TVE) in the 1980s and has grown into a group of companies including dozens of domestic and foreign invested firms. One-sixth of all frozen spinach exports from China is made by them (Oshima 2007). In Shandong, foreign investment in the food processing sector is quite active, with most of the investment coming from Japan and Taiwan, and they specialize in exporting to the Japanese market. At present, exports of frozen vegetables are dominated by large-scale agribusinesses with PBs which can guarantee the amount, quality and safety of materials, which is the key advantage of such enterprises.

## Exports of Vegetable Products

The composition of vegetable products exported from China has undergone several changes since its beginning in the late 1980s. At first, 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 out with the vegetables that keep better such as garlic, ginger and root vegetables, then expanding to include a wider range of varieties later. As the main importer, Japan has increased its dependence on Chinese fresh and processed vegetables which are produced at lower prices. In the mid-1990s Japanese frozen food companies and trading companies invested in Shandong province<sup>6</sup> and other coastal areas and started to export vegetables to Japan in the manner of the Development and Import Strategy.

**Figure 5: Various Vegetable Products Exported from China (value)**



Source: UN-Comtrade<sup>7</sup>

<sup>6</sup> Shandong province attracted foreign direct investment in agriculture from Japan for three reasons. First, the similar climate in Shandong province enabled firms to bring vegetables grown in Japan without much modification. Second, Shandong province is located close to Japan and has two good ports, Yantai and Qingdao. Finally, farmers in Shandong province have traditionally grown vegetables and have good technical skills and productivity.

<sup>7</sup> In this paper, the category of “fresh vegetables” includes HS codes 0701, 0702, 0703, 0704, 0705, 0706, 0708, 0709, 0714, 0910, “frozen vegetables” includes HS codes 0710, 071490, 2004, *Dried vegetables, mushrooms, peas and beans* includes HS codes 0712.39-010, 0712, 0713, and *Preserved vegetables* includes HS codes 2001, 2002, 2003, when sourced by UN-Comtrade.

**Figure 5** shows the export trend of various vegetable products since 1992. Among these products, fresh vegetables have always been the major category and grew rapidly during the 2000s, with the speed of growth skyrocketing after 2009. Dried vegetables show a similar trend. Frozen vegetable exports saw slower growth than these two commodities, yet exceeded US\$1.4 billion in 2012, 14 times higher than 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, following the introduction of the positive list system in May 2006. The shares of each product in the total value of vegetable exports in 2011 were as follows: fresh vegetables accounted for about half, dried vegetables 31%, preserved vegetables 10%, and frozen vegetables 9%.

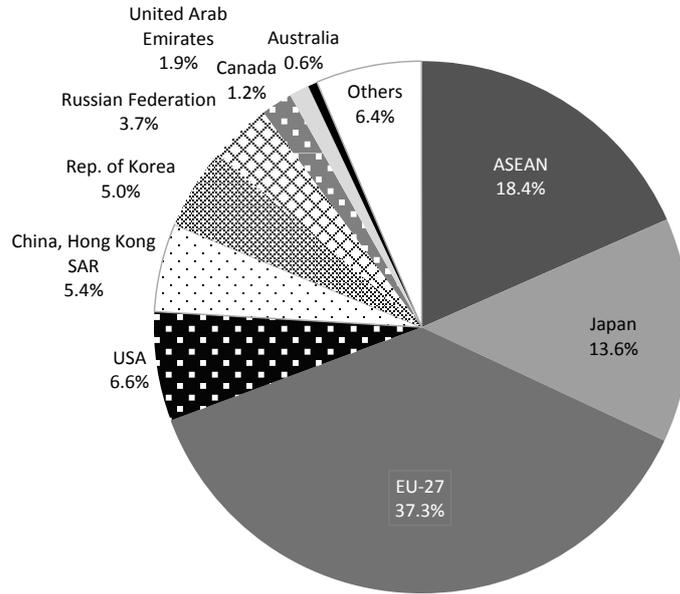
#### *The distribution of major import countries*

The major market for fresh vegetables is East Asia accounting for more than 40%, followed by the EU, US, Russia and Middle East (see **Figure 6**). Japan had been the largest importer of Chinese vegetables – both fresh and frozen – until 2008, although the value started decreasing after the positive list system was introduced in May 2006. Fresh vegetable exports (by value) to new importers – ASEAN countries especially Malaysia and Thailand – increased dramatically, as a result of gradual tariff reductions on agricultural products since 2005 under the ASEAN-CHINA FTA (ACFTA) scheme. Russia imports Chinese vegetables through border trade mainly from the three northeastern provinces (Agriculture and Livestock Industries Corporation (ALIC) 2011).

Similar to the case of fresh vegetables, Japan has been the largest importer of Chinese frozen vegetables, although Japan's share has declined from 71% in 2002 to 44.9% in 2011 (see **Figure 7**). The second largest importer in 2011 was the EU (16.4%), followed by Korea (13.1%), and the US (10.4%). The distribution of frozen vegetable exports is also diversified the same as fresh vegetables, especially to developing countries other than Japan where the standards are less strict, although Japan's power to purchase highly processed vegetables is higher than developing countries.

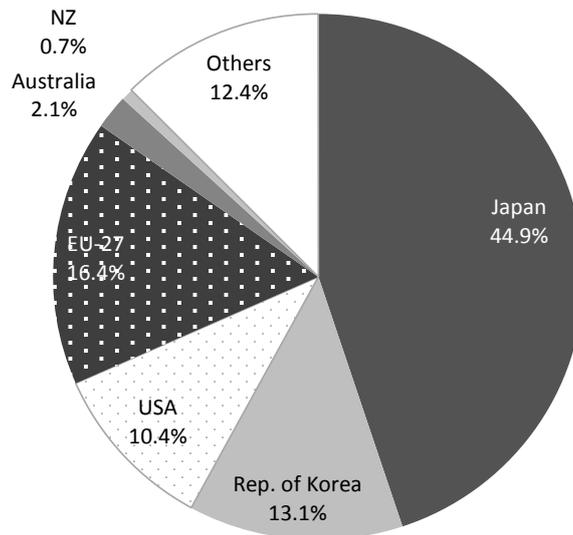
Since the incidents of detecting residual agricultural chemicals in Chinese-made vegetables in 2002, Japan has banned imports from China several times and has introduced stricter standards on imported products. In response, Chinese exporters have diversified into other export markets to reduce the risk, some of them shifting to markets in developing countries or even focusing solely on the domestic market, where quality standards are less strict compared to those for export products, although Chinese residents are demanding safer and higher-quality food as they become more prosperous. This tendency has continued since the positive list system was introduced in 2006.

**Figure 6: Distribution of importers of Chinese fresh vegetables in 2011 (by value)**



Source: UN-Comtrade

**Figure 7: Distribution of importers of Chinese frozen vegetables in 2011 (by value)**



Source: UN-Comtrade

Japan adopted the positive list system for residual agricultural chemicals in 2006. This system sets maximum residue limits (MRL) for 799 agricultural chemicals for thousands of

commodities, and imported foods must not exceed the MRL<sup>8</sup>. If imported food is found to contain a chemical which is not on the list, it must not exceed the limit of 0.01 ppm. This new policy requires exporters to comply with the strictest quality control in the world and poses a new challenge for Chinese exporters. Only the exporters who had engaged in producing frozen vegetables for export to Japan for years survived. These surviving firms either had good connections with Japanese customers or were invested in by Japanese firms. In most cases, these firms were invested in by Japanese frozen food producing companies and trading companies, and they could prepare for the new standard in advance by collecting the latest information and could receive technical assistance from Japan.

After the adoption of the positive list system in Japan in 2006, the China Inspection and Quarantine Services (CIQs) required exporters to double-check export commodities by CIQ and by private inspection centers before shipping. Some processors without any self-inspection facilities must request the inspection centers of other processing firms or private inspection companies specialized in inspecting export products. The cost of safety inspections has been rising as the number of items to be checked has increased and the variety of standards has diversified. These cumbersome procedures and high costs have caused some firms to shift to export markets with less strict standards.

Some exporters, mostly invested in by Japanese or Taiwanese firms, have long engaged in producing products for the Japanese market. Because the requirements and specifications of Japanese customers are so specific, these firms cannot easily change their products and destination markets. One of the firms interviewed in 2012 was invested in by Taiwan, and another was invested in by Taiwan, Japan and China. For these two firms, more than 90% of their frozen vegetables are exported to Japan, and the rest of them are exported to EU and ASEAN countries. The third firm interviewed – a large domestic group company with investors from various countries – shifted its focus to the domestic market by diversifying away from horticulture crops, although one key advantage of this firm is its food safety control system, which was transferred by the foreign investors.

### **Supply chain management by MNCs**

Incidents regarding residual pesticides from Chinese frozen vegetables in 2002 in Japan dramatically changed the supply chain management by exporting firms in China. Chinese frozen spinach imported by Japan was found to contain residues of the pesticide chlorpyrifos in late 2001

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<sup>8</sup> For a more detailed explanation of the policy, see the website of the Japanese Ministry of Health, Labour and Welfare. <http://www.mhlw.go.jp/english/topics/foodsafety/positivelist060228/index.html>

and 2002. In August 2002, the Japanese government issued an advisory to halt imports of Chinese frozen spinach, but this stopped all imports of frozen vegetables from China to Japan. In February 2003, the Japanese market was reopened to imports of frozen vegetables from China, though it was closed again because new tests revealed continued problems with the same pesticides (Calvin et al. 2006). This incident made food safety one of the top priorities between China and Japan. After the incident, the national General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ) ordered the Commodity Inspection Quarantine Bureaus (CIQ) at the provincial and city levels to report on plans for countermeasures to tackle food safety problems. Among the various proposals submitted by CIQs, the idea of constructing large-scale farms specialized for export suggested by the Shandong Yantai CIQ was adopted. The AQSIQ Announcement on Inspection and Quarantine of Import and Export Vegetables was enforced in 2002 which specified that a vegetable export firm must have more than 20 hectares of farmland which is assembled into large plots with no prior contamination by banned substances; manage proper pesticide use; ensure traceability; and conduct sampling inspections of chemical residues. In addition, export firms are not allowed to purchase vegetables from places other than registered farms, and each registered farm (PB) should have a technical extension officer called a *Field man* and so on.<sup>9</sup> The costs of ensuring food safety including land rents and inspection fees are a large burden for exporters.

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

**Figure 8** shows the change of procurement system for material vegetables for export processors in Shandong province before and after 2002 based on extensive interviews with several export enterprises by Sui (2005), partly supplemented by fieldwork by the author in the same area. Before 2002, most of the agribusiness procured material vegetables from village committees (Type A) or from rural wholesale markets via brokers (Type B). Export processors collected material vegetables through loose production contracts with nearby villages whose farmers produce material vegetables. In this method, quality control in the production process was completely left to village leaders and farmers and traceability was very weak, though the processors provided basic technical assistance by dispatching officials to villages.

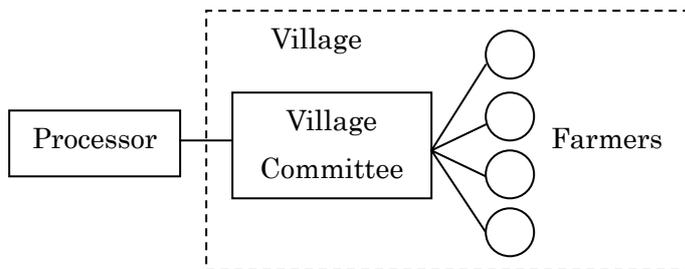
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<sup>9</sup> Based on the national standard decided by Announcement on Inspection and Quarantine of Import and Export Vegetables, local CIQs set original standards for the farm size for each agricultural commodity at its discretion based on the land endowments, development level of the processing industry and the variety of products in each region. For example, Yantai city's CIQ in Shandong province classifies vegetables into three categories by the level of residual pesticide risk and management level (Mori 2009). The highest is leaf vegetables, the second is solanaceous crops, while root vegetables have the lowest risk of residual pesticides (Sakazume, Park and Sakashita 2006).

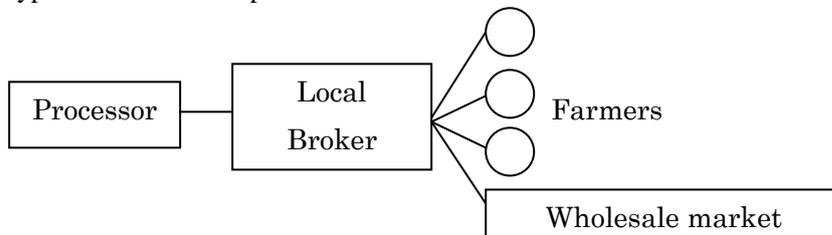
**Figure 8: Systems for procuring material vegetables for export processors in Shandong before and after 2002**

<Before 2002>

Type A: Village Committee procurement

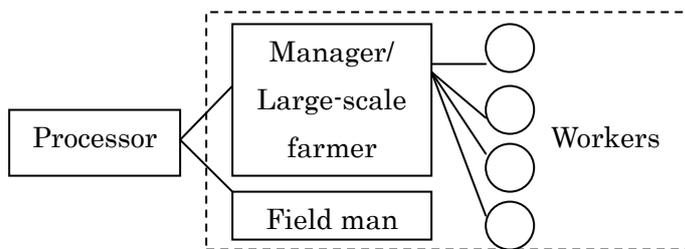


Type B: Local broker procurement

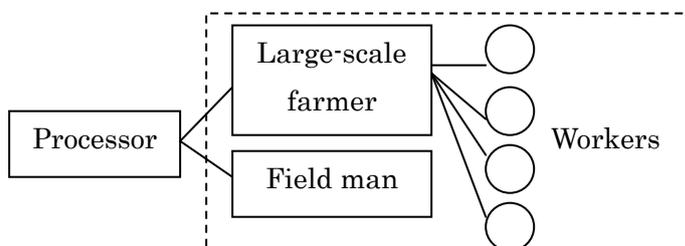


<After 2002>

Type C: Direct-managed farm (the land is rented by processor)



Type D: Contract farm (the land is rented by large-scale farmer)



Source: Sui (2005), partly supplemented by interviews with three export enterprises in Yantai, Shandong by the author in June 2012.

Note: The broken lines in the figure refer the scope of land concerned in each type.

At that time, another type of procurement was Type B or local broker procurement from the rural wholesale market or small-scale farmers. Traceability was impossible with this type, too. Even before 2002, some of the large agribusinesses had directly-managed large-scale farms, though the objectives of holding such farms were mainly to stabilize the quality and quantity of materials, not to avoid the problems associated with residual agricultural chemicals.

Since 2002, materials for export are required to be produced in authorized plots of land; export processors abandoned former procurement systems and constructed new systems, shown as Type C and D in the figure. According to AQSIQ Announcement on Inspection and Quarantine of Import and Export Vegetables enforced in 2002, all export processors must use materials from registered farms of appropriate size and conditions. This requirement has forced export processors either to rent land plots from nearby villages by aggregating smaller plots or contract with large-scale farmers who have their own rented land.<sup>10</sup>

In Type C, a processor rents farmland and directly manages the production by dispatching a manager who is hired by the firm or a specialized large-scale farmer and makes that person responsible for daily management of production and quality control based on the firm's production plan. The Field man is a technical extension official who is responsible for giving technical assistance to the manager and workers (usually the villagers). Quality control tends to be better when the manager is dispatched from the firm rather than by any other method, so this arrangement is usually adopted for leaf vegetables which require stricter management. 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, part of the risk is shared with him by requiring deposits to be paid to the processor, to mitigate the risk of poor production skill or detection of residual pesticides in the vegetables.

In Type D, production is contracted to individual farmers, and necessary technical assistance is provided by the processor. Type D is used when the farmer can afford to rent large enough plots of land and has good connections or trust with the village from which the farmer is renting. However, this method has the loosest control over quality and is used only for vegetables that have lower risk levels such as root vegetables. In this type, the Field man does not stay at the farm all the time and is regularly sent to each plot to check the production only when needed.

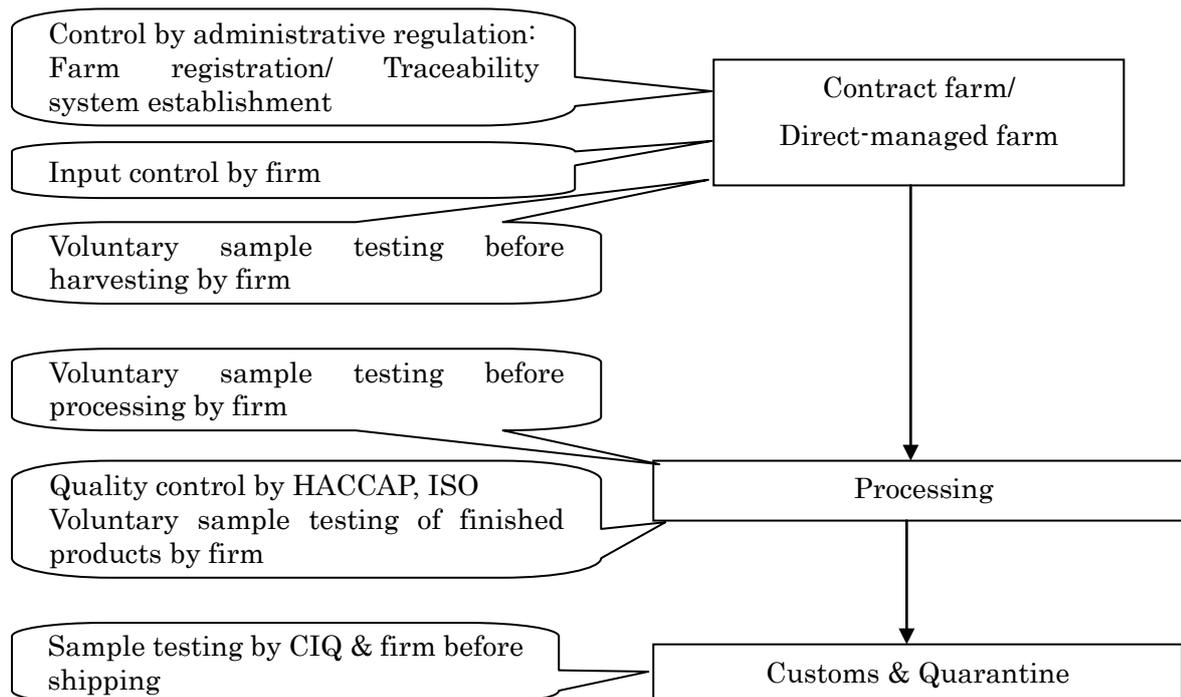
In all the types, most of the production materials such as seeds, pesticides and fertilizers are provided by the processing firm. Many of the former brokers who became shut out from export channels have become managers of the newly founded farms, since they are familiar with the required quality control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

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<sup>10</sup> According to the Chinese Land Management Law, farmland is owned by "rural collectives", or municipal villages and village groups, except for some land owned by the government. Farmers only have the right to use the land.

**Figure 9** shows the flow of the supply chain for vegetable exports and its supply chain management by the government and firms. Along the supply chain from the farm to the exporting port, the materials are voluntarily checked three to four times by firms. Export processors usually check by random sampling the material vegetables in the PBs before harvesting. If excessive amounts of residual chemicals are found, they do not harvest all the vegetables of the plot and abandon them, or if possible, sell them to another market. Some of the processors check the harvested materials again before they enter the processing factory. Third, processed products are checked before shipment. Finally, the local CIQ checks the final products at the port. Some large export processors in Shandong have already established their own inspection centers for checking the safety of products. Some of these inspection centers are even authorized by the local CIQ and are able to test for all the substances controlled by the importing countries, to avoid the risk of rejection and shipping back after inspection in the destination country.

**Figure 9: Inspection system for export vegetables**



Source: author, partly based on Mori 2009.

*Potential export capacities and the hurdles for new entrants*

To expand vegetable exports to the markets of developed countries, China must succeed in improving quality and meeting importers' standards, although exports to developing countries with less strict standards have already increased dramatically. The Chinese government started to deal seriously with food safety problems of both the domestic and global markets in the early 2000s. It

aims to improve the quality of competitive items to expand exports, motivated by the pressure from importers of Chinese agricultural products. According to the National Plan for the Development of Vegetable Production Regions (2009–2015) of 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 intensively supporting the development of these areas. 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, Shaanxi and Shanxi provinces; and 16 cities and counties in the northeast area including Jilin, Heilongjiang and Inner Mongolia. The plan aims to increase the exports and processing rate of vegetables, and to raise 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 which are small, to participate in exports to markets in developed countries is the large initial investment needed to create a vertically integrated system which would enable them to implement stricter supply chain management. Such vertically integrated system includes: the acquisition of large-scale farmland with suitable conditions with high rents; the construction of a processing system specializing in a targeted market; continuous monitoring of the rules and regulations of importing countries which tend to change rather frequently; and the costs associated with inspections. Furthermore, rapid increases in domestic wages and shortages of labor are occurring in coastal areas, making Chinese products less competitive than those from other countries. Some domestic processors may find that focusing on the domestic vegetable market is more attractive.

The transportation infrastructure, especially reliable cold chains linking production regions to ports, is also crucial for export products that need delicate temperature control. At present, all cold chains for frozen vegetable exports in China are provided by exporters themselves because of the lack of domestic cold chain facilities. The National Development and Reform Commission enforced the Guidelines for the Development Plan for Agro-food Cold Chains 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 distributed by cold chains in horticulture, meat and aquaculture products reached 5%, 15% and 23%, and that by chilled chains reached 15%, 30% and 40%, respectively. There are still not enough cold storage chambers and only 0.3% of container trucks are equipped with temperature control facilities. What is worse, facilities have become old and need refurbishing urgently.

The last is the limited searching capability of domestic firms to find suitable customers. The safety of Chinese food products has become one of the most sensitive issues in the international market, and some foreign consumers have tended to shy away from them. To counter this, most

Chinese agro-food exporters targeting the Japanese market have one or two Japanese staff to communicate effectively with Japanese buyers who are very sensitive to Japanese consumers' suspicions on the safety of imported food. Even though the Japanese market may be exceptionally sensitive and strict, if new domestic processors are considering starting to export frozen vegetables, technical support is essential not only for production and processing, but also for marketing know-how.

### **Policy Implications**

Some policy implications for better management of the quality and safety of export agro-food products in China are as follows.

- Assistance for the development of large-scale producers and contract farming

Currently, the development of large-scale farming and contract farming is limited in China; small-scale family farming remains dominant. To improve the efficiency as well as the quality and safety control of Chinese food, the most effective way is to reduce the number of channels and distribution layers. This would also improve traceability. As we have seen in the early part of this paper, producers for the domestic market and those for the international market are completely separated from each other. Production for the international market is done only by large-scale farmers who have contracts with exporting firms. Meanwhile, for the domestic market, most family household farmers sell their products directly to local brokers. In the latter case, farmers are not well organized and extension services on production techniques and knowledge about correct usage of production materials including pesticides and other chemicals for farmers are very poor. Possible ways to solve this problem are as follows.

- Support for the development of leading firms

As we have seen in this paper, the development of agro-food exporting firms and processing firms led to the expansion of contract farming, and thus to improved quality control at the production stage in coastal areas. Empowering small and medium-sized firms to go into the agro-food business would improve domestic food safety, though contracts between the agro-food firms and farmers should be reasonable to protect the incomes of farmers. Necessary technical and financial support should be provided to help these new entrants enter the international market. Nevertheless, for some importing countries with specific, strict standards, only large-scale foreign-invested firms specializing in very specific products for the target 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 of uncontaminated land. Currently, the farmland rental market is not well developed in China. Farmers usually lease or rent the right to use land at very low prices to other farmers. Most land transactions are among relatives. Sometimes they let the renter cultivate their land for free, although the national land policy allows farmers to trade land use rights at reasonable prices based on the market. The reason why farmers are not willing to rent their land use right to others when agriculture is less profitable than other jobs is that they regard their land use right as an important insurance and so tend to lend the land to others within their personal network, or a trusted person such as a relative. This is partly because the formal social security system for rural residents, including financial infrastructure and insurance services, is insufficient. As a result, most large-scale land aggregations are implemented by villages (collectives) that have the legal ownership of rural land, and then these aggregated pieces of land are rented to firms. An intermediate platform to provide information on rents and lenders is required for the development of the land rental market, as well as the preparation of a social security system for rural residents to enable them to easily sell their land use rights.<sup>11</sup>

- Technical assistance and information services for farmers

Currently, the provision of formal agricultural technical extension services in China is very weak.<sup>12</sup> Most of the farmers do not have any opportunities to receive such services, even for very basic training on how to properly use pesticides or chemical fertilizers. Furthermore, they have few chances 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 and monitor their production processes. The capability of private technical extension services (FPAs, for example) remains weak, and government support to empower public extension services and development of the private sector are required.

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<sup>11</sup> The need to reform and establish the national social security system in China has long been identified as a major issue (see for instance, World Bank 1997). This issue is made more urgent by the rapid aging of the population. If the current fertility rate continues, China's population is expected to peak in 2026 and then decline thereafter. While other countries—mainly advanced countries—are facing problems associated with population aging, the problem facing China is more severe since it will arise while China is at a relatively low income level (“Demography: China's Achilles Heel 2012” *The Economist*, 21<sup>st</sup> August, 2012). For the current discussion on pension reforms in China, see World Bank and DRC (2012).

<sup>12</sup> For a review on this, see Gao and Zhang (2008). Hu, R. et al. (2009) showed 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, R. et al. 2012).

- Financial support for large-scale farming

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

- Investment in cold chain facilities

Investment in cold chain facilities is necessary to develop exports because currently export firms have to invest in these facilities by themselves, which increases the production cost. To keep the quality of final products and to prevent port rejections because of bacteria and microbes, there is an urgent need to construct infrastructure for proper temperature control throughout the supply chain.

- Strict control of the market for pesticides and other production inputs

Although there are basic regulations on materials such as pesticides and fertilizers, the distribution channels of these materials are complex in China, or completely uncontrolled in most parts. Farmers usually buy their production materials from nearby shops or unspecified brokers, some of whom happen to sell illegal, poisonous or inferior quality ones. Some farmers are even willing to buy banned pesticides that will give instant effects 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.

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