

The vegetable industry in China

Developments in policies, production, marketing and international trade

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The Vegetable industry in China; Developments in policies, production, marketing and international trade

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Development of Chinese vegetable industry over the past three decades. The changes of governmental vegetable policy and the major institutions involved. The major production regions in China, their leading vegetable varieties and cultivation technology. The reform of vegetable marketing structure and the domestic consumption. The development of Chinese vegetable trade and its international competitiveness. The main destinations for China's vegetable trade and its top export varieties. A case study of vegetable export in Anqiu city, Shandong province. Food safety and certification system.

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Contents

	Page
Preface	7
Executive Summary	9
1. Introduction	11
2. China's food safety policies with respect to vegetables	13
2.1 Introduction	13
2.2 Legal system with regard to vegetable safety	13
2.2.1 Legal institutional framework	13
2.2.2 Institutions involved in vegetable safety	15
2.2.3 Laws and regulations with respect to vegetable safety	17
2.3 Governmental programmes on vegetable safety	18
2.3.1 The vegetable basket project	18
2.3.2 The action plan for pollution-free agricultural products	20
2.3.3 Measures on the administration of pollution-free agricultural products	21
2.3.4 Green food development project	21
2.3.5 Organic food development programme	22
2.4 Governmental standardization programmes	23
3. The development of China's vegetable production	26
3.1 Area and output	26
3.2 Variety structure	27
3.3 Regional structure of vegetable production	27
3.4 Production mode	29
3.5 Cultivation technology	30
4. China's vegetable consumption	32
5. China's vegetable marketing	35
6. China's international vegetable trade	39
6.1 The general situation of China's vegetable import and export	39
6.2 Structure of China's vegetable trade	40
6.2.1 Variety structure	40
6.2.2 Regional structure	41
	5

	Page
7. International competitiveness of China's vegetable industry	45
7.1 Introduction	45
7.2 International market share of China's vegetables	45
7.3 Comparison of domestic and international prices	45
7.4 Comparison of production costs	46
7.5 Revealed comparative advantages of China's vegetable products	47
7.6 Net export effect of China's vegetable export	48
7.7 Domestic resource cost coefficients of selected varieties of vegetable	49
8. The vegetable industry in Anqiu County	53
8.1 Introduction	53
8.2 Vegetable production in Anqiu	54
8.3 Vegetable processing	60
8.4 Vegetable marketing and exporting	62
8.5 Case studies: townships and companies	67
8.6 Summary	74
9. Summaries and conclusions	76
Appendix	
1. Abbreviations	80
References	81

Preface

Over the past three decades, the vegetable industry in China has undergone dramatic changes, from a situation of undersupply before the 1980s, through an oversupply in the 1990s, to the recent efforts in the new century to ensure the safety and quality of vegetable products. These changes have provided a unique opportunity to investigate the development of Chinese government policy on vegetable production, marketing and international trade.

This report provides a comprehensive overview of the vegetable sector. It covers such issues as institutions related to the vegetable sector, the main production regions, the leading vegetable varieties, cultivation technology and the marketing system. Much attention is also paid to the vegetable trade and the international competitiveness of Chinese vegetables in international markets.

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Executive summary

China claims that it produces more than 60% of the world's vegetable supply and that 150 million people are engaged in vegetable production, processing and marketing. This document reports comprehensively on the Chinese vegetable sector. The topics cover governmental vegetable policies and the development of vegetable production and marketing during the last two decades. Attention is also paid to international trade and China's competitiveness in the world vegetable sector.

A dozen public institutions are involved in China's vegetable sector. The National People's Congress and the State Council are the main policymakers related to food safety and food regulations. The major policy executive institutions include the Ministry of Agriculture, the State Administration for Quality Supervision, Inspection and Quarantine (AQSIQ), the Ministry of Health, and the State Administration for Industry and Commerce. Apparently, there are overlapping and disputed tasks among these institutions. The recently established State Food and Drugs Administration (SFDA) aims to better coordinate and control the increasingly important issue of food safety.

Over the past two decades, the Chinese government has launched various programmes related to vegetables in line with its policy themes. The first programme was the Vegetable Basket Project, which made city mayors responsible for supplying vegetables to the urban population. The project was implemented in two phases. The focus of phase 1 (in the 1980s) was on increasing production to solve the nationwide shortage of vegetables. Phase 2 (1990s) focused on diversifying the vegetable production to meet the demand for more vegetable varieties. At the beginning of this century, the government launched another ambitious programme, namely the Action Plan for Pollution-free Agricultural Products. The focus of this programme is on food safety and food quality. Although the action plan covers all edible agro-foods, the safety of fresh vegetables was the first problem to be tackled. The Ministry of Agriculture has drafted a series of pollution-free food standards and now manages a certification scheme. The standards cover four aspects: production environment, production process, product performance and post-harvest. The standard for pollution-free products is acting as a compulsory standard for agricultural produces in China. Two other certification schemes - namely Green Food and Organic Food - are voluntary standards.

Vegetable production in China has expanded tremendously during the past two decades in terms of both sown area and output. In 1980, the vegetable-sown area in China covered only about 3 million ha with an output of 80 million tons. By 2000, the sown area covered 15 million ha with an output of more than 400 million tons. The number of varieties has also increased from few handful to over 40. The leading varieties include Chinese cabbage, cucumber, radish and tomato. In terms of regional structure, the top 10 vegetable producing provinces (out of a total of 31) account for 70% of the total national output. The leading production regions are Shangdong, Hebei, Henan, Hubei and Guangdong. Technology has contributed substantially to the growth of vegetable production, particularly in

the northern regions. For example, while greenhouses covered only 7000 ha in the whole of China in 1980, in 2000 the figure was 1.7 million ha.

The reform of the vegetable marketing structure started in the late 1980s. Before then, vegetable production, procurement and marketing were part of the central planning system. State-owned vegetable companies and semi-governmental supply and marketing cooperatives were the only legal players in China's vegetable supply chain. By the early 1990s, however, all the state-owned vegetable companies and their shops had been replaced by private traders who are active in newly established wholesale and open markets.

Although China's vegetable trade increased substantially during the last two decades, vegetable exports still account for only about 1% of total production. Nevertheless, the 5 million tons of exports in 2003 makes China one of the largest vegetable players in the international markets. The main export categories are fresh and quick-frozen vegetables, which account for more than half of the total export. The leading export varieties include garlic, onions, beans and edible fungi. Every year China also imports a small quantity of vegetables, mainly refrigerated celery and frozen sweet corn. The leading exporting provinces are Shandong, Guangdong, Fujian and Zhejiang. The main destinations for China's vegetables are Japan, Hong Kong, Korea, the USA and the Netherlands.

Several methods are used to calculate the competitiveness of China's vegetable industry. Firstly, if only comparing the producers' prices of vegetables, the more labour-intensive the vegetables are, the more advantages the Chinese producers have. For example, China's producers' prices for tomatoes are only 2.54% of what it is in Japan. However, one should bear in mind that the labour costs in China are rising fast, particularly in the suburban areas of metropolis. Three other calculating methods (i.e. revealed comparative advantages, net export effect and domestic resource cost coefficients) all indicate that, in general, most of China's varieties (with the exception of celery, pea and potato) could be strongly competitive in the world markets.

At the end of this report we present Anqiu, a county-level city in Shandong province, as a case study to demonstrate vegetable development and, in particular, how this city operates for the export markets. According to the local official's estimate, 50% of Shandong's vegetable exports originate from Anqiu. The main export varieties are stem and root types, such as ginger, scallion, onion, taro, yam, etc. Other export varieties include leaf types (e.g. spinach and lettuce) and fruit types (e.g. cucumber and eggplant). All sorts of vegetable producing and processing companies are present in Anqiu, including those with sole foreign proprietorship, foreign joint ventures and domestic private ownership. They develop all sorts of schemes to contract farmers and/or their land for large-scale production and better food safety control. The processing industry is dominated by foreign and joint ventures, which produce such products as vegetable juice, mashed and dehydrated vegetables, vegetable powders, etc. The main exporting destinations are Southeast Asia and the Middle East. For instance, Japan is the largest importer of fresh ginger and scallion from Anqiu, while South Korea is the largest importing country of fresh onions and Chinese cabbage from Anqiu. Another unique feature observed in Anqiu is the companies' desire to have their production bases and their processing factories certified - a direct result of customers demanding food safety assurance. It is not unusual for a company to possess one or more international certifications (such as ISO 14000, ISO 9001, HACCP, JAS, BRC).

1. Introduction

The Chinese economy has undergone very rapid growth since the 1980s as a result of the economic reforms implemented by the central government in the late 1970s. Even in recent years, the annual growth rate of the Chinese economy (about 7%) is among the highest in the world, while most nations are faced economic slowdown or even recession. China's rapidly growing economy has profound impact on the population's food consumption patterns. As the population's living standards have improved, the quantity of food consumed has increased and the values, patterns and food consumption habits have undergone a dramatic change. These changes have led the Chinese government to shift its attention from food quantity to food safety and food quality. The focus of this report is on the vegetable industry. In fact, safety is the basic requirement consumers demand for their food. Some consumers think food safety is a public good. However, overuse of agrichemicals over the past decades has made food safety a special concern. Food quality is a step further than food safety, while consumers demand more on issues such as nutrition, freshness, varieties, etc. Since Chinese vegetable policy combines both elements of food safety and food quality, these two concepts are used interchangeably in the text.

The vegetable industry holds an important position in China's agricultural sector for four reasons, namely:

1. Vegetables are an important non-staple food for the Chinese population and provide unique nutritious elements in their diets. Furthermore, China ranks top in the world consumption of fresh vegetables.
2. The vegetable industry is an important part of not only the agricultural sector but of the whole national economy. The production value of China's vegetable industry accounts for more than 10% of the total agricultural production value. Taking the year 2000 as an example, the total production value of the vegetable industry was RMB 315 billion – less than that of grain (RMB 460 billion) but far above that of other crops, such as fruit (RMB 100 billion), oilseeds (RMB 50 billion), cotton (RMB 40 billion) and tobacco (RMB 30 billion). Although the sown area for vegetables accounts for only about 10% of the total sown area for all crops in China, its production value accounts for more than 30% of the total production value of China's crop production sector. The vegetable industry is the second largest industry in the crop production sector in China. In addition, the vegetable industry provides raw material for the food-processing industry.
3. Vegetables are an important trade commodity: the total domestic trade value of vegetables was RMB 300 billion in 2000 - less than that of meat, poultry and eggs (RMB 355.7 billion) but more than that of fruit (RMB 200 billion) and aquatic products. In 2000, China exported vegetables worth USD 2.03 billion, with a trade surplus USD 1.96 billion, topping all the exported agricultural products.
4. The vegetable industry is an important source of income - especially cash income - for farmers. According to some estimates, about 16% of farmers' per capita net in-

come came from vegetable growing in 2000. About 78 million rural main labourers were employed in vegetable growing, and a further 80 million in vegetable processing and marketing.

The developments in China's food safety policies are described in the following section. Subsequently, the drastic changes in the vegetable production and marketing structure in the last decades are described, as is China's current position in the international vegetable market. The report concludes with a description of the developments in Anqiu, one of China's major vegetable producing, processing and exporting regions.

2. China's food safety policies with respect to vegetables

2.1 Introduction

Vegetables are one of the most important food items in people's daily diet, because people obtain essential nutrients from vegetables, which they cannot get from other food. Therefore, eating vegetables is a part of people's daily life, which may be why people pay so much attention to the quality of the vegetables they buy. Vegetable quality has to do with the freshness of the product, the diversity of varieties, hygiene standards, the level of chemical residues, etc. In the past, most Chinese consumers were concerned only about the freshness and diversity of vegetable varieties. Until a few years ago, they did not realize that hygiene and agrochemical residues pose a problem. In fact, food safety is a new concept to most Chinese consumers. Nowadays, consumers - and especially urban consumers - are very cautious about the safety of the vegetables they eat. They attach importance not only to freshness and the diversity of varieties, but also to sanitary aspects and chemical residues. They complain about the poor quality of the vegetables they buy and, consequently, vegetable safety has become a socio-economic and even a political issue in China.

To overcome the problems associated with vegetable safety, China has taken comprehensive, concrete measures including the enactment of laws and regulations and the launching of programmes for their implementation. In this section, the following issues are described and discussed:

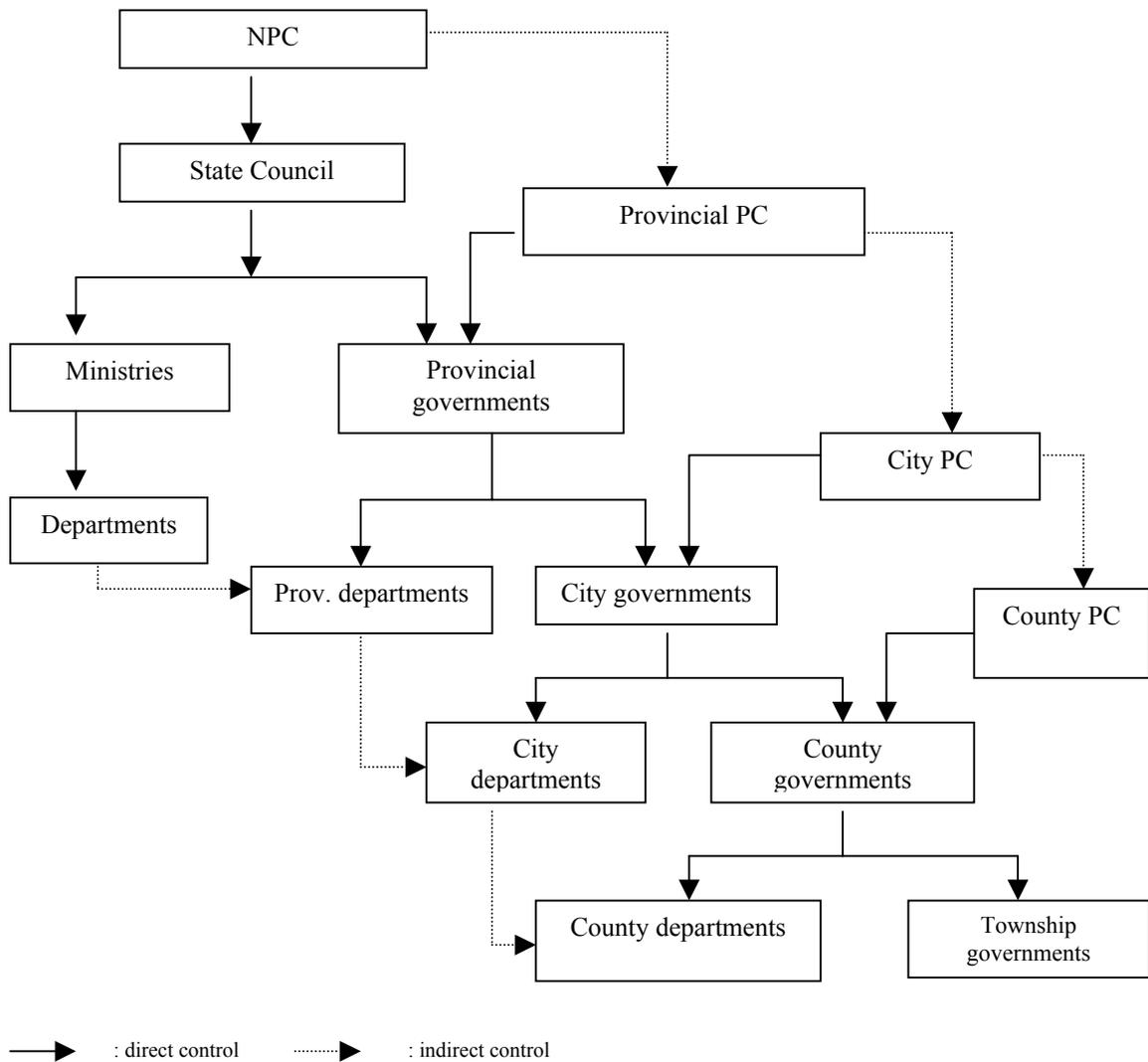
- Laws, regulations and policies related to vegetable safety in China.
- Vegetable safety programmes launched by the Chinese government.
- Vegetable safety testing and monitoring systems.
- Organizational structure (who is responsible for what).

2.2 Legal system with regard to vegetable safety

2.2.1 Legal institutional framework

In China, the National People's Congress (NPC) - which is equivalent to the legislature in Western countries - is at the top of the pyramid of the legal system. Under the NPC is the State Council, which has jurisdiction over individual ministries and commissions. In addition to these central-level legal institutions, there are corresponding institutions at local levels from provincial level down to city, county and township levels (Figure 2.1). At the provincial level, for instance, there are the provincial people's congress, the provincial government and the individual governmental departments; the same structures exists at the lower levels (for more information, visit www.npc.gov.cn).

The NPC is the institution that makes laws/acts. The State Council makes the regulations at the central level. The individual ministries introduce administrative measures. Similarly, the corresponding institutions at provincial/local levels have the same functions as the institutions at the central level. For instance, a provincial people's congress makes bylaws and a provincial government makes provincial regulations, etc. But basically, the lower-level legal institutions are mainly responsible for supervising and enforcing the laws and regulations introduced by the central and provincial legal institutions, rather than for enacting bylaws and sub-regulations themselves.



Legend: NPC:National People's Congress; PC:People's Congress

Figure 2.1 The Structures of the National People's Congress and the governments

2.2.2 Institutions involved in vegetable safety

Wide-ranging institutions are involved in the safety aspects of vegetable production, processing and marketing. In this report, the focus is on the major players in the enactment of laws and regulations and in the formulation of policies related to vegetable quality control. These institutions include:

- National People's Congress (NPC)
- State Administration for Quality Supervision, Inspection and Quarantine (AQSIQ, www.aqsiq.gov.cn)
- Ministry of Agriculture (MoA; www.agri.gov.cn)
- State Environmental Protection Administration (SEPA; www.sepa.gov.cn)
- Ministry of Health (MoH; www.moh.gov.cn)
- State Administration for Industry and Commerce (SAIC; www.saic.gov.cn)
- State Food and Drugs Administration (SFDA; www.sfda.gov.cn).

The National People's Congress (NPC) is the top-level legislature in China that makes laws concerning vegetable quality and safety control. There are a number of special committees under the NPC, although only three of them are involved in the development of food safety laws. These committees are the Legal System Committee, the Environmental Protection Committee and the Agricultural and Rural Work Committee. As far as we know, no special laws on vegetable quality have been passed by the legislature, although there are two general laws concerning food safety, namely the Food Hygiene Act and the Quarantine Inspection Act on Plant-Animal Import and Export.

The State Council cooperates closely with the NPC on law and regulation issues through its Law Office, and is responsible for issuing regulations and making recommendations to the NPC on law issues. If any regulations are submitted to and approved by the NPC, the regulations formally become laws.

The State Administration for Quality Supervision, Inspection and Quarantine (AQSIQ) - a key government department representing the State Council - works on commodity quality issues in general, including food safety issues. There are several departments/bureaus under the AQSIQ. The most relevant to food safety are the Bureau of Quarantine and Inspection for Imports and Export, the Department of Supervision, the Department of Standardization, and the State Committee on Superintendence and Administration of Certification and Accreditation. The AQSIQ has a number of responsibilities in relation to food safety. It is responsible for:

- drafting and enforcing laws, regulations and policies concerning food hygiene and safety;
- reviewing, approving and issuing the national food hygiene standards for all food-stuffs, including vegetables;
- coordinating and guiding the formulation of the state and local/provincial standards, and for managing and registering state and local standards;
- formulating regulations and policies on certification and accreditation in relation to food hygiene and safety, for reviewing, inspecting and approving certification institutions and for registering certification staff and institutions.

The Ministry of Agriculture (MoA) - another key government department representing the State Council on food quality/safety issues – is deeply involved in food safety issues, and particularly in vegetable safety. The departments related to vegetable safety include the Department of Agricultural Regulations and Policies, the Department of Market and Economic Information, the Department of Crop Farming Management and the Environmental/Green Food Development Centre. On behalf of the State Council, the MoA is responsible for drafting and enforcing laws, regulations and policies related to food hygiene and safety. In recent years, the MoA has taken concrete measures to improve food safety. It has:

- prepared a number of policies on the administration for food market access permissions. These policies include the MoA Opinions on Strengthening Agricultural Product Safety Administration, the MoA Opinions on Speeding up the Development of Green/Environmental Food, the MoA Measures on Administration of Pollution-free Agricultural Products, and Enforcement Outlines on Action Plan of the Pollution-free Agricultural Products;
- made arrangements on food safety testing and inspection and developed methods for rapidly testing and inspecting for food safety;
- tightened control over the use of agricultural inputs. For instance, it has forbidden the application of highly toxic and high-residue pesticides to vegetables and has abolished some highly toxic and high-residue pesticides;
- formulated over 400 state-level standards for agricultural products and over 1000 ministry-level standards, including 73 for pollution-free agricultural products.

The State Food and Drugs Administration (SFDA) was created from the former government department, the State Drugs Administration. This new entity represents the State Council on the safety of food, health products, cosmetics, medicines and drugs. This is a change in the governmental institutions at the central level, demonstrating the determination of the Chinese central government to bring about the better management and control of food safety in China. Under the SFDA, there are three departments related to food safety: the Policy, Law and Regulation Department, the Food Safety Coordination Department, and the Food Safety Supervision and Inspection Department. The general responsibilities of the SFDA in relation to food safety are to organize the relevant government departments for drafting laws and regulations, developing safety control policies and working plans, and supervising the enforcement of the laws, regulations, policies and working plans. SFDA is authorized by the State Council to investigate and penalize any food safety incidence, to perform food safety examinations and evaluations, and to disseminate food safety information.

The State Environment Protection Agency (SEPA) has many responsibilities. In regard to food safety, it is responsible for drafting laws and regulations on behalf of the State Council and for formulating policies and development plans on such issues as air pollution, water pollution and soil pollution which might contaminate vegetables in the process of production, processing and marketing. In 1994, SEPA established the Organic Food Development Center to promote and popularise organic food in China as a part of an environmental protection movement. The Center, acting on behalf of the government, certifies state-owned enterprises, private companies and individuals as organic food

producers, processors and/or marketers. The Center is a member of the International Federation of Organic Agricultural Movements (IFOAM) and adheres to IFOAM's standards.

The Ministry of Health (MoH) is responsible for drafting laws and regulations and formulating policies on food hygiene issues, and establishing food hygiene standards at the ministry level. The MoH is not a particularly important government institution as regards the topic of this report, since it deals mainly with processed food, including processed vegetables, which account for only a very small proportion of China's total vegetable production and consumption.

The State Administration for Industry and Commerce (SAIC) is a governmental organization which monitors and manages all market places, including wholesale and retail market places. Therefore, it is a potentially important governmental institution but at present plays only a minor role in the vegetable markets.

In addition to the key institutions mentioned above, various other institutions are involved in vegetable safety issues, such as the State Development and Planning Commission (SDPC), the Ministry of Finance (MoF) and the Ministry of Science and Technology (MoST; www.most.gov.cn). One should bear in mind that there is considerable overlap between these institutions. The aforementioned institutions and their functions are summarized in Table 2.1.

Table 2.1 Institutions and their functions in association with vegetable safety

Institution	Function	Specific task
NPC	Law-making	Food safety laws
State Council	Regulation-making	Food safety regulations
AQSIQ	Policymaking	Food quality control
MoA	Policymaking	Food standards
SFDA	Policymaking	Coordination and evaluation
SEPA	Policymaking	Water, soil and air pollution controls
MoH	Policymaking	Processed food
SAIC	Policymaking	Market outlets management and inspection
SDPC	Policymaking	Development programming
MoF	Policymaking	Project funding
MoST	Policymaking	Research projects

2.2.3 Laws and regulations with respect to vegetable safety

At present, the Chinese laws and regulations related to vegetable safety are incomplete in China. So far, only two laws and two regulations have come into effect. The first law is the Food Hygiene Act, which was promulgated by the NPC and came into effect in 1995. It is a general law concerning public health in general food consumption. Very little specific issues on vegetable quality are mentioned. The second law is the Quarantine Inspection Act on Plant-Animal Import and Export. This act concerns border control measures on agricultural imports and exports.

It is the State Council that issues regulations. So far, it has issued two regulations related to vegetable safety. The first is the Pesticide Administrative Regulation, which was issued in 1997. It contains very concrete stipulations regarding pesticide registration, production, marketing and application. For instance, extremely toxic and highly toxic

pesticides may not be applied to vegetables, fruits, teas or Chinese herbal medicines. In 2000, the State Council issued the second regulation, the Bio-safety Administration Regulation on Genetically Modified Organisms (GMOs) in Agriculture.

It is said that the Agricultural Product Safety Act is being drafted at the moment. The MOA is responsible for drafting this act. It is said that the MOA has finished the draft and has submitted it to the State Council. Once the draft act is approved by the State Council, it will be passed on to the NPC for approval. It is expected that it will take a year or two before the draft act can be approved by the NPC and become an actual law. The general information about the five laws and regulations are summarized in Table 2.2.

Table 2.2 General information on laws and regulations

Law/Regulation	Issued by	Enforced by
Food Hygiene Act	NPC	MoH, AQSIQ
Quarantine Inspection Act on Plant-Animal Import and Export	NPC	AQSIQ
Pesticide Administrative Regulation	State Council	MoA, SEPA, MoH and AQSIQ
Bio-safety Administration Regulation on GMOs in Agriculture	State Council	MoA, SEPA and AQSIQ
Agri-Product Safety Act (in the formulation process)	NPC	MoA, SEPA and AQSIQ

2.3 Governmental programmes on vegetable safety

Since the late 1980s, the Chinese central government has launched several programmes relating to vegetable quality/safety. These programmes include the Vegetable Basket Project, the Action Plan for Pollution-free Agricultural Products and the Green Food Development.

2.3.1 The Vegetable Basket Project

The Vegetable Basket Project (VBP) was launched in 1988 and has been implemented in three phases. In the first phase (1988-94), the VBP aimed to increase vegetable production in order to overcome the vegetable supply shortage problem. At the time, China was still in the planned economy era and those food commodities, including vegetables that were controlled by the government were in short supply. The first priority task for the government was to increase supply to meet consumers' demand by gradually opening the vegetable markets. This led to the lifting of price controls on vegetables and giving farmers the freedom to grow vegetables. As a result, vegetable supply increased significantly. In fact, in the period 1988-1994 the sown area for vegetables increased threefold and the total production by 178%. In other words, the VBP was very successful.

As a result of rapid economic growth and of the consequent improvement in incomes, Chinese consumers were no longer satisfied with the sufficient quantity supply of vegetables. Instead, they were demanding more varieties of vegetables to diversify their vegetable consumption. Unfortunately, very limited varieties of vegetables could be sup-

plied to consumers, especially to those in the north in the winter. In fact, until 1994 only Chinese cabbage and a few kinds of root vegetables were available to consumers in the north in the winter. In 1995, the government launched the second phase of the VBP.

In its second phase (1995-2001), the VBP aimed to diversify the varieties of vegetable and to meet consumers' demands. For the implementation of the Vegetable Basket Project, a macro control system was established to coordinate production and marketing. Relevant management organizations were set up not only in the Ministry of Agriculture and the then Ministry of Domestic Trade, but also by some local governments. The central government elaborated the Mayor's Responsibility System for the Vegetable Basket, which was introduced in 1988, and in 1995 the State Council urged 36 metropolises and medium-sized cities to appoint a deputy mayor to take specific responsibility for the Vegetable Basket Project, given that the mayor takes the general responsibility for the project. The governments at the central and local level developed policies to support the Project. In just the period 1996-2000, the governments invested RMB 500-600 million in constructing vegetable wholesale markets, building logistics facilities for marketing vegetables from southern to northern China, and promoting trade, processing and farming integration.

In addition, the government established an Anti-risk Fund for Vegetable Marketing. After relaxing the control on vegetable marketing, the direct subsidies the governments used to give to consumers were transformed into indirect subsidies. To strengthen their indirect control over vegetable marketing, the governments used a part of the previous subsidies to create an anti-risk fund for non-staple food marketing. Since 1995, the anti-risk fund at the national level has amounted to RMB 38 million, which is appropriate to finance the related activities from the central government. As of the end of 1997, such funds had been set up in 29 provinces (autonomous regions, municipalities), with a total sum of RMB 1 billion. These funds are used, for example, to pay the interest on loans for constructing vegetable wholesale markets, as well as the charges derived from vegetable marketing during the period of important festivals and disasters.

The second phase of the VBP was also considered a big success. Its objective was achieved by developing transportation systems and greenhouse technology in the north of the country. The improvement of transportation systems made it possible to rapidly transport different varieties of fresh vegetables from the south to the north. In addition, greenhouses were built all over the north and the northern farmers were able to produce fresh vegetables of all kinds all the year round, even in winter. As a result, the number of vegetable varieties increased from fewer than 10 to more than 40 over the 1995-2001 period, and now consumers can buy fresh vegetables of different kinds the whole year round.

Very recently, the Chinese government launched the third phase of the VBP, which aims at improving the quality and safety of vegetables supplied to consumers. As more and more consumers are becoming aware of food safety issues, they are demanding safer vegetables. They want food that is produced in a hygienic and pollution-free manner. Food safety has therefore become a social and even a political issue in China. In response, the Chinese government, especially the MoA, is making great efforts to solve food safety problems. The enforcement of the Action Plan for Pollution-free Agricultural Products is a part of these efforts.

2.3.2 The action plan for pollution-free agricultural products

The Action Plan for Pollution-free Agricultural Products (APPAP) was drafted by the MoA and approved by the Chinese Communist Party Central Committee and the State Council, which illustrates its political importance. In April 2001, the MoA formally launched the APPAP and implemented it in Beijing, Shanghai, Tianjin and Shenzhen as a pilot project. Recently, the MoA decided to extend the APPAP all over China, based on the lessons and experiences drawn from these four cities.

The APPAP does not focus solely on vegetables, but covers all edible agricultural products (vegetables, fruits, cereals, beans, meat, aquatic products, etc.), although vegetable safety control is one of its most important parts. The overall objective of the APPAP is to establish a sound system and complete institutions for supervising, inspecting and controlling the whole process of agricultural production and marketing – from field to dining table – for food safety purposes and to improve the overall level of agricultural product safety in China. According to this plan, in about five years' time, China should be producing agricultural products that are pollution-free and 100% safe for human consumption. For the domestic markets, the proportion of agricultural products that meet the pollution-free standards should be over 95%, while the safety level of the products for exports should meet the international standards of importing countries. The priority task for the APPAP is to control the levels of agrochemical residues, antibiotics and heavy metals under food safety standards.

The MoA is taking the following three groups of concrete measures to implement the APPAP.

Supervising and controlling vegetable production, i.e.:

- establishing a number of export production bases, standardized production demonstration areas and pollution-free production bases;
- strictly controlling the pollution from industrial wastes and urban garbage and agrochemical residues to vegetable production environments;
- strictly controlling agri-inputs markets and applications of agrochemicals;
- standardizing vegetable production and marketing, including production, grading, packaging, storing and transportation;
- organizing producers, buyers and sellers into associations such as producer's associations, marketing associations, cooperatives, etc.

Establishing and completing a market access system, i.e.:

- setting up a monitoring and inspection system to monitor and test the production environments, inputs and safety status;
- adopting and rapidly applying testing technology that can be used to check the agrochemical residue status at production bases, wholesale markets and retail markets;
- establishing special areas/counters in wholesale markets and supermarkets for pollution-free products, green products and organic products;
- implementing product labelling and tracing systems.

Completing the support system, i.e.:

- further developing the legal system,
- completing the standardizing system,
- completing the testing and inspecting system,
- establishing a certification system,
- intensifying the research and extension system,
- constructing an information network, for training and publicity purposes.

The MoA is in charge of implementing the APPAP, while the agricultural departments at various government levels are responsible for enforcing it. Local governments can work out their own practical and applicable plans to enforce the APPAP according to the local situation. The APPAP will be carried out step by step from the provincial capital cities down to second-level cities, and eventually to small towns.

2.3.3 Measures on the administration of pollution-free agricultural products

In order to facilitate the smooth enforcement of the APPAP, the MoA and SEPA jointly issued the Measures on the Administration of Pollution-free Agricultural Products (MAPAP) in April 2002. There are eight sections and 42 clauses in the MAPAP, which includes very detailed information on the definition of 'pollution-free agricultural products'; who is responsible for enforcing, supervising and administering the MAPAP; production management and the field conditions required for producing pollution-free agricultural products; applications for producing pollution-free agricultural products; product certification; supervision, penalties, etc.

So far, the MAPAP has been carried out as smoothly as expected in the four experimental cities. In Shanghai, it is expected that the safety standards for the main varieties of vegetables will meet the national standards within two or three years. The quality of agricultural products will be inspected and controlled throughout the chain from field to dining table. In Beijing, a five-year plan has been made for the enforcement of the MAPAP. In the next five years, Beijing plans to establish 100 production bases to produce safe agricultural products, as well as to develop 100 high quality/safety brands of agricultural products; to impose market entry permission on agricultural products; to approve special agents for marketing pollution-free agricultural products; and to develop temporary local standards for pollution-free agricultural products. In Tianjin, local standards for pollution-free vegetables have already been developed. There are 158 production bases in Tianjin for producing pollution-free vegetables, with a total production area of 10 thousand ha and a total production of more than 700 thousand tons. There are 13 large commercial companies engaged in producing and marketing pollution-free vegetables.

2.3.4 Green food development project

'Green food' in Chinese official language means food, which meets high level of food safety standards. The term covers a wide assortment of food, such as grain and edible oil products, animal products (meat, milk, eggs), beverages, vegetables, teas, fruits, alcohol, etc. In May 1990, the MoA formally announced the start of the Green Food Development

Project, which is also aimed at protecting ecological environments, improving agricultural products quality, speeding up the development of the food-processing industry, improving people's health conditions and increasing agricultural exports. In the same year, the Green Food Development Center (GFDC) was founded. In 1993, the GFDC became a member of IFOAM (International Federation of Organic Agricultural Movements). Since 1990, the GFDC has developed a networking system for producing green food in most provinces in China. The GFDC now has 41 green food management centres at the provincial level. It has established 12 product-quality inspection and monitoring institutions in different regions. It has also charged 56 provincial institutions with inspecting and controlling environments in different locations.

The green food industry has developed very rapidly since 1990. For instance, while in 1990 China was able to produce only 127 different varieties of green food products, it is now producing 2400. There are 1217 companies engaged in the green food business. The annual production of green food is more than 20 million tons, and in 2002 the sales turnover was about RMB 50 billion. The total area of monitored and protected crop land, grassland, lakes and rivers has reached 3.87 million ha. So far, however, most of the green foods developed by the GFDC are non-vegetable commodities. Statistics show that of the total products, grain and edible oil products account for 27%, animal products (meat, milk, eggs) 15%, beverages 15% and vegetables 18% (the rest are tea, fruit and alcohol). However, it is expected that in the years to come the supply of green vegetables to the domestic markets will grow very rapidly.

In 2003, the GFDC was divided into two departments: the Green Food Department and the Organic Food Department. The former is in charge of developing green food and green food certification, while the latter is responsible for developing organic food and organic food certification.

2.3.5 Organic food development programme

The Organic Food Development Programme is carried out by SEPA. SEPA's involvement in organic food development dates back to the late 1980s (SEPA's Nanjing Institute for Environmental Sciences - NIES - joined IFOAM in October 1989). In 1994, the Organic Food Development Center (OFDC) of NIES was formally established. The major functions of the OFDC include processing applications for organic certification, issuing organic certificates, supervising and managing use of the OFDC logo, interpreting OFDC Organic Certification Standards and relevant rules and regulations, developing information exchange at home and abroad, and international cooperation in the field of organic certification.

The OFDC is composed of the Department of Certification, the Department of Quality Management, the Department of External Cooperation and the Administrative Office.

The *Department of Certification* is responsible for accepting applications for organic certification, dealing with routine affairs relevant to certification and the use of the organic logo, issuing organic certificates and permits to use the organic product logo upon the decision of the Certification Committee, and setting up a tracing system for certification management.

The *Department of Quality Management* is responsible for working out proposals for revising the OFDC Organic Certification and Standards in line with IFOAM Basic Standards for Organic Production and Processing and with EEC 2092/91, writing and revising a quality management manual and an inspector's manual, dealing with complaints, monitoring and tracing the quality of organic production throughout the entire production chain (i.e. from raw materials through processing, packaging, storage and transportation, to trading), and dealing with related works concerning IFOAM and ISO accreditation.

The *Department of External Cooperation* is responsible for maintaining communication and cooperation with organic certification bodies both at home and abroad, establishing and consolidating communications with related international NGOs, implementing cooperative research projects, providing relevant national decision-making departments with technical support and policy proposals, collecting, compiling and publishing information on the organic food industry both at home and abroad, and organizing academic symposiums, training workshops and expositions, etc.

The *Administrative Office* is responsible for handling finance and personnel affairs, organizing meetings and training programmes, editing the Organic Food Times magazine and providing logistics services.

Since 1994, the OFDC has developed a networking system with branches for developing organic food in 21 provinces all over China. By the end of 2001, the total certified organic food production area reached to 11,000 ha; a further 17,000 ha were in transition. The OFDC has developed about 200 different organic food varieties, including bee products, teas, dairy products, grain products, vegetables, fruits, livestock products, aquatic products, Chinese medicines, natural edible products, spices, etc. Most of the organic food is for export to Europe, the United States and Japan.

2.4 Governmental standardization programmes

In China, all food standards are established either by the central government and various ministries or by local/provincial governments. There are three categories of food standards representing different levels of governmental standards. At the top level are the national standards set by the central government; at the second level are the ministry/trade standards set by the individual ministries; and at the third level are the local/provincial standards set by the provincial governments. The first two standards can be applied nationwide, while the last-mentioned standards can be applied only within the borders of the respective provinces.

Pollution-free food standards

Four aspects need to be taken into account in the pollution-free food standards, namely:

1. Environmental quality standards in the field (air quality, water quality and soil quality).
2. Production technology standards (production input quality controls).
3. Both primary product standards and processed product standards (product formation requirements, physical and chemical requirements and biological requirements).
4. Packaging, labelling, storing and transportation standards.

The MoA is the key ministry for formulating agricultural product standards at the ministry level. As mentioned, by the end of 2001 the MoA had drafted more than 400 agricultural standards at the national level and formulated more than 1000 agricultural standards at the ministry level. In terms of pollution-free food, the MoA had developed a total of 199 standards for pollution-free agricultural products by the end of August 2002. Of these standards, about 40 are pollution-free vegetable standards for various products, such as cucumbers, beans, radish, carrots, celery, mushrooms and black fungi.

There are also local standards for pollution-free food. In Tianjin, for instance, the local government has formulated the Tianjin Pollution-free Vegetable Standards and the Tianjin Field Environmental Quality Standards for pollution-free vegetables.

Green food standards

The green food standards are established by the GFDC on the behalf of the MoA, and are therefore considered ministry-level standards. There used to be two grades in the green food standards, grade A and grade AA. The former allowed the use of low-toxic agrochemicals on limited crop varieties within a limited time period, but there could not be any residues tested positive in the products. The grade AA allowed no agrochemicals to be applied at all and required high environmental standards as regards air, water, soil, etc. In fact, the grade AA products were organic farm products. More accurately, the grade AA standards met the international standards for organic food, and since the break-up of the GFDC, grade AA food has been renamed 'organic' food.

Organic food standards

The OFDC is presently the only official institution in China that certifies organic food. The OFDC issued the Organic Certification Standards, which came into effect on 1 July 2002. Like the green food standards, the organic food standards are ministry-level standards set by SEPA. The standards are based on the basic standards developed by various organizations, such as IFOAM's Organic Production and Processing standards, the EU's organic agriculture regulation (EEC No. 2092/91) and the standards of many other countries, including Germany, Sweden, UK, USA, Australia and New Zealand. These standards are the fundamental requirements for organic production, processing, marketing and trading. Organic food operators applying for certification must sign an agreement with OFDC guaranteeing that they will fulfil the Standards in organic production, processing and marketing, and that they will accept certification inspection by OFDC inspectors. The OFDC Certification Committee issues organic certificates to qualified producers, processors and traders upon completing examination of the inspection report prepared by the inspector, and then authorizes them to use the OFDC organic logo on their organic products. By the end of 2001, the OFDC had certified more than 120 operators and over 50,000 ha for producing a wide range of organic products. The following is a list of OFDC Certified products:

- Tea (green tea, black tea, Pu'er tea, Oolong tea, etc.)
- Bee products (honey, royal jelly)
- Dairy products (milk powder, fresh milk)
- Grain (soybean, rice, barley, wheat, buck wheat, red bean, kidney bean, black bean, etc.)

- Cash crops (peanut, sesame, sunflower seed, pumpkin seed, cotton, etc.)
- Vegetables (fresh, frozen, dehydrated)
- Bamboo-shoot products (spring bamboo shoot, air-dried bamboo shoot)
- Fruits (pineapple, passionflower, kiwi, orange, loquat)
- Chinese medicinal herbs (liquorice root, the fruit of Chinese magnolia vine, Reishi or Ganoderma Luchidum, maitake mushroom etc.)
- Wild products (pine nut, mushroom, etc.)
- Condiments (soy sauce, aniseed, ginger)
- Sugar cane and sugar
- Organic fertilizer
- Pigs
- Aquatic products (freshwater fish)

3. The development of China's vegetable production

Since the rural reform launched in 1978, China's vegetable industry has developed quite quickly. In particular, the implementation in 1988 of the Vegetable Basket Project and the Mayor's Responsibility System for the Vegetable Basket directly promoted the development of China's vegetable industry. Since 1990 (and especially since the late 1990s), many places in rural China have increased the area devoted to vegetables in response to the structural oversupply of grain.

3.1 Area and output

According to statistics, the sown area for vegetables in China was 3.1 million ha in 1980, with an output of 80.62 million tons and per capita availability of less than 80 kg. In 1990, these three indicators more than doubled, to reach 6.6 million ha, 195.51 million tons and 173.1 kg, respectively. In 2000, China's sown area for vegetables and the output again doubled, to reach 15.24 million ha and 423.98 million tons, respectively. The per capita availability of vegetables in China reached 326.1 kg that year, a figure far above the world average (110.5 kg). China's vegetable output had increased at a rate of 8.65% annually between 1980 and 2000, as a result of the increase in the sown area rather than an increase in the yield (see Table. 1). In 2001, the sown area for vegetables in China was 16.34 million ha and the output was 483.37 million tons, an increase of 7.2% and 14%, respectively, over the previous year. In 2003, the sown area for vegetables and the output in China reached about 18 million ha and 540 million tons, respectively, a lower increase than in previous years.

Table 3.1 Sown area and output of vegetables in China

Year	Sown area (million ha)	Output (million tons)	Yield (tons/ha)	Per capita availability (kg)
1980	3.2	80.6	25.5	79.8
1990	6.6	195.5	29.6	173.1
1994	7.0	209.4	29.9	178.3
1996	10.1	308.6	30.6	250.9
1998	12.3	384.9	31.3	296.0
1999	13.3	405.1	30.4	317.2
2000	15.2	423.9	27.8	326.1
Annual growth (%)	8.2	9.7	0.44	7.3

Source: Editorial group: Techniques for Pollution-free Vegetable Production, China Agriculture Press, 2002, p1.

3.2 Variety structure

Data on varieties are available only for the period 1995-2000. In general, the variety structure of China's vegetable production did not change much in that period. The output of the seven major vegetable varieties accounted for more than 60% of the total output of vegetables. However, there were some small changes. First, the proportion of ordinary vegetable varieties (e.g. tomato and Chinese cabbage) declined, while the proportions of high-quality vegetable varieties (e.g. cucumber and other vegetables) increased. Secondly, the production structure of vegetables fluctuated slightly from year to year, which may be related to fluctuations in vegetable prices in domestic markets.

Table 3.2 Variety structure of vegetable production in volume in China (%)

Year	Total	Chinese cabbage	Radish	Cucumber	Chinese onion	on-Tomato	Eggplant	Pepper	Others
1995	100	24.1	10.5	8.1	3.4	10.9	5.1	5.6	32.2
1996	100	21.6	9.4	9.0	4.1	10.9	5.2	5.7	34.0
1997	100	22.7	9.5	9.2	4.1	8.3	6.1	7.2	33.1
1998	100	20.9	9.3	9.0	3.5	8.2	5.9	6.7	36.6
1999	100	21.3	9.3	9.9	4.3	8.3	5.5	6.7	34.6
2000	100	20.3	9.7	10.5	4.1	8.5	5.6	6.7	34.7

Source: Statistics on China's Agriculture, relevant years, China Agriculture Press.

3.3 Regional structure of vegetable production

The regional structure of China's vegetable production can be characterized as follows:

- A. Vegetable production is spreading all over the country. According to statistics from some relevant departments, in 2000 there were at least 850 counties (including cities and districts at the county level) where the sown area for vegetables exceeded 100 thousand mu (= 6,666.7 ha). Among these, were at least 160 counties where the area devoted to vegetables was more than 300 thousand mu¹ (= 20 thousand ha).
- B. China's vegetable production is relatively concentrated in the central and southern parts of China. Concentration started in the mid 1980s. According to the Ministry of Agriculture, in 2000 the vegetable output of the top 10 vegetable producing provinces accounted for 73.3% of the total output of the whole country (See Table 3.1). Based on the characteristics of vegetable production and marketing, there are three major regions for vegetable production in China. (1) The northern region, which includes Shandong, Hebei and Liaoning provinces. Because of its unique natural conditions and well-developed facilities for vegetable production and marketing, this region sells its vegetables quite broadly to other regions. (2) The southern region, which includes Guangdong, Guangxi, Hainan, Sichuan and Yunnan provinces. This region has advantages in terms of climate: it produces vegetables in the winter for the

¹ At the end of 1999, there were 2858 counties in China, including cities and districts at the county level. Some of the districts are located in urban areas, and some in rural areas, especially the suburbs of big cities.

markets in north-eastern, northern and north-western China. (3) The central region, which includes Henan, Jiangsu, Hubei, Hunan and Anhui provinces, where vegetables are mainly produced for the demand within the region and are marketed in nearby areas in general.



Figure 3.1 Provinces of China

Table 3.3 Top 10 vegetable producing provinces in China

1997		2000	
Province	Output (million tons)	Province	Output (million tons)
Shandong	54.3	Shandong	72.6
Hebei	30.3	Hebei	44.5
Henan	24.9	Henan	39.8
Hubei	23.0	Jiangsu	33.1
Guangdong	19.9	Hubei	27.3
Sichuan	18.5	Sichuan	23.1
Jiangsu	18.4	Guangdong	22.2
Hunan	12.9	Hunan	17.8
Guangxi	12.2	Guangxi	16.1
Jiangxi	9.1	Anhui	14.5

Source: Editorial group: Techniques for Pollution-free Vegetable Production, China Agriculture Press, 2002, p247.

C. In some regions vegetable production bases with specific features have been established. These production bases make use of an area's comparative advantages,

particularly the advantages in climate and geographic location, to produce commodities with local characteristics, thus avoiding competing with each other. The establishment of production bases also makes it possible to meet the diversified demand of consumers. Some of the production bases are situated in the main growing areas, but some of them utilize certain distinctive advantages and become quite influential although they are not situated in the main growing areas. Five commercial vegetable production bases can be distinguished based on the seasonal characteristics of vegetable production. (1) The southern base for winter production for marketing to the north, which is concentrated in Hainan, Guangdong, Guangxi, Fujian, Yunnan, Sichuan provinces. (2) The Yellow River, the Huaihe River and the Haihe River base for early spring vegetable production, which includes the northern parts of Jiangsu and Anhui, the southern parts of Shandong and Henan. (3) The western base for vegetable production for marketing to the east, which is concentrated in the western corridor of the Yellow River in Gansu Province. (4) The base in Hebei, Shandong and Henan for production in the autumn, which provides Chinese cabbage to northern China to meet the demand in winter. (5) The base of summer and autumn off-season production for Beijing and Tianjin, which is located in Zhangjiakou prefecture of Hebei province, northwest of Beijing and Tianjin. The establishment of vegetable production bases and the improvement of the vegetable marketing system supplement each other, promoting the formation of China's general pattern of vegetable marketing, under which vegetables are transported from south to north, from west to east, and from north to south.

- D. The production of vegetables in suburbs has been shrinking. As a result of the policy of 'producing on the spot, supplying on the spot' in the years of the centrally planned economy, almost all the vegetables demanded by cities were produced by the bases in their suburbs. However, such restrictions resulting from unfavorable growing conditions meant that it was hard to succeed. Under the market economy system, it is not rational to do so and as a result of the new vegetable marketing pattern, the vegetable production in the nearby suburbs of some metropolises has been replaced by production in the outer suburbs and outside the metropolis. The vegetable producers in the nearby suburbs have turned to leafy vegetables, which are hard to transport over long distances.

3.4 Production mode

The household land contract system - under which the rural household is the basic unit of agricultural production - is the basic farming system in China. Vegetables, too, are produced under this system. On the basis of the share of vegetables and other crops grown in one household, the farming system for vegetables can be divided into two types: single operation and diversified operation. It is also possible to divide the households on the basis of the organization of production: independent operation or integrated operation. In China's main vegetable producing areas, the vegetable growing households are mostly of the type independent operation and rely for marketing on the local wholesale market. In these areas, the production of vegetables is concentrated in certain relatively large zones, the scale of

production of the households is rather large and a large part of the vegetables are grown for commercial use (trade). In other regions, the household is also still the basic unit for vegetable production, but the integrated operation is developing rapidly as a result of agricultural industrialization. The average scale of vegetable production per household ranges from 0.2 to 0.3 ha. The production scale of even some specialized and large-scale households hardly exceeds 10 ha. Outside the main vegetable producing areas, the operational form of vegetable production is usually an independent and diversified one. In these areas, the rural households grow vegetables during the production intervals between the major crops and on odd pieces of land. Consequently, the production of vegetables in these areas is very seasonal, and the production scale is small. The marketing rate of vegetables is low because it is primarily aimed at meeting the demand for vegetables of the households itself, and only the surplus is sold in the market.

3.5 Cultivation technology

It is estimated that technological progress is responsible for more than 50% of the growth in vegetable production - about 10 percentage points higher on average than its contribution to the growth of agriculture in general in China.

China's vegetable variety resources

China has a long history of vegetable cultivation. So far, China has collected more than 30,000 portions of vegetable germ plasmas. There are about 140 varieties of vegetables under cultivation in China, of which 110 are quite common. The total production for 20 varieties exceeds 10 million tons (for each variety). In recent years, China has achieved a lot in researching and using vegetable variety resources and developing new, good breeds of vegetables. China has developed and popularized 1000 breeds of vegetables since 1980s, and good breeds make up 80% of the breeds in vegetable production.

Cultivation technology

Another technique that has had a great impact on the development of China's vegetable industry is the greenhouse, which effectively solved the discrepancy between balanced supply and the seasonal production of vegetables. The total area of greenhouses used in China's vegetable production was 7,200 ha in 1981 and 1982, with an output of about 200,000 tons. In 1999 and 2000, however, the area of greenhouses was 1.6 million ha and the aggregate output of vegetables produced in them reached 87 million tons, a growth of more than 220 times and 400 times, with annual growth rates of 35% and 40%, respectively (see Table 3.4).

Table 3.4 *Development of greenhouses in China's vegetable production*

Year	Total area (1000 ha)	Greenhouse area (1000 ha)	Proportion (%)
1980	3,161.8	7.2	0.2
1985	4,753.3	46.8	0.9
1990	6,616.1	169.2	2.6
1995	9,446.5	900.4	9.5
1996	10,089.1	996.5	9.9
1997	11,424.7	1,221.8	10.7
2000	15,159.8	1,700.0	11.2

Sources:

- Tan Xiangyong, Xin Xian et al.: *Analyses of Markets of China's Major Agricultural Products*, China Agriculture Press, 2001.
- *Statistics on China's Agriculture*, relevant years, China Agriculture Press.
- Zhang Zhenhe: *Problems in The Development of Vegetable Industry in China and Some Countermeasures*, China's Herald of Agricultural Sciences and Technology, No. 3, 2001.
- Editorial group: *Techniques for Pollution-free Vegetable Production*, China Agriculture Press, 2002.

Comparison of China's vegetable yield with that of other countries

Although China has achieved huge progress in the technology of vegetable production, its technology still lags behind that of some countries where the vegetable industry has developed much better. The gap between China and those countries can be illustrated by the differences in yields per ha (Table 3.5). In 1999, China's vegetable yield was 68.64%, 65.68%, 62.65%, 57.33% and 30.82% the level of Poland, USA, Japan, Spain and the Netherlands, respectively. Table 5 also shows that since the 1980s, China's vegetable yield has increased more slowly than that of other countries (except for Japan).

Table 3.5 *Comparison of the vegetable yields of selected countries*

Year	Production of vegetables (tons/ha)					
	USA	Japan	Poland	Spain	Netherlands	China
1980	19	28	14	18.8	40.7	14.4
1985	21	28	19	20.0	44.4	16.0
1990	23	27	23	22.9	53.2	17.7
1995	25	28	22	26.2	50.9	18.8
1999	26	27	25	29.6	54.9	16.9

Source: FAO.

4. China's vegetable consumption

Introduction

As people's living standards are improving and the supply of staple and non-staple food is becoming sufficient in China, the volume of per capita consumption of vegetables in some urban areas has begun to decrease, and the consumption of vegetables has entered the development stage of quality-pursuing and diversification. This trend is more obvious in cities and towns than in rural areas. The current vegetable consumption in China's large and middle-sized cities shows the following trends. First, the seasonal consumption of the ordinary vegetable varieties is gradually decreasing, while the year-round consumption of varieties of high-quality and fine vegetable is increasing year by year. Consumers favour off-season vegetables and fine vegetables more and more. Second, the demand for vegetables used as spices (e.g. onion, ginger, garlic, chilli pepper and coriander) is increasing steadily. Third, cleaned vegetables and pollution-free vegetables are beginning to be favoured by consumers. In addition, the way vegetables are purchased has begun to change: consumers are now buying cleaned vegetables in stores, supermarkets, warehouse markets, chain shops and groceries. Fourth, the demand for leafy vegetables in spring and autumn is increasing.

Amount of consumption

The per capita consumption of vegetables in China dropped from 157 kg in 1983 to 114 kg in 2000, a decline of 43 kg (27%), at an annually decreasing rate of 1.87%. Although declining, China's per capita consumption of vegetables in 2000 was still more than 100 kg, which is the world average. However, the change in urban residents' per capita vegetable consumption differed from that of rural residents: urban residents' per capita vegetable consumption dropped from 152 kg in 1981 to 115 kg in 1997, while rural residents' per capita consumption first rose, then dropped. In the year 2000 the consumption levels were about the same (Table 4.1). The quality of vegetables that urban residents consume is, generally speaking, higher than that consumed by rural residents. There are three reasons for the decrease in China's per capita consumption of vegetable: people in northern China have started to consume more fine vegetables and fewer vegetables preserved for the winter; people in coastal cities in southern China consume more aquatic products as a substitute for vegetables; and an increase in fruit consumption has reduced vegetable consumption.

Table 4.1 Comparison of vegetable consumption between urban and rural residents in China

	Per capita vegetable consumption of vegetables (kg)					
	1981	1985	1990	1995	1997	2000
Urban residents	152	144	139	116	113	115
Rural residents	124	131	135	105	107	112

Source: Tan and Xin (2001) and Ding (2001)

The total consumption of vegetables in China has been relatively stable for the past two decades, ranging from 130 to 150 million tons. That means that although per capita vegetable consumption dropped in that period, the total amount of consumption did not change too much due to population growth. For instance, the total amount of vegetable consumption rose slowly from about 142 million tons in 1985 to 143 million tons in 2000, increasing by only 880,000 tons in 15 years, or 60,000 tons annually, at a rate of 0.041% per annum.

This phenomenon leads to a question. The available figures show a big gap between the total output and the total consumption of vegetables in China, and over the last decades this gap has been widening, as the total output has been increasing continuously while the total amount of consumption has remained quite stable. How can this be explained? As pointed out later in this report, both China's vegetable exports and the quantity of vegetables used for processing are quite small, so the gap could not be caused by these factors. The gap could be explained from three other factors: the total consumption of vegetable does not include residents' consumption outside their homes (i.e. it does not include the amount of vegetable consumed in restaurants etc.); vegetable output is calculated as farm-gate output (i.e. the output of primary products) while the consumption is calculated as the amount of end products; and the losses in vegetable marketing are quite large.

Variety structure

The Chinese consume mainly fresh vegetables. The 25 most common varieties are Chinese cabbage, cabbage, spinach, rape, celery, leek, water spinach, Chinese onion, cauliflower, radish, carrot, onion, ginger, asparagus lettuce, garlic flower shoot, garlic, cucumber, wax gourd, towel gourd, tomato, eggplant, sweet pepper, green bean, lotus root and bean sprouts.

The per capita consumption of vegetables differs from region to region. For example, in terms of volume it is higher in the cities in northern China than it is in China's coastal areas in the southeast, whereas in terms of expenditure, it is the other way around. This difference is mainly caused by the difference in vegetable varieties consumed in different regions. According to a survey on annual per capita consumption of vegetables in 12 metropolises, the top seven varieties are Chinese cabbage, cucumber, cabbage, tomato, rape, eggplant and celery. The top seven varieties consumed in China's northern metropolises are Chinese cabbage, cucumber, tomato, cabbage, eggplant, celery, potato, while in southern China the most popular are rape, cabbage, Chinese cabbage, cucumber, eggplant, celery and tomato.

Consumption elasticity

Vegetable consumption is affected by consumer income, vegetable prices and the prices of other relevant commodities. Based on the data of food consumption expenditures of urban households at different income levels in 1985-1994, Tan and Xin (2001) calculated that the vegetable consumption elasticity to income is estimated at 0.441, while those for grain, meat and poultry, aquatic products, and eggs are 0.260, 0.722, 0.800 and 0.754, respectively. This indicates that with the increase in income, the consumption expenditures on all kinds of food also increased. Of these, the increment of grain was the smallest, followed by

that of vegetables; the increments of meat and poultry, egg, and aquatic products are relatively large.

The impact of the price of vegetables on their consumption can also be indicated by the price elasticity. The price elasticity has been estimated based on data on rural households' consumption of all kinds of food. The result is -0.467 for vegetables, while those for grain, meat and poultry and egg, aquatic products, alcohol and other food are -0.181, -0.779, -0.829, -0.535 and -0.807, respectively (Tan and Xin, 2001). The absolute values of price elasticity of vegetables are greater than those of grain but smaller than those of each of the others, implying that vegetables are a basic food and that their consumption cannot be affected by prices easily.

The impact of changes in the price of other commodities on vegetable consumption can be indicated by cross price elasticity. Based on data on the food consumption expenditure of rural households, the cross price elasticities of vegetable consumption to meat, poultry and egg as a whole, and aquatic products are 0.18 and 0.149, respectively. This implies that vegetable consumption can substitute the consumption of those two kinds of non-staple foods only to some extent.

5. China's vegetable marketing

The reform of the marketing structure in China

The development of the vegetable marketing system can be divided into two stages: before and after the economic reform. Although China's reform started in the late 1970s, the real liberalization of the vegetable sector began only in the late 1980s. The following description of the changes in the marketing structure is taken from a report on marketing in Tianjin (see www.wur.nl/leichina).

During the central planning period, the Tianjin government had a detailed plan for the allocation of the vegetable production, the selection of crops and varieties, and the distribution. The main marketing policy before 1990 was 'total procurement' and 'total sale': the former meant that the total production of all farmers was purchased and the latter that the total purchased production was sold. The Tianjin Vegetable Company (TVC) played a central role in the implementation of this policy. The TVC had its own vegetable collecting stations in all vegetable production regions. Farmers could deliver their produce only to these collecting stations or to the supply & marketing cooperative (which was also controlled by the government) at fixed prices. On the distribution side, the TVC had a vegetable distribution centre (total 12) in each urban district. After receiving the vegetables from the collecting stations, these distribution centres redistributed them to all 300 state-owned vegetable shops, where consumers could buy the vegetables at subsidized prices. The flow chart of the Tianjin vegetable supply chain in the pre-reform period is given in Figure 5.1. Every year, the Tianjin municipality government had to allocate a huge proportion of its budget to the TVC to compensate it for its operational costs and losses. Despite that, this central planning system did not ensure the effective production and distribution of vegetables, given the shortage of vegetables among the urban consumers.

Following the economic reform policy of the central government, in 1991 the Tianjin government started to gradually reduce the subsidies to the TVC, and in 1993 the TVC became a completely independent commercial company. The traditional distribution centres and vegetable shops were either closed down or used for other purposes. While the old market system was shutting down, open (street) markets and wholesale markets were rapidly developed with the government's permission and even encouragement. In 2002, Tianjin has four large wholesale markets, 16 middle-sized wholesale markets and hundreds of small local street markets. In 1999, the total vegetable transaction volume was around two million tons, of which half was traded at the four big wholesale markets. The current vegetable flow chart in Tianjin is presented in Figure 5.2.

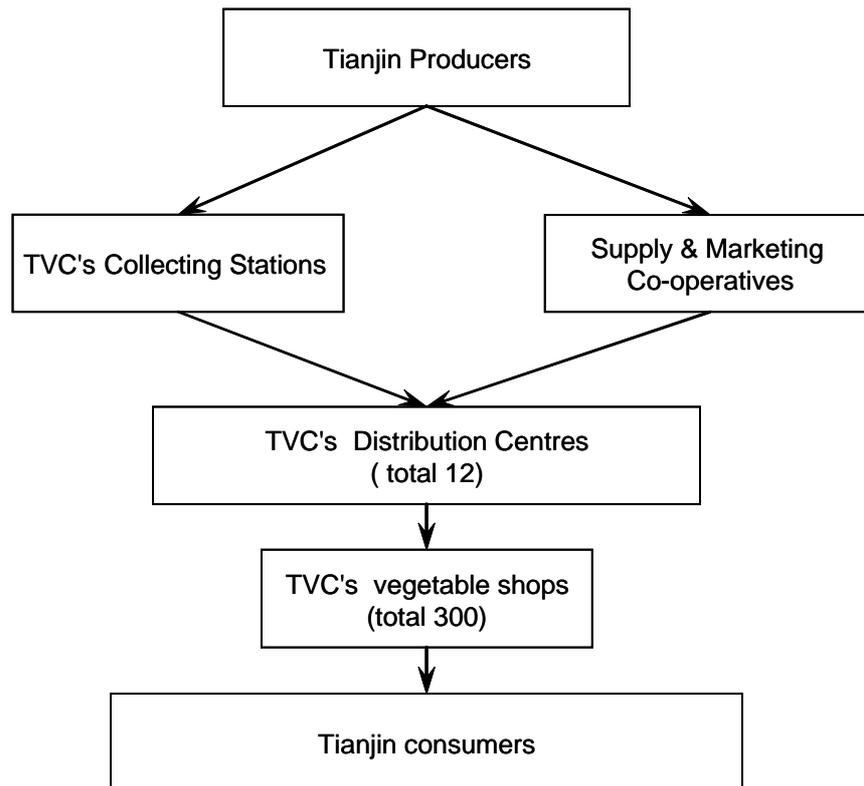


Figure 5.1 The Tianjin vegetable supply during the central planning period

At the end of 1998, there were about 26,000 markets for agricultural products of all forms all over the country. Among them were about 4,000 relatively large markets (see Table 5.1), most them dealing with vegetable products. China's first vegetable wholesale market in a producing area was established in 1984. The vegetable wholesale market has a very important position in the wholesale market for agricultural products in China. In terms of numbers, of the total number of 4,243 wholesale markets for agricultural products in 1998, 1,288 were for vegetable products (30%). There were 836 wholesale markets for fruit, 323 for aquatic products, 270 for meat, poultry and eggs, 543 for grain, 221 for piglets and 822 for other products. In terms of the volume of business, agricultural products valued at RMB190.6 billion were traded through wholesale markets in 1996; vegetables sales amounted to RMB 60.5 billion, or 32% of the total.

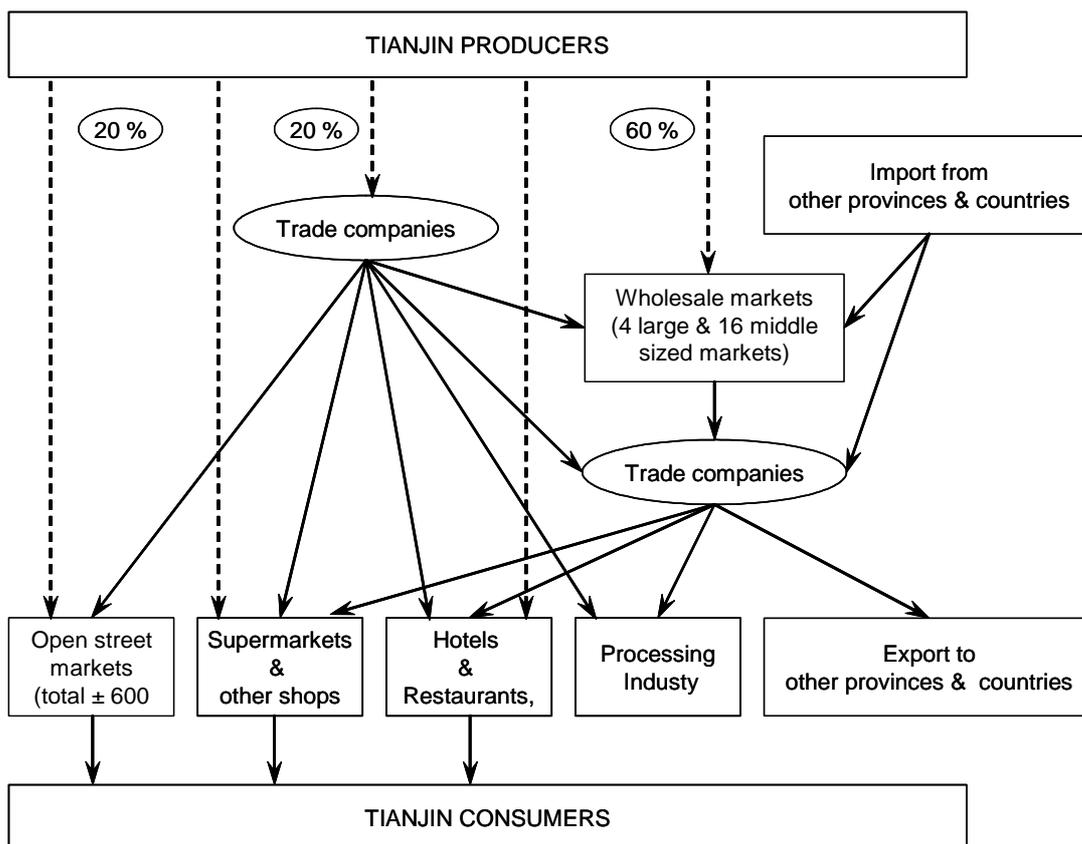


Figure 5.2 Current flow of vegetables in Tianjin

Table 5.1 Development of wholesale markets for agricultural products in China

Year	Number of markets				Volume of business (RMB billion)	Volume of business of each market (RMB million)
	Total number of markets	Increase rate over previous year (%)	Number in rural areas	Number in urban areas		
1986	892	-	565	327	2.8	3.18
1987	1095	22.8	679	416	5.0	4.60
1988	1224	11.8	746	478	7.1	5.77
1989	1313	7.3	795	518	9.5	7.25
1990	1340	2.1	795	545	11.6	8.65
1992	1858	23.1	1101	757	22.4	12.03
1993	2081	12.0	1229	852	64.7	16.69
1994	2471	18.7	1528	943	68.2	27.60
1995	3517	42.3	2100	1417	142.2	40.43
1997	4038	-	2311	1727	-	-
1998	4243	5.0	2363	1880	-	-

Source: Tan Xiangyong, Xin Xian et al.: Analyses of Markets of China's Major Agricultural Products, China Agriculture Press, 2001, p307.

Wholesale markets play a dominant role in vegetable marketing in China. It is estimated that since 1993, about 30% of all vegetables and 40% of all fruit consumed in China have been marketed through wholesale markets. In urban areas, these proportions are much higher (58% for vegetables, 74% for fruit). So far, about 100-200 regional wholesale markets for vegetable have evolved into larger scale markets, including an increasing number of influential organizations for vegetable transactions in large quantities.

Most of the wholesale markets for vegetables in China deal with both the wholesale and the retail trade. In addition, free street/wet markets have been established all over the country forming the basis of the vegetable marketing system in China. The wholesale and street markets handle about 95% of the total transaction volume of vegetables, indicating that the structure of commerce and retail of vegetables in China has changed rapidly, as well as that it is still in an early phase of development.

The vegetable marketing system in China is not very efficient. First, most of the traders are small scale. As to the link between production and market, some case studies show that in Shouguang City (Shandong province) - one of the main producing areas - 70% of the vegetable output is provided to the market by the farmers themselves. This is the situation even in some metropolises, such as Shanghai, Chengdu and Wuhan. As to the link between market and consumption, some case studies also show that the main body of vegetable marketing consists of individual traders. Thus, in general China's vegetable marketing is based on individual traders. Consequently, marketing vegetables from producer to consumer needs relatively much time and is inefficient. Secondly, the marketing method is out of date. Even in wholesale markets - the core of the vegetable marketing system in China - business is done face to face, one to one and with payments in cash. The quality of the vegetables is tested only by the eyes. Some marketing services - such as collecting, transportation and preliminary distribution - have not yet been separated and provided by specialists, but are undertaken by the traders themselves. In addition, the vegetable market system in China lacks a classification and an auction mechanism. Thirdly, the post-harvest losses are very large. For a long time, only the cultivation of vegetables was emphasized, while their preservation and storage requirements were ignored. In addition, the processing capacity is insufficient: only 2-4% of China's vegetable output is processed. The annual loss of vegetables accounts for as much as 30% of the total vegetable output.

The inefficiency of vegetable marketing results in high costs for marketing and a big difference between the producer's price and the consumer's price. According to some surveys, the retail price is 80-100% higher than the price at the wholesale market level, the profit the traders earn is 2-3 times higher than that of the producers, and the producer's price is only about a quarter to two fifths of the consumer's price.

6. China's international vegetable trade

6.1 The general situation of China's vegetable import and export

China's vegetable import and export has developed quite rapidly in the past ten years, with the export of vegetables more important than import in the total volume of trade. According to the statistics of China's Customs service, China exported 2.1 million tons of vegetables in 1995, valued at USD 2.1 billion. China's vegetable export was then affected by the Asian financial crisis, which arose in 1997. During that period, the amount of China's vegetable export remained almost the same as in the previous years, but the value dropped. In 1999, China's vegetable export resumed growth in terms of amount, but it was not until 2000 that the value of China's vegetable export recovered to the 1995 level. On the other hand, China imports only a small amount of vegetables. For example, in 2000, the value of import accounted for only 3.3% of the value export. The import of vegetables consists mainly of foreign varieties and processed vegetable products to meet the demand of international tourism, but China has seen an accelerating increase in vegetable import in recent years (Table 6.1).

Table 6.1 Amount of export and value of import and export of China's vegetable products

	1995	1996	1997	1998	1999	2000	2001	2002	2003
Amount of export (million tons)	2.095	2.174	2.151	2.151	2.774	3.147	3.936	4.657	5.527
Value of export (USD billion)	2.094	1.993	1.859	1.867	1.879	2.034	2.340	2.633	3.068
Value of import (USD billion)	0.012	0.016	0.020	0.026	0.049	0.067	0.080	0.071	0.072

Source:

- Editorial group: Techniques for Pollution-free Vegetable Production, China Agriculture Press, 2002, pp.249-250.
- Ministry of Agriculture: Annual Report on China's Agricultural Development, 2002, China Agriculture Press, 2002, p.25.
- Net for Agricultural Information in China (www.agri.gov.cn).

According to FAO statistics, since 1990 China has been the fifth biggest vegetable exporter in the world, following Spain, Italy, USA and the Netherlands. Between 1990 and 1999, the places of the four countries ranking ahead of China changed drastically: the Netherlands fell from the first to the fourth place, while Spain climbed from the fourth to the first place. However, the portion of China's vegetable export in the total vegetable export of the world is still quite small. Some data indicate that the amount of China's vegetable export makes up only 9% of the world amount. This portion is far below China's share in the total world output of vegetables, which is about 40%. Some analyses even show a share of over 60%. In addition, the amount of China's vegetable export accounted for only 1.31% of its total output in 2000 (FAO data), compared with the 6% for the world. All the above-mentioned indicators suggest that although China is one of the world's largest producers of vegetables, it is not yet a big exporter.

6.2 Structure of China's vegetable trade

6.2.1 Variety structure

Classified by forms of exported vegetables

Generally, China's exported vegetables can be divided into two categories:

- a. Fresh vegetables. This category can be subdivided into two types:
 - Fresh vegetables and frozen vegetables. This is currently the main part of China's vegetable export. According to the statistics from China's Customs service, the export amount of fresh vegetables and frozen vegetables for the country as a whole was 994,500 tons in 1995, accounting for 47.48% of the total vegetable export; the export amount increased to 1,707,800 tons in 2000, accounting for 54.17%.
 - Temporarily preserved vegetables and vegetables processed to keep them fresh. China exported 359,900 tons of this type of vegetable product in 1995, accounting for 17.18% of the total vegetable export; the export amount in 2000 was 381,500 tons, accounting for 12.12%.
- b. Processed vegetables. This category can be subdivided into three types.
 - Pickled vegetables. The export amount of pickled vegetables has remained relatively stable over time, with 231,300 tons in 1995 and 206,600 tonnes in 2000.
 - Dried vegetables (both artificially and naturally dried). China has been exporting dried vegetables for 30 years. According to statistics from China's Customs service, China's export volume of dried vegetables has made up two thirds of the world's total export volume. China exported 130,000 tons of dried vegetables in 1995 and 152,100 tons in 2000.
 - Canned vegetables. China has been producing canned vegetables for 90 years. China exported 508,100 tons of canned vegetables in 1995 and 471,800 tons in 2000. In addition, China produces and exports a very small amount of soup vegetables, which is also a type of processed product.

Classified by varieties of exported vegetables

China exports a wide range of vegetable varieties, but only about 10 are exported in quantities exceeding a thousand tons a year. In 1999, for example, these varieties included spinach, garlic flower shoots and garlic bolt, cow pea and other vegetable peas, potato, pine mushroom, sweet corn, pea, garlic, leaf mustard, lettuce, cauliflower, tomato, carrot and radish, leek and onions (Table 5.2).

Table 6.2 *Vegetables the export of which exceeded 10,000 tons (1999)*

Variety	Quantity (10,000 tons)	Variety	Quantity (10,000 tons)	Variety	Quantity (10,000 tons)
Garlic	29.2	Leaf mustard	6.2	Cucumber	3.5
Onions	20.2	Carrots and radish	4.8	Eggplant	1.7
Beans	10.5	Ginger	4.3	Cauliflower and cabbage	1.6
Edible Fungi	10.2	Spinach	4.0	Tomato	1.4
Potato	7.2	Aquatic vegetables	3.9	Other onions	1.0

Source: Research team on techniques to guarantee vegetable export: technological measures to guarantee vegetable export, China vegetable, No. 1, 2002.

Classified by imported vegetable varieties

China imports only a small amount of vegetables, mainly fresh ones. But in the past few years, the import of fresh vegetables has declined, while there has been an increase in the import of dried edible fungi and vegetables processed in order to keep them fresh. For instance, in 1999 China imported 77,000 tons of vegetables, of which 20,500 tons were fresh, 12,300 tons were vegetables that had been processed to keep them fresh, and 55 tons were dried edible fungi. In terms of varieties, fresh or refrigerated celery (except root tuber celery) and frozen sweet corn were the main imported varieties, the import of which amounted to 13,200 and 11,600 tons, respectively, in 1999. Other major imported vegetable varieties (import amount >1000 tons) are potatoes and peas.

6.2.2 Regional structure

Structure of domestic exporting regions

Currently, China's exporting bases for vegetable products are mainly concentrated in the eastern coastal regions, although they are beginning to shift and expand towards central and western China. The coastal region in eastern China enjoys several favourable advantages for the export of fresh vegetables, such as a good climate, good production conditions, higher levels of planting and processing technology, a developed infrastructure for transportation, the popularization of new vegetable varieties introduced from abroad, and a relatively short distance to the major export markets. Among the 10 major exporting provinces in terms of their export volumes, eight are located in the eastern coastal region; in terms of export values seven of the 10 major exporting provinces are located in that region. According to other statistics, in the late 1990s the amount of vegetables exported from the top 10 exporting provinces accounted for more than 85% of the national total, the top six accounted for about 75%, and the top three for about 60%. In 2000, ranked by their export amounts, the top 10 provinces were Shandong, Guangdong, Fujian, Zhejiang, Jiangsu, Xinjiang, Liaoning, Beijing, Guangxi and Tianjin; ranked by their export values, the top 10 were Shandong, Fujian, Zhejiang, Guangdong, Liaoning, Jiangsu, Sichuan (including Chongqing), Yunnan, Xinjiang and Anhui (Table 6.3). The distribution of domestic vegetable exporting regions is identical to the distribution of domestic vegetable producing regions.

Table 6.3 Top 10 vegetable exporting provinces (2000)

Province	Quantity (10,000 tons)	Province	Quantity (10,000 tons)
Shandong	91.9	Shandong	493.5
Guangdong	55.3	Fujian	481.9
Fujian	52.4	Zhejiang	204.4
Zhejiang	19.3	Guangdong	148.9
Jiangsu	13.1	Liaoning	95.4
Xinjiang	11.2	Jiangsu	91.5
Liaoning	7.9	Sichuan	63.3
Beijing	7.6	Yunnan	62.3
Guangxi	6.6	Xinjiang	48.9
Tianjin	6.2	Anhui	40.5

Source: Editorial group: techniques for pollution-free vegetable production, China Agriculture Press, 2002, p274.

Structure of export markets.

At present, China's vegetable export markets include 150 countries and regions throughout the world. In general, China's vegetable export markets are concentrated mainly in developed regions in Asia. Among them, Japan is the largest market for vegetable exports from China: it consumes a third of China's vegetable exports. China's vegetable export markets are mainly within three trade circles. One is the APEC trade circle. In this circle, China has the advantages in exporting vegetables to neighbouring developed Asian countries/regions, because the distance between China and these countries/regions is short and China's vegetable export can be aimed quite precisely at the demand there. Nevertheless, China has to compete with some neighbouring countries and regions. This circle also includes the US market. The main vegetable exporters to the US market are the developing countries in Central America. The market share of China's vegetable products in the USA is small. Although there is potential in the US market for Chinese vegetable products, China's vegetable products have no geographic advantages due to the long distance between the two countries.

The second circle is the EU trade circle. At present, China has no clear competitive advantages in exporting its vegetable products to this market, because the post-harvesting and processing techniques are not advanced enough and the distance between China and the EU is too great. However, there is a big potential for China to export its vegetable products to the EU market. Within this circle a huge amount of vegetables are traded among EU Member States; especially, Spain, Italy and the Netherlands export a lot of vegetable products to other Member States. The EU also exports large quantities of vegetables to the USA, but imports little from developing countries.

The third circle is the that among CIS (Commonwealth of Independent States) countries. The vegetable markets in Russia and other CIS countries depend largely on vegetable imports from China. As the economy in these countries recovers, China's vegetable exports to them will increase further. The top 10 vegetable importers from mainland China are shown in Table 6.4.

Table 6.4 Top 10 Importing countries and regions for vegetables from mainland China

Ranked by quantity of import	Ranked by value of import
Japan	Japan
Hong Kong	Hong Kong
Korea	Germany
Netherlands	Korea
USA	USA
Germany	Netherlands
Singapore	Italy
Russia	Canada
Indonesia	Singapore
Malaysia	France

Source: Editorial group: Techniques for Pollution-free Vegetable Production, China Agriculture Press, 2002, pp250~251.

The reasons why China exports vegetable products to the above-mentioned countries and regions are directly linked to the insufficiency in vegetable production there. For example, Japan's self-sufficiency rate of vegetables is 83%, Hong Kong's is a mere 20%, Germany's is 41% , Russia's is 86% and Malaysia's is 78%. Besides, China's vegetable export to those countries and regions can also satisfy the consumers' demand for alternative/exotic vegetable varieties. The most typical example is China's export to the Netherlands, because the vegetable self-sufficiency rate of the Netherlands is near 200%, while China's rate also surpasses 100%. The trade of vegetables to some other countries also has this nature; for instance, both Korea's and the USA's self-sufficiency rates of vegetables are at a relatively high level of 98%.

For China's vegetable export, different forms of vegetables have different export markets. Fresh vegetables are mainly exported to Japan, Korea, Singapore, the USA and the Middle East. Some special vegetables (e.g. ginger) are mainly exported to the UK, Australia and France. Pickled vegetables are mainly exported to Japan, Korea, the USA and Singapore (Japan's demand for pickled vegetables is quite huge). Dried vegetables are marketed to western Europe, Japan, the USA, Australia, Korea and Singapore, with western Europe, Japan and the USA being the main markets. Canned vegetables are mainly exported to western Europe, the USA, Japan and Korea. Vegetable soups are mainly exported to the USA, western Europe, Japan and Hong Kong. Refrigerated vegetables are mainly exported to Japan, Korea, the USA, western Europe, New Zealand and Australia.

Structure of China's importing regions

The regions that import vegetables from abroad are mainly located in China's coastal regions. Taking 1999 as an example, Guangdong province and Shanghai municipality were the biggest importers, with imports of 46,200 tons and 11,600 tons of vegetables, respectively. The provinces/municipalities that imported more than 1000 tons of vegetables in that year included Zhejiang, Tianjin, Liaoning, Fujian and Hebei.

Structure of countries exporting to China

China's imported vegetables come mainly from the USA, namely 23,000 tons in 1996 and 53,000 in 1999, accounting for 68% of the total amount of vegetable import in that year. The major items of vegetable import from the USA were fresh vegetables and vegetables processed to keep them fresh. In 1999, the other countries that exported vegetables to mainland China (import >1000 tons) were Thailand, New Zealand, Canada, Hungary, Taiwan and the UK.

7. International competitiveness of China's vegetable industry

7.1 Introduction

There are a lot of methods for analysing international competitiveness or comparative advantages for a certain product. Some methods focus on the actual situation, others on potential advantages. The relatively simple methods use market share and comparisons between domestic and international prices to show the comparative advantage of a certain product. The relatively complicated ways calculate certain parameters, such as the revealed comparative advantage (RCA) and the net export effect. The most complicated, most advanced and most prevailing method is to calculate the domestic resources cost coefficients (DRCC). In this section all the above-mentioned methods are applied to analyse the international competitiveness of China's vegetable industry.

7.2 International market share of China's vegetables

Although in general the share of China's vegetables in the international market (the portion of the amount of China's vegetable export in the total amount of vegetable export of the world) is not high, the shares of some vegetable varieties are relatively high. The average share of China's vegetable export in the world vegetable export is 9%, according to FAO statistics. The vegetable products whose shares in the international market were above the average in 1999 are dried mushrooms (61.6%), temporarily preserved vegetables (57.3%), vegetable juice (37.7%), canned mushrooms (35%), garlic (33.8%), fresh peas (31.7%), dried vegetables (30.4%), pepper (21.8%), fresh mushrooms (18.4%), processed vegetables (15.5%), frozen vegetables (12.9%) and sweet potatoes (9.7%). Others with a share above 5% are cabbage (8%), eggplant (7.4%), tomato paste (6.9%), green peas (6.4%) and onions (5.2%).

7.3 Comparison of domestic and international prices

This comparison shows that the producer's prices for most of China's vegetables are lower than those in other countries. Additionally, the more labour-intensive the vegetables are, the more obvious their advantages in producers' prices. Table 7.1 shows that China's producers' prices are in general lower than those in other countries, except for a very few vegetables, such as China's producers' price for green pea which is higher than that of Australia. For some varieties, China's producers' prices are even a small fraction of the highest producers' prices of other countries. For example, China's producers' price for tomato is only 2.54% of the producers' price in Japan. However, it should be noted that the fixed ex-

change rate between RMB and the US dollar could lower the production prices for Chinese vegetables.

Table 7.1 International Comparison of producers' prices of vegetables, 2001 (USD/ton)

Varieties	Australia	France	Germany	Italy	Japan	Netherlands	USA	China
Potato	189.15	82.10	119.32	231.8	714.9	84.31	130	66.45
Cabbage	184.61	150.51	137.67	305.97	575.67	448.02	220	42.29
Asparagus	1933.36	2545.07	3671.27	1483.51	7001.35	2851.05	1906	484.26
Tomato	316.26	684.16	904.05	113.58	2378.9	1058.96	180	60.41
Cauliflower	259.76	205.25	413.02	301.34	1089.1	896.04	680	42.29
Cucumber	551.31	684.16	266.17	370.88	1790.01	814.59	370	48.33
Eggplant	NA	752.57	NA	370.88	2247.43	1506.98	630	66.45
Onion	NA	342.08	NA	NA	1764.34	NA	NA	70.08
Garlic	NA	1901.96	NA	927.19	NA	NA	917	314.14
Green bean	685.48	1778.81	848.98	839.11	4511.98	692.4	811	157.07
Green pea	185.11	355.76	1009.6	686.12	5289.91	651.67	300	187.27
Carrot	325.84	232.61	238.63	315.25	113.19	266.37	240	57.99
Mushroom	2092.24	1696.71	1927.41	1274.89	NA	1547.71	2230	676.61

Source: Editorial group: Techniques for Pollution-free Vegetable Production, China Agriculture Press, 2002, pp. 267-268.

There is no doubt that this kind of comparison is not completely reasonable. A lower producer's price for a certain product does not mean that it has an advantage in export. There are two reasons for this. First, by comparing prices between different countries, it is preferred to compare the CIF price (the price of the exported product including cost insurance and freight to the importing country) with the domestic market price of the importing country. It is much better to compare the price of the imported product with that of the domestically produced one in the same market. Therefore, the efficiency of marketing is very important in this case. Extra marketing costs may offset the advantages in producers' prices. In fact, marketing expenditure constitutes an important part of the consumer's price for agricultural products. In some cases, producers' prices are only a third of the consumer prices. Second, the comparison does not take into account the differences in quality of the same product. As a result of that, the producer's price of a product can be lower than that of a competitor, but the amount of export is not higher.

7.4 Comparison of production costs

Prices are based on costs. China's vegetable industry has comparative advantages mainly because the industry is labour-intensive, and China has an abundant, low-cost rural labour force. Taking as an example the Chinese onion (which is exported from China to Japan in large quantities), its production costs in China are much lower than those in Japan. Taking labour cost into account, the per kg production cost of the Chinese onion in China is RMB 8.7 lower than that in Japan; without labour cost, the difference is only RMB 3.1 (Table 7.2).

Table 7.2 Comparison of production cost of Chinese onion between China and Japan

Items	Unit	Japan (1)	China (2)	Difference (1) - (2)
Seeds	RMB/ha	8250	15,000	-6750
Fertilizer	RMB/ha	21,150	6450	14,700
Pesticide	RMB/ha	19,950	750	19200
Machinery, irrigation, equipment, electricity, etc.	RMB/ha	66,420	6500	59,920
Labour	RMB/ha	191,715	30,333	161,715
Total cost	RMB/ha	307,500	59,700	247,800
Yield	kg/ha	30,015	37,500	-7485
Production cost without labour cost	RMB/kg	3.9	0.8	3.1
Production cost with labour cost	RMB/kg	10.2	1.6	8.7

Source: An Yufa et al.: A Study on The Competitiveness of China's Vegetable Export to Japan, Chinese Rural Economy, No. 11, 2002.

However, one should not ignore the fact that with the development of the economy, the production costs of agricultural products in China (and especially the labour costs) are tending to increase rapidly. This trend can be observed more clearly in the suburbs of some metropolises. For instance, the production costs of nine major agricultural products in the suburbs of Beijing (i.e. grain, vegetable, watermelon, peanut, apple, freshwater fish, pig, egg and dairy cattle) increased steadily in 1984-1996. Among these products, the increase in vegetable production costs ranked on top. The per ha production costs had increased by 5.8 times, or 17.3% annually; the labour cost had increased faster than the material cost, by 8.0 and 4.5 times, respectively. As of 1995, the production costs of the major agricultural products in Beijing suburbs started to be higher than those in neighbouring areas. For example, the per 100 kg production cost of vegetables in Beijing was 2.6 times higher than that in Tianjin and 3.82 times higher than that in Hebei. Furthermore, the labour costs in Beijing were much higher than those in Tianjin and Hebei, by 3.54 and 4.58 times, respectively. This to some extent explains the aforementioned changes in vegetable production regions.

With declining vegetable prices, the trend of increasing vegetable production costs means that China's vegetable production faces more and more severe situations. Since 1995, the price level of vegetables in China has been falling considerably: the prices of most in-season vegetables have dropped by 20% or more, while the prices of some off-season vegetables that have become quite popular have dropped by 50% or more. Meanwhile, the prices of fertilizers and plastic film for covering greenhouses have remained almost at the same high level.

7.5 Revealed comparative advantages of China's vegetable products

The revealed competitive coefficient (RCA) of China's vegetables is calculated by the ratio of the share of China's vegetable export in China's total export to the share of world's vegetable export in the world's total export. $RCA > 1$ means there is a comparative advantage for the product.

Calculation shows that from the 1970s till the 1990s, Australia and New Zealand had robust competitiveness in vegetable products, though the competitive coefficients dropped slightly (Table 7.3). China and other countries in Southeast Asia also had a quite robust, though the coefficients decreased. The competitiveness of the USA and Central-north America remained in the middle, but increased in the 1980s and then fell in the 1990s to the level of the 1970s. The RCA of the EU had kept going up, but was still quite weak.

Table 7.3 Vegetable Competitive coefficients of selected countries

Period	China	Japan	Korea	Southeast Asia	Australia & NZ	Central-north America	USA	EU
1970s	3.14	0.31	0.70	3.51	2.45	1.11	1.11	0.74
1980s	2.24	0.16	0.56	2.12	2.34	1.49	1.58	0.84
1990s	1.86	0.10	0.41	1.56	2.08	1.18	1.16	0.95

Source: Editorial group: Techniques for Pollution-free Vegetable Production, China Agriculture Press, 2002, p263.

7.6 Net export effect of China's vegetable export

The effects of China's vegetable export can be measured by net export effect indicators. This indicator is the ratio of China's net export value of vegetables to the sum of China's export value and import value of vegetables. The closer the indicator is to 1, the better the export's effect.

Calculations show that China's vegetable products as a whole have very strong comparative advantages, with the indicators remaining above 0.9 over time (Table 7.4). Classified by forms of vegetable products, the net export effect indicators of fresh vegetables (including vegetables processed to keep them fresh and frozen vegetables), processed vegetables (including canned vegetables, dried vegetables and vegetable juice) were mostly above 0.9. However, over time the net export effect indicators for fresh vegetables steadily decreased, which means that the comparative advantage of fresh vegetables was declining. Among the processed vegetable products, canned vegetables had maintained a very high level of comparative advantage, with the net export effect indicators quite stable. The net export effect indicators for dried vegetables dropped slightly. The net export effect indicators for vegetable juice were relatively low in general, but were climbing in a fluctuating pattern. Classified by vegetable varieties, the net export effect of celery had always been negative and kept declining, which means it has no competitive advantage at all. The net export effect indicators for pea and potato dropped, but they still have some competitive advantages. Other vegetables hold very strong competitive advantages, with stable, very high net export effect indicators.

Table 7.4 Net export effect indicators for China's major exported vegetables

Variety	1995	1996	1997	1998	1999
Total vegetable export	0.988	0.984	0.978	0.972	0.949
Processed to keep fresh	0.982	0.976	0.975	0.941	0.877
Fresh and frozen	0.985	0.976	0.963	0.965	0.947
Vegetable juice	0.217	0.821	0.859	0.669	0.802
Canned veg.	0.994	0.999	0.998	0.999	0.998
Dried veg.	0.992	0.988	0.989	0.983	0.948
Ginger	0.996	0.996	0.987	0.988	0.991
Onion	0.982	0.983	0.958	0.976	0.983
Mushroom	0.990	1.000	1.000	1.000	0.990
Garlic	1.000	1.000	1.000	1.000	0.999
Pea	0.985	0.864	0.753	0.678	0.483
Celery	-0.423	-0.827	-0.972	-0.984	-0.934
Potato	0.892	0.523	0.456	0.425	0.421
Carrot & radish	0.996	0.996	0.994	0.996	0.998
Tomato	1.000	0.999	0.997	1.000	0.997
Spinach	1.000	0.994	1.000	1.000	1.000

Source: Editorial group: Techniques for Pollution-free Vegetable Production, China Agriculture Press, 2002, p265.

7.7 Domestic resource cost coefficients of selected varieties of vegetable

Domestic resource cost means the value of the cost of domestic resources consumed in the production to earn one unit of foreign currency. It is actually the cost-effect ratio, taking the world market as the frame of reference and the whole country as an economy entity. Its indicator is the domestic resource cost coefficient (DRCC), which is expressed as a fraction. In the fraction, the numerator represents the cost of domestic resources consumed in producing a certain commodity, which is estimated by shadow prices or opportunity costs; the denominator represents the net earning or saving of foreign currency in producing the commodity with domestic resources. The DRCC formula is: $DRCC = \frac{\sum_{j=k+1}^n a_{ij} v_j}{p_i - \sum_{j=1}^k a_{ij} p_j}$ where

a_{ij} $j=1 \dots k$ is the amount of tradable input j consumed in producing one unit of commodity i ; a_{ij} $j=k+1 \dots n$ is the amount of input j which is a domestic resource or not tradable and is consumed in producing one unit of commodity i ; v_j for the shadow price of input j ; p_i^b and p_j^b for the shadow prices of tradable commodity i and input j .

It is clear that the numerator represents the cost of the goods that cannot be traded, and the latter half of the denominator represents the cost of the goods that can be traded. The lower the DRCC ($DRCC \geq 0$), the more competitive the commodity.

In this report three varieties of vegetables have been selected for calculation of the DRCC, namely garlic, potato and radish. The selection is based on the importance of these vegetables as exports and the availability of relevant data. The DRCCs of garlic, potato

and radish are 0.14, 0.281 and 0.2115, respectively. All three DRCCs are quite low, showing they are relatively strongly competitive.

Table 7.5 Data for estimating the DRCC of garlic (units: RMB/mu)

Item	1997	1998	1999	Average
I. Non-tradable inputs				
1. Manure	201.93	86.07	127.52	138.51
2. Animal power	6.60	12.67	9.00	9.42
3. Machinery	9.67	2.80	12.78	8.42
4. Irrigation	26.53	10.79	15.19	17.5
5. Shelter	/	/	/	/
6. Other direct costs	/	15.53	1.80	8.67
7. Depreciation	38.43	38.87	48.33	41.88
8. Allocation of initial production cost	/	/	/	/
9. Small farming tools and reparation	27.95	9.01	9.93	15.63
10. Marketing cost	89.81	85.87	86.67	87.45
11. Labour cost	773	455.55	483.27	570.61
12. Land rent	42.5	26.27	38.44	35.74
13. Management cost	5.60	1.0	1.0	2.53
Subtotal	1182	744.22	833.94	920.05
II. Tradable inputs				
1. Seedling	358.34	211.80	272.08	280.74
2. Fertilizer	195.14	238.91	193.83	209.29
3. Pesticide	35.37	69.31	52.63	52.44
4. Plastic film	4.55	/	/	/
5. Fuel and electricity	/	/	/	/
Subtotal	593.4	520.02	518.21	543.88
III. Export price (RMB/kg)	4.98	4.36	3.31	4.22
IV. Yield (kg/mu)	1679	1919	1718	1772

Source: Survey Data on Costs of China's Agricultural Products, relevant years.

Table 7.6 Data for estimating the DRCC of potato (RMB/mu)

Items	1997	1998	1999	Average
I. Non-tradable inputs				
1. Manure	75.97	64.82	55.42	65.4
2. Animal power	9.80	7.86	8.12	8.59
3. Machinery	0.91	6.27	12.68	6.62
4. Irrigation	7.13	6.97	11.33	8.48
5. Shelter	/	/	/	
6. Other direct costs	/	/	0.61	0.61
7. Depreciation	9.548	6.67	14.52	10.25
8. Allocation of initial production cost	/	/	/	
9. Small farming tools and reparation	4.09	4.35	5.17	4.54
10. Marketing costs	22.19	29.48	25.81	25.83
11. Labour costs	233.24	171.55	180.50	195.10
12. Land rent	28	50.05	18.75	32.27
13. Management costs	1.14	4.42	1.80	2.45
Subtotal	392.02	352.4	340.68	361.70
II. Tradable inputs				
1. Seedling	134.69	118.38	124.37	125.81
2. Fertilizer	42.04	51.72	51.09	48.28
3. Pesticide	5.52	3.70	3.99	4.40
4. Plastic film	8.05	17.88	8.77	11.57
5. Fuel and electricity	1.74	0.40	3.69	1.94
Subtotal	192.04	192.08	192.91	192.34
III. Export price (RMB/kg)	1.17	1.143	1.177	1.163
IV. Yield (kg/mu)	1282	1605	1559	1482

Source: Survey Data on Costs of China's Agricultural Products, relevant years.

Table 7.7 Data for estimating the DRCC of radish(RMB/mu)

Item	1997	1998	1999	Average
I. Non-tradable inputs				
1. Manure	46.25	65.98	69.19	60.47
2. Animal power	8.42	3.51	5.39	5.77
3. Machinery	5.08	7.35	7.85	6.76
4. Irrigation	16.98	11.61	13.03	13.87
5. Shelter	/	/	0.12	0.12
6. Other direct cost	0.91	1.52	1.77	1.40
7. Depreciation	24.596	28.138	35.486	29.41
8. Allocation of initial production cost	0.74	/	/	0.74
9. Small farming tools and reparation	8.70	8.64	3.23	6.86
10. Marketing costs	23.77	56.07	56.22	45.35
11. Labour costs	430.452	317.184	389.967	379.20
12. Land rent	30	38.66	37.96	35.54
13. Management costs	3.26	10.51	9.36	7.71
Subtotal	599.158	538.60	613.78	583.85
II. Tradable inputs				
1. Seedling	38.02	34.21	39.55	37.26
2. Fertilizer	52.24	69.43	62.84	61.50
3. Pesticide	20.04	26.47	25.29	23.93
4. Plastic film	2.30	6.80	7.47	5.52
5. Fuel and electricity	1.24	0.91	5.49	2.55
Subtotal	113.84	137.82	140.64	130.77
III. Export price (RMB/kg)	2.684	2.238	1.804	2.24
IV. Yield (kg/mu)	2607	2510	2724	2614

Source: Survey Data on Costs of China's Agricultural Products, relevant years.

8. The vegetable industry in Anqiu county

8.1 Introduction

The data in this section are derived from two visits to Anqiu county in Shandong province, one by CASS staff and one by the LEI researchers. Both teams met local government officials and representatives of producers and managers of companies/processing companies. Some figures in this section are merely indicative, because exact data on exports, for instance, are not collected by the local statistical office.

Anqiu City is a county-level city located in the central part of Shandong province. There are 24 towns/townships and 1440 villages under the jurisdiction of the city. At the end of 2002, the total population of the city was 1.09 million and the total number of households was about 308 thousand. Thus, on average, each rural family in Anqiu consists of 3.6 members. The total land area for the city is about 2010 square kilometres, of which 98,461 ha are classified as arable. On average, the per capita arable land area is only about 0.09 ha.



Figure 8.1 Location of Anqiu

Anqiu has a relatively large agricultural population. In 2002, for instance, its agricultural population amounted to 0.97 million, that is, 88.9% of the total population, which is substantially more than for China as a whole (73.3%). It is obvious that Anqiu is an agriculturally oriented rather than an industrialized city.

Anqiu's agriculture has a unique feature in that it is focused on producing vegetables for export. In fact, within Shandong - and perhaps even within China - Anqiu is one of the largest vegetable producing counties and one of the largest county-level exporters of vegetables to overseas. In 2002, for instance, the total vegetable production in Anqiu amounted to 2.17 million tons, which accounted for 2.8% of total vegetable production in Shandong province. According to estimates made by Anqiu local officials, 50% of Shandong's vegetable exports originate from Anqiu. But the exact vegetable export figures are not available since the local statistical bureau does not collect the information.

8.2 Vegetable production in Anqiu

Agricultural Land Use

As elsewhere in China, the arable land in Anqiu traditionally was used extensively for grain production. But nowadays it is used in general for four farming activities, namely for the production of grain, vegetables, fruit, and cash and other crops (Figure 8.2 and Table 8.1). Table 8.1 shows the land area that is used for different crops. It should be pointed out that in recent years the importance of grain production has been declining while the importance of vegetable production has been increasing. The figures in Table 5.1 show that about a third of the arable land is used for vegetable production, a third for grain production and a third for cash crop and fruit production. This indicates that agriculture in Anqiu is in a transition from traditional grain production towards commercial vegetable production.

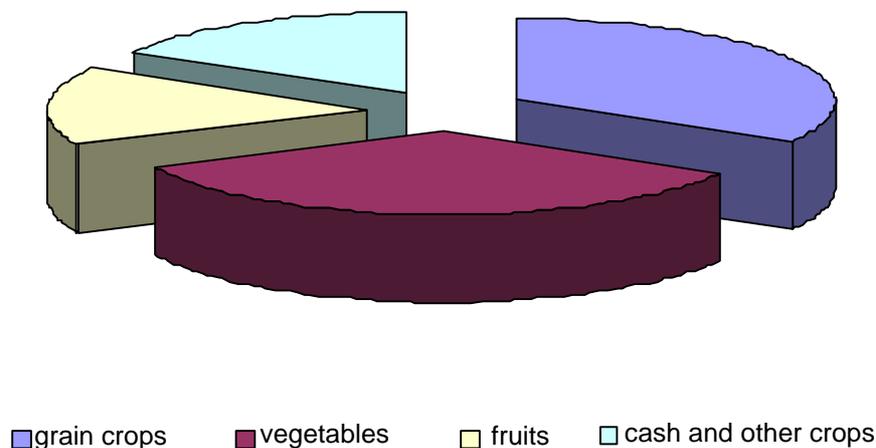


Figure 8.2 Arable land use pattern in Anqiu

Table 8.1 Arable Land Use in Anqiu City in 2002/2003 (1000 ha)

Grains		Vegetables		Fruits		Cash & other crops	
Crop	Area	Crop	Area	Crop	Area	Crop	Area
Wheat	16.3	Fresh ginger	7.3	Peach	8.1	Cotton	3.9
Maize	16.7	Garlic	3.3	Apple	2.0	Peanut	7.8
Millet	0.2	Scallion	4.7	Pear	1.4	Tobacco	2.9
Sorghum	0.2	Onion	2.1	Grape	0.4	Water melons	5.3
Sweet potato	6.4	Chinese cabbage	2.3	Chestnut	1.4	Sweet melons	0.5
Others	2.4	Others	24.5	Others	6.3	Others	0.5
Total	42.2		44.2		19.6		20.9
Percent.	33.3%		34.8%		15.4%		16.5%

Source: Collected from local officials during the field trip, October 2003.

Notes:

- 1) The breakdown of the crops is not a common statistic, only for analysis of this research.
- 2) Areas are calculated based on the sown rather than the physical land area.

As Table 8.1 illustrates, grain production remains an important farming activity in Anqiu. For instance, in 2002/2003 the total land area for grain production was about 42,200 ha, which accounted for 33.2% of the total amount of agricultural land. The most important grain crops are wheat and maize/corn. In 2002/2003, the planted areas for the two crops were 16,300 ha and 16,700 ha, respectively. The land area used for these two crops accounted for 78.2% of the total used for grain crops. In addition to wheat and maize, sweet potato and soybean are important crops. The land area used for these two crops accounted for 19.9% of the total amount of land used for grain crops. Thus, the land area used for the four crops accounted for 98.2% of the total for grain crop production.

Vegetable production is becoming the most important sector of agriculture in Anqiu. In fact, vegetable production has undergone rapid growth in the past 12 years, in terms of both production area (Figure 8.3) and total output (Figure 8.4). The vegetable-planted area increased from 10 thousand ha in 1990 to 52 thousand ha in 2002, and the total vegetable production from 425 thousand to 2.2 million tons. The two diagrams illustrate the rapid growth of vegetable production in Anqiu over the past 12 years.

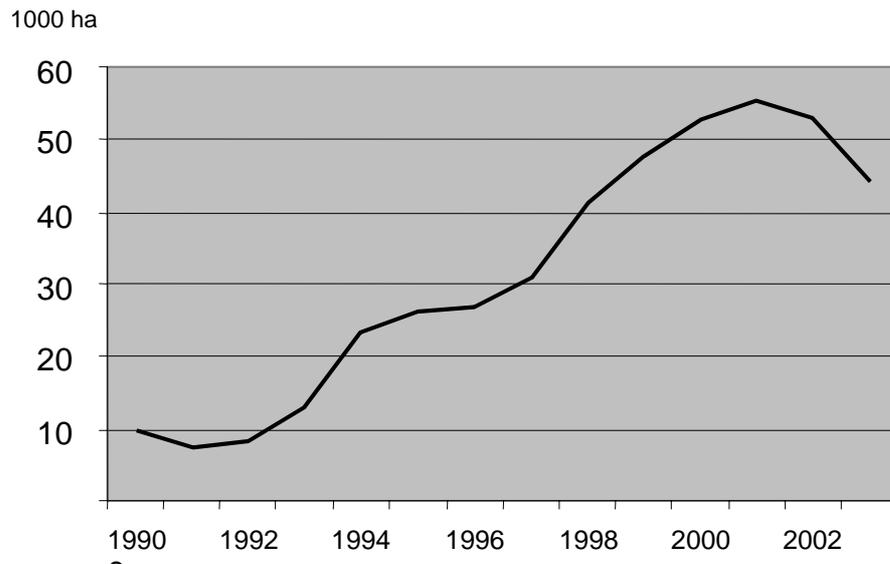


Figure 8.3 1990-2003 Vegetable planted area in Anqiu

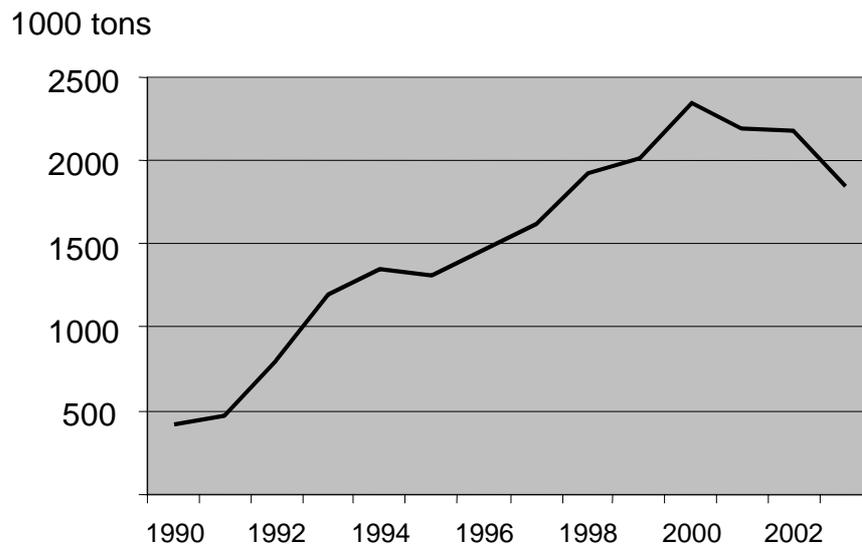


Figure 8.4 1990-2003 Total vegetable production in Anqiu

Fruit production and cash/other crops production are much less important than the grain crops and vegetables. In 2002/2003, the total amount of land used for cash/other crops and fruit production were 20,900 ha and 19,600 ha, and accounted for 16.5% and 15.4% of the total agricultural land, respectively (Table 8.1). Among cash/other crops, peanut, melons, cotton and tobacco are the most important. The planted land area for the four crops accounted for 97.6% of the total land used for cash/other crops.

In summary, the land used for grain crops is declining in Anqiu. In the meantime, the land for cash/other crops and fruit production is growing, but not as fast as the land used for vegetable production. The landuse pattern in Anqiu is unique: it is not found at the county level in any other part of China.

Varieties of Vegetables

Farmers in Anqiu produce different varieties of vegetables. The list is too long to name all the varieties the farmers grow here. In general, there are three destinations for the vegetables produced in Anqiu, namely local retail markets for local consumption, local wholesale markets for domestic markets and local wholesale markets for export markets. However, the amount of vegetables that go to the local retail markets is relatively insignificant in comparison with the total amount that goes to the export markets and local wholesale markets. It is estimated that about 50% of the vegetables produced in Anqiu are sold in the overseas markets, 30% in the domestic markets through the local wholesalers and 20% in the local markets. As the export markets are the focus of this report, they are discussed later in this report in more detail. The vegetable varieties, planted area and total production for each variety are summarized in Table 8.2.

Table 8.2 Area and production of different varieties of vegetables in Anqiu in 2002/2003

Vegetable	Planted area (ha)	Production (1000 tons)	Vegetable	Planted area (ha)	Production (1000 tons)
Ginger	7333	330	Potato	2320	100
Garlic	3300	750	Cabbage	540	28
Scallion	4687	200	Capsicum	553	25
Onion	2113	150	Hot pepper	1400	5
Eggplant	867	30	Asparagus	1693	50
Cucumber	1313	80	Lettuce	360	13
Kidney bean	1700	450	Lotus root	133	8
Tomato	2093	90	Great burdock	560	40
Leek	1560	40	Broccoli	380	15
Celery	1007	52	Radish	807	15
Coriander	853	18	Taro	2313	80
Spinach	473	8	Chinese yam	173	10
Chinese cabbage	2307	150	Long bean	380	10
Carrot	467	20	Others	2940	75

Source: provided by the local officials during field trip, Oct. 2003

Technologies

All the technologies that farmers adopt for vegetable production are conventional, for example irrigation, plastic covers, plastic greenhouses, fertilizers and pesticides. These technologies have been widely used by the vegetable producers in Anqiu for years.

Vegetable watering is not a problem in Anqiu, because almost the entire 44,200 ha used for vegetable production in the county/city is located along the banks of the Wenhe and the Quhe rivers. According to local officials, all the land for melons and vegetable production can be irrigated when needed.

The plastic covering technology - which is called the 'White Revolution' in rural China - has been widely used by Chinese farmers for decades now. Farmers use very thin plastic to cover the land after sowing crop seed in the soil. The plastic helps to keep the soil warm and to maintain its moisture, helps the seeds to germinate and helps the farmers to have the crops ready for marketing earlier than the crops grown under natural conditions (allowing the farmers to sell their crops at a market premium). It is reported that the plastic covering technology has been applied to about 13,300 ha (30%) of the vegetable production land in Anqiu.

The plastic greenhouses are the most common conventional technologies that farmers have adopted in Anqiu. These solar-heated greenhouses have a wall on the north and a plastic covered dome on the south; the gross size is an average of 1 mu (about 666.7 m²). Plastic greenhouses can be found in most villages. There are two types of plastic greenhouses: heated greenhouses (which, as they name suggests, can be heated in winter) and solar-heated plastic greenhouses, in which vegetables grow at the ambient temperature (in early spring and late autumn). It is reported that at present there are 10,000 heated plastic greenhouses occupying a land area of 867 ha, and 68,000 solar-heated plastic greenhouses occupying a land area of 5,867 ha. The two types of greenhouses together occupy a land area of 6,667 ha, or about 15% of the total vegetable-planted land in Anqiu. This implies that a significant amount of vegetables are produced in the open fields. Presumably, most of the vegetables produced in greenhouses go to export markets.

The application of fertilizers and pesticides is well under control in Anqiu. It seems that vegetable safety in Anqiu has significantly improved compared to the rest of China. This issue is further discussed in detail later in this report. It should be pointed out that in most cases, the seeds of vegetables which are for export markets are imported from vegetable importing countries, such as Japan, Korea, the USA and Israel. Good examples for this are the scallion seed planted in Anqiu, which is imported from Japan - the largest scallion export market for Anqiu - and the onion seed, which is imported from Korea, the largest onion export market for Anqiu. The production of the imported seeds involves high-tech methods (such as biotechnology), and certain seed cannot be produced in China at present. This means that if China succeeds in increasing its exports of vegetables, it will need to import more vegetable seeds.

Seasonality of vegetable production

Vegetables are seasonal crops if grown under natural climate conditions. However, greenhouse technology makes a difference. As mentioned, the plastic greenhouse is commonly applied to vegetable production in Anqiu. For those vegetables that grow under natural conditions, some of the varieties can be harvested only once a year while others can be harvested more than once. For instance, the scallion is harvested three times a year, onions twice a year and garlic only once a year. Normally, July to October is the busiest season for vegetable harvesting in Anqiu. Vegetables that grow under greenhouse conditions are no longer seasonal crops. But, generally speaking, greenhouses are mostly used for leafy rather than root vegetables.

Farm structure

As regards farm size, vegetable growers can generally be categorized into three groups, namely non-specialized household growers, specialized household growers and corporate growers/companies. There are about 20 large corporate growers, each of which cultivates on average more than 60 ha (multiple cropping area, the same hereafter) annually. There are also 50 specialized household growers; the farm size for this group ranges from 6 to 60 ha. The majority of the vegetable growers are non-specialized household growers (roughly 100,000 households, or a third of all rural households in Anqiu). On average, each of the non-specialized households grows 0.44 ha of vegetables. However, there are great variations in farm size among the non-specialized households.

Vegetable growers can either concentrate on a single variety of vegetable or produce different varieties at any one time. According to the figures provided by local officials, there are about 80,000 growers producing ginger, 60,000 producing scallions, 40,000 producing garlic, 10,000 producing asparagus, 1000 producing great burdock, and 50,000 growers producing Chinese cabbage, cucumber and other vegetables.

Different types of production bases

'Production base' is a special term used in China to refer to a large plot of land used to grow a certain vegetable crop (e.g. ginger or garlic). China started the Household Responsibility System (HRS) in the rural areas in the early 1980s. The implementation of the HRS broke down the large areas of the former collectively owned land into small family plots. As a result, most Chinese farmers worked individually on their small family plot. More often, though, each farmer grew his own favourite crop varieties, which might have been very different from those of his neighbours. Since the introduction of HRS, it has been rare to find a large piece of land on which a few families grow the same variety of crop. A much larger piece of land, however, is needed for commercial vegetable production, especially for the foreign export markets. This means that some neighbouring farmers have to organize and coordinate themselves to make a large piece of land available for a single variety of vegetable. This large piece of land is the production base.

Vegetable production bases are very important for the vegetable processors and for food safety reasons, because they need to be able to carry out their own field management over the crops, for instance, the control of fertilizers and pesticides applications. Processors, and especially the large ones, tend to trust only their own field management because they rely heavily on vegetables produced in the production bases for their processing activities. In fact, a very large proportion of the processed vegetables in Anqiu are produced on production bases. However, the relevant statistics are not available at the moment.

There are two types of vegetable production bases in Anqiu, namely farmer's/contracted production bases and processors' own production bases. The former are organized and established by a number of farmer's families who have the same interests and agree to grow the same variety of vegetable in order to meet the requirements of processors by signing a marketing contract. It is sometimes difficult to establish a farmers' production base because the neighbouring farmers have to agree to contribute their family plots to a large piece of land plot in order to meet the production base standards required by the local government and the processors. As a result, the farmers must coordinate themselves, and such is not always easy. A production base can be established by exchanging a

farmer's family plot with another family plot located elsewhere. The size of a farmer's production base in Anqiu may vary a great deal both within a village and from village to village and township to township. But, in general, a production base must not be less than 6.67 ha of land per plot in which only one crop variety is grown, according to local government policies. According to a local government report, so far a total of 26,000 ha of farmer's production base have been developed in Anqiu.

Processors' own production bases are established by large processors. In order to have their own production bases, processors usually source their land either from individual farmers or from village collectives (and on some occasions from state-owned farms) by signing land contracts with land owners/users. The contract is normally effective for 2-3 years. After it expires, the contract can be renewed. The processors can source their production bases from local farmers in two ways: they can rent land from farmers or exchange land with farmers at another location. According to the local government report, 2933 ha of processors' own production bases have been developed in Anqiu. As with farmers' production bases, the size of a processor's own production base varies from less than ten ha to hundreds of ha.

Not all the vegetable production bases of the processing companies in Anqiu are located locally. Apart from the local production bases, some of the large processors have recently extended their production base to outside Anqiu or even outside Shandong province. Some of the large companies are reported to have developed their production bases in such provinces as Shanxi, Inner Mongolia, Yunnan, Guangxi, Zhejiang and Hainan. Importantly, some large processors are still expanding or planning to expand their production base outside Anqiu.

Contract farming arrangements

Vegetable processors source their vegetables not only from their own production bases (which are really the corporate production bases mentioned above) but also from the farmers' production bases, because their own production bases can meet only a small proportion of the total demand for processing. When processors plan to purchase vegetables from a farmers' production base, a contract is arranged a year in advance between the producers and the processors. The contract needs to be signed every year. The processors can sign a contract either directly with the individual farmers or indirectly through village committees. It is common that once the contract is signed the processors provide the producers with the key production inputs (e.g. seeds, fertilizers and pesticides) needed for vegetable production. These inputs are provided to the farmers as a production loan in kind and are repaid to the processors at the end of production when the processors purchase vegetables from the producers and deduct the loan from the sales.

8.3 Vegetable processing

Vegetable processing is becoming an important sector of the vegetable supply chain. In fact, the vegetable production sector in Anqiu has more or less stabilized while the processing sector is expanding very rapidly. It is reported that there are currently more than 1000 vegetable processors in Anqiu. According to the local government report, however,

in Anqiu there are only 328 processors with assets greater than RMB 500,000. This indicates that most of the vegetable processors in Anqiu are small as regards size/processing capacity.

Classification of processors

Processors can be categorized by ownership into sole foreign proprietorship (SFP), foreign joint ventures (FJV), corporate processors (CP) and privately owned individual processors (POI). The SFPs, FJVs and CPs are large processors, while almost all the POIs are small processors. In most cases, the SFPs and the FJVs are engaged mainly in deep/further processing, while the CPs and the POIs are engaged mainly in primary processing.

Although local government officials normally do not collect information from food processors, they do collect some basic figures - such as annual turnover, gross profit, total investment and total export value - from foreign investment companies for police and decision-making purposes. The basic figures for the top eight vegetable processors with foreign investment are listed in Table 5. 3. Apart from the government sources, we visited seven food processing companies during our field trip; the basic figures we collected are summarized in Table 5.4.

Table 8.3 Top eight vegetable processors with foreign investment in Anqiu 2002

Company	Turnover (RMB 1000)	Gross profit (RMB 1000)	Total investment (USD 1000)	Export value (USD 1000)
Anqiu Fuhua Food Co.	105,580	27,035	4760	12,911
Anqiu Fukesi Food Co.	16,651	2391	2100	2112
Santong Food (Weifang) Co.	8242	-1190	2000	997
Weifang Xinsheng Food Co.	26,203	25	800	3223
Weifang Rihe Food Co.	17,057	-1598	500	2004
Anqiu Yihua Food Co.	2768	-337	450	334
Anqiu Xinsheng Food Co.	6596	52	350	581
Anqiu Linfu Food Co.	10,924	103	150	1320

Source: provided by local officials during field trip, Oct. 2003

Table 8.4 Basic figures of the seven processors interviewed

Company	Ownership	Fixed assets (RMB million)	Processing capacity (tons)
Anqiu Deli Food Co.	Privately owned	6	12,000
Anqiu Zhendong Food Co.	Joint venture with Japan	15	15,000
Anqiu Linfu Food Co.	Sole H.K Investment	6	7000
Foodstuff Foreign Trading Co.	Corporate	200	60,000
Anqiu Wanxin Food Co.	Joint Venture with the USA	60	18,000
Dongfanghong Food Co.	Privately owned	Not available	10,000
Anqiu Fuhua Food Co.	Sole Japanese Investment	JPY 4 billion	N/A

Source: provided during field trip, Oct. 2003

The vegetables processed

As discussed, many varieties of vegetables are produced in Anqiu, but not all varieties are processed. Generally speaking, varieties for the domestic markets are not processed, while those for the export markets are processed, as required by foreign importers. The processed

vegetable varieties are mainly ginger, garlic, scallion, onion, taro, great burdock, Chinese cabbage, etc.

In general, there are two categories of processed vegetables, namely primarily processed vegetables and further/deeply processed vegetables. Primarily processed vegetables are vegetables that are simply handled by processors. Vegetable handling normally involves washing, grading and packaging. How vegetables are handled depends entirely on the nature of the variety and on the buyer's requirements. For instance, a ginger processor we interviewed washed, graded and packaged ginger in order to meet the requirements of the Japanese buyers. On another occasion, an onion processor we spoke to simply graded and packed onions for the Korean markets. Further processed vegetables are processed from their fresh form into different forms of products. The further processed vegetables include such products as vegetable juice (e.g. spinach juice), vegetable mash (e.g. mashed garlic), dried/dehydrated vegetables (through quick-freezing technology), pickled vegetables (e.g. pickled cucumbers and garlic) and vegetable powders (e.g. food spices).

In general, the small processors are engaged in primary processing. This is because they have limited capital to invest in the fixed assets required for further processing (e.g. buildings and equipment), have limited access to advanced technology for further processing, and have limited market information, especially information on buyers. On the other hand, the large processors concentrate on further vegetable processing. This is because they can afford to invest in the fixed assets needed for further processing, further processed vegetables generate high value added (the processor can market its products for premium price, and in turn is able to enjoy the benefits from marketing its premium products), and they have many other advantages the small ones do not, such as advanced technology, market information and access to international markets.

8.4 Vegetable marketing and exporting

As mentioned, three marketing channels are generally available to the vegetable producers in Anqiu, namely local markets, domestic markets and foreign export markets. All the small and large producers target the overseas export markets. They do their best to meet the export market requirements in order to gain the export market premium. But not all the producers and not all the vegetables produced meet the export market requirements. Normally those vegetables, which meet export standards, are sold in the international markets and those vegetables, which do not, are sold in either the local or the domestic markets. However, the following discussions concern only the export markets.

Overview of vegetable exporting in Anqiu

Anqiu has been exporting vegetable to overseas markets for only a relatively short time. In fact, it exported very few vegetables to foreign countries until the early 1990s. It started exporting vegetables in 1990 when a Taiwanese firm began to invest and establish the very first vegetable processing enterprise in Anqiu: this sole foreign proprietorship was named Anqiu Yongfeng Food Industry Co. Ltd. It is said that the company purchased vegetables from farmers at a price, which was as high as double the local market price, and then processed and exported the vegetables. The company generated a healthy profit from exporting

vegetables and the Anqiu farmers increased their incomes from selling their vegetables to the company. Thus, it was a win-win situation.

When the company started to export the vegetables from Anqiu to foreign countries, it not only sold the vegetables produced in Anqiu in the overseas markets but also sold the vegetable brand of Anqiu in the markets. For this reason, foreign buyers came to Anqiu seeking investment opportunities in vegetable production and processing. As a result, there are now more than 50 foreign investments in vegetable processing, including sole foreign investments and foreign joint ventures.

Anqiu accounts for about 6% of China's total vegetable export and is currently the largest county-level vegetable producer for the foreign export markets in China, and its export share is growing very rapidly. Official statistics shows that Anqiu exported 1 million tons of food products, mainly processed vegetables and fresh vegetables through different exporting channels in 2002 and the total export value was estimated at RMB 2 billion (about USD 240 million).

The vegetables exported

Vegetables can be broadly categorized into three types, namely leaf type (e.g. spinach, lettuce, leek, cabbage), fruit type (e.g. cucumber, eggplant, tomato) and stem and root type (e.g. celery, ginger, scallion, onion, radish, taro, potato). The most significant proportion of exported vegetables produced in Anqiu is comprised of stem and root types, including ginger, scallion, onion, taro, Chinese yam and great burdock. This is the impression we had during our field survey when we visited some of the producers and processors. This fact was also told to us by the local officials who accompanied us for the survey. However, the statistics for each of the vegetable variety exported are not available at the moment since there are no institutions to collect such information in Anqiu.

Another way to view the exported vegetables is to group them into six types according to the type of processing, namely fresh vegetables, frozen vegetables, pickled vegetables, dehydrated vegetables, mashed vegetables and canned vegetables. The most significant proportion of exported vegetables processed in Anqiu comprises fresh vegetables, including ginger, scallion, onion, taro, Chinese yam and great burdock.

The question is why mainly the stem and root type of vegetables in a fresh form are exported from Anqiu. The answer to this question involves both economic and food safety factors. The cost of processing fresh vegetables (primary processing) is low. This is because primary processing requires much less capital than further/deep processing to be invested in workshops and equipment, and primary processing is labour-intensive and needs only unskilled labourer, and labourers – especially unskilled labourers – are very cheap in Anqiu. According to a company we interviewed, an unskilled labourer costs about RMB 800-900 (roughly USD 100) a month. For food safety reasons, the chances of stem and root type vegetables becoming polluted with pesticides are much less than they are for the leaf type. Consequently, overseas buyers are less concerned about food safety issues when it comes to the stem and root types. This is perhaps why both small and large processors in Anqiu are involved in fresh vegetable processing and exporting.

Destination countries

According to a local government report, the exporters in Anqiu export vegetables to more than 30 countries and regions throughout the world. These countries include Japan, Korea, Southeast Asian countries, Middle Eastern countries, Central and North America, the European countries, and Taiwan and Hong Kong. The largest vegetable importers are Japan and Korea. The various importing countries have different demands in terms of vegetable varieties and types. For instance, Japan is the largest importer of fresh ginger and scallion from Anqiu, while South Korea is the largest importer of fresh onions and Chinese cabbage from Anqiu. Table 5.5 provides a picture based on the information provided by the seven processors we interviewed during the field trips.

Table 8.5 General information on the vegetables exported by the seven processors

Company	Country of destination	Variety	Type	Quantity (tons)	
Anqiu Deli Food Co.	Japan	Scallion	Fresh	2000	
		Ginger	Fresh	1500	
		Great burdock	Fresh	500	
		Carrot	Fresh	300	
		Taro	Fresh	500	
		Onion	Fresh	200	
Anqiu Zhendong Food Co.	Korea	Onion	Fresh	800	
	Japan	Ginger	Fresh	6000	
		Scallion	Fresh	1500	
		Garlic	Fresh	500	
		Taro	Fresh	4000	
Anqiu Linfu Food Co.	Japan	Great burdock	Fresh	500	
		Ginger	Fresh	N/A	
		Scallion	Fresh	800	
		Taro	Fresh	N/A	
		Garlic	Fresh	N/A	
		Onion	Fresh	1000	
	Korea	Ginger	Fresh	N/A	
	Italy	Ginger	Fresh	N/A	
	British	Ginger	Fresh	N/A	
	Taro	Fresh	N/A		
	Holland	Ginger	Fresh	300	
	USA	Ginger	Unknown	N/A	
	Garlic	Unknown	N/A		
	Pakistan	Unknown	Unknown	N/A	
	Australia	Garlic	Fresh	N/A	
Foodstuff Foreign Trading Co.	Japan	Spinach	Quick frozen	N/A	
		Asparagus	Quick frozen	N/A	
		Taro	Fresh	N/A	
		Chinese Beans	Fresh	N/A	
		Green Soybean	Fresh	N/A	
		Unknown	Unknown	N/A	
	Korea	Unknown	Unknown	N/A	
	Australia	Asparagus	Canned	N/A	
	Anqiu Wanxin Food Co.	Japan	Ginger	Unknown	N/A
		Korea	Onion	Unknown	N/A
British		Garlic	Unknown	N/A	
USA		Ginger	Unknown	N/A	
Saudi Arabia		Ginger	Unknown	N/A	
Arab United		Hot Pepper	Unknown	N/A	
Holland		Ginger	Unknown	N/A	
Germany	Ginger	Unknown	N/A		
Dongfanghong Food Co.	Japan	Scallion	Fresh	6000	
		Ginger	Fresh	4000	

Anqiu Fuhua Food Co.	Japan	Garlic	Mashed	N/A
		Spinach	Juice	N/A
		Onion	Oil	N/A
		Cabbage	Fresh	N/A
		Celery	Unknown	N/A

Source: provided by the local officials during our field trip, Oct. 2003

Time of export

As mentioned before, vegetables are seasonal crops and therefore different varieties of vegetables vary a great deal in peak seasons for exporting. For instance, the peak export season for garlic is late June to mid August, and for scallion June to September. Fresh ginger can be supplied to importers every month because ginger can be stored under the ground for at least for a year.

Export channels

All vegetables are exported from Anqiu to overseas countries through three channels, namely the processor's export, the agent's export and the buyer's export. It should be pointed out that an export/import license is required in order to export vegetables to foreign countries. The license can be acquired by applying to a foreign trade department of the government. A company becomes eligible for exporting vegetables if its application is approved and certified by the foreign trade department. But not all companies are eligible to apply: only companies whose total assets value of initially registered capital (zhuce ziben) is greater than RMB 5 million are eligible for the applications according to a Chinese trade regulation. However, this regulation was liberalized to some extent in mid 2003, when this requirement was reduced to 'greater than RMB 2 million'. But in Anqiu, this requirement is merely 'greater than RMB 0.5 million', according to a local official from the foreign trade department of the city government. Since July 2004, the central government has relaxed the policy related to export rights in line with WTO agreement. The requirement for registered capital has been abolished and the eligible scheme replaced by a voluntary register system.

Processor's export is made by those large vegetable processors that are certified by the foreign trade department and have the export rights, and more often than not have a large production base. It is reported that at the moment 60 large processors have an export licence and can therefore export vegetables directly to the overseas markets from Anqiu. These large companies are mostly those that are foreign investments.

Agent's export is made by those agents that are certified by the government and have a licence to export. The agents usually export vegetables at the request of those processors that are not certified and therefore do not have an export licence. A significant quantity of vegetables are exported through this channel, according to a local government official. The agent companies are based either in or outside Anqiu. For this reason, it is really hard to know the number of agents involved in exporting operations.

Buyer's export is made by those buyers that are certified and have an export licence. They do not produce or process any vegetables, but can obtain overseas orders because they have connections with overseas importers. The buyers very often purchase vegetables from processors and export them to specific overseas buyers. It should be pointed out that the large export processors can sometimes act as export agents or export buyers.

Vegetable quality control

Vegetable quality control is one of the most important aspects of the whole supply chain. Exporters are becoming aware of the importance of food safety as the importing countries are very cautious about the safety of imported food and often use food safety as a way to raise non-trade tariff barriers to protect the producers in their own countries. Often, if vegetables with safety problems produced in a region/county or prefecture are detected by an importing country, importing vegetables from that region is banned by the importers for at least one year. For that reason, the processors/exporters and the local government control the vegetable quality as strictly as possible.

In Anqiu, export vegetable quality is controlled at three levels or three different stages, namely on-farm quality control, government control and importer's control. Almost all the exported vegetables in Anqiu are produced on production bases. One of the advantages of developing production bases is that on-farm quality control of the vegetables can be implemented. Processors/exporters can control vegetable quality on farms by signing contracts with the producers who grow vegetables on the production bases. It is often written into the contract that the processors/exporters are responsible for providing the growers with field management services, including providing seeds, fertilizers, pesticides, crop management practices and soil care. These production inputs are provided by the processors as a loan in kind, as mentioned before. The producers themselves are not permitted to buy seeds or pesticides from the inputs markets. The processors also advise the growers which fertilizers and pesticides to use, how much to use and when to apply them to their crops. In addition, the processors send their staff to the farms to collect fresh vegetable samples from the fields for lab tests. The processors then make a decision on whether or not to buy vegetables from the farm based on the results of their lab tests. This is roughly the way vegetable quality is controlled on farms.

Large processors, which are usually also exporters, have invented their own ways to control vegetable quality. They categorize all vegetables into three groups by food safety risk levels. Group A are the leaf and fruit type vegetables (e.g. spinach and capsicum), which are considered a high-level risk. They grow group A vegetables themselves rather than buy them from the contract growers for export. Group B are the stem type vegetables (e.g. celery and scallion), which are considered a medium-level risk. They can buy them from contract farmers or grow them on their own production bases. Group C are the root type vegetables (e.g. ginger and taro), which are considered a low-level risk. The processors can buy them from non-contract/individual farmers who grow vegetables on non-production bases.

Government control over vegetable quality is carried out by the local Commodity Inspection and Quarantine Authority. The Authority advises the processors/exporters about the requirements and specifications of the export vegetable quality control. It also inspects the vegetables lot by lot before they are loaded on board. Sometimes the local Technology Supervision Bureau holds training classes for local leaders, growers and processors on vegetable quality control measures.

The importing countries also inspect the vegetables upon arrival in accordance with their own standards. For instance, in Japan the Japanese Agricultural Standards (JAS) inspects the vegetables arriving from Anqiu. The local growers and processors complain

about the Japanese inspectors, saying that they use double standards to inspect the vegetables produced in Anqiu and those produced in Japan, and that their inspection points change from time to time so that both growers and processors find the regulations hard to satisfy.

Certification of vegetable production

Production certification is another step taken by the local industry in order to control vegetable quality. The large processors are very keen to have both their own/corporate production bases and their factories certified. The processors have access to a number of certification services, namely the Green Food Development Center¹ (GFDC) certification, Organic Food Development Center² (OFDC) certification, Hazardous Analysis for Critical Control Point (HACCP) certification, ISO 9000 and ISO 14000 certification, the JAS certification, the British Retailers Consortium (BRC), etc. Certification is optional for processors although the local government is encouraging the processors to have their factories or products certified. Different companies take different options. For instance, the Foodstuff Foreign Trading Company obtained ISO 9000 certification in 1999 and HACCP certification in 2000; the company has also had 20 ha of its production base certified by OFDC for organic asparagus production. The Anqiu Fuhua Food Company has obtained ISO 9001 and HACCP certification, and has had 13 ha of its production base certified by the JAS for onion production. The Anqiu Wanxin Food Company has had more than 100 ha of its production base certified by the EU for ginger production.

8.5 Case studies: townships and companies

Linghe township

Linghe township comprises 68 villages (12,000 rural households) with a total population of 55,000. The total arable area is about 50,000 mu, of which 35,000 mu are permanent and 20,000 mu are seasonal, because it is river foreland and thus regularly under water. The division of the landuse in the township is 11,000 mu for grain crops, 21,000 mu for vegetables, 13,000 for trees and orchards, and 5000 for others.

Of the 21,000 mu of vegetables, 5000 mu are processors' own production bases, 5000 mu are farmer's/contracted production bases and 11,000 mu are individual family plots. It is said that in 2002, 6000 (50%) of the rural households were vegetable growers and that, on average, each household grew 3.5 mu of vegetables. Of the 6000 households, 5000 operate a farm smaller than 2 mu and 1000 a farm larger than 3 mu. About 4000 grow scallions and 2000 grow ginger.

Linghe Township has been growing vegetables for less than a decade: until 1995 the whole area was used to cultivate wheat and maize. Then one farmer started growing vegetables and made big profits, and the others rapidly followed. The net income for wheat and maize is RMB 500-600 per mu per year, while for greenhouse vegetables it is about RMB 5000.

¹ The GFDC is under the Ministry of Agriculture (MOA).

² The OFDC is under the State Environmental Protection Administration (SEPA).

The main vegetables are scallion (spring onion), ginger, garlic, taro and great burdock (a Japanese root plant). Some detailed information on the vegetable production in Linghe Township was collected during our field survey (Table 5.6). Particularly the great burdock is very profitable, yielding RMB 20,000 per mu (2003). During the field trip a large variety of vegetables were visible in different farming systems: open fields, fields covered with plastic, small tunnels, larger tunnels and solar-heated greenhouses, orchards and tree nurseries. According to the statistics provided by local officials, there was a new development of the different farming systems between January and June 2003 in that both the number of larger sized producers/processors and the average size per producer increased (Table 5.7).

Table 8.6 Vegetable production in Linghe Township in 2002

variety	Area		Production		
	Subtotal/mu	%	Subtotal/tons	%	
Ginger	6000		28.6	24,000	26.7
Scallion	7700		36.7	44,800	49.8
Asparagus	2360		11.2	500	0.5
others	4940		23.5	20,700	23.0
Total	21,000		100	90,000	100

Source: Collected during field survey, October, 2003.

Table 8.7 The new development of the different farming systems in Linghe Township

System	Number	Average size (mu)
Large tunnels	989	1028
Solar-heated greenhouses	261	272
Total	1250	1300

Source: Collected during field survey, October, 2003.

The local government expects that the total area for vegetables will increase further, to about 80% in three years' time. In fact, in 2003 about two thirds of the land was used for vegetables, which is a big increase since 2002 (i.e. from 42% to 66%).

There are about 36 large processing and trade companies in the township and about 200 small-scale processing enterprises. Of the 36 large processing companies, 3-5 are foreign owned and 10 are joint ventures; the others are privately owned, and range in size from 1 million to 10 million yuan turnover per year. The last-mentioned are mostly involved in washing and cleaning vegetables (e.g. ginger, garlic and great burdock) and employ 20-30 people each. They sell their cleaned vegetables to the local trade companies or to other traders. Only a few have an export license. In 2002, between them the processors processed 200,000 tons of vegetables, of which 80,000 tons were exported and earned USD 50 million.

The large-scale companies have about 30,000 mu under contract, while only 5,000 to 6,000 mu is non-contracted vegetable land. The contracts are concluded between the company and the village leadership/committee. The farmers are contracted to deliver all the produce to the company, even if the market price is higher than the contract price.

The individual farmers without contracts have three outlets for their produce: the wholesale market (the buyers at this market are the many 'cleaning' companies located at or near the market, middlemen and large traders from other provinces), the farm gate (to middlemen and traders) and local companies

The local government expects that the number of small-scale companies will decrease, while the large companies will increase their production, particularly off deep-frozen vegetables. The market expectations are high. It is expected that the demand for ginger will grow further, as it will for green asparagus.

Zhaoge township

The township comprises 82 villages with a total population of about 50,000. The average income is rather high as a result of industrial activities. Agriculture accounts for about 30% of the township's GDP. The common agricultural land use until 1995 was wheat and maize; 90% of the land was used for these crops, and only 10% for vegetables. The township government took the initiative to change the farming structure. The transition started in 1995 when township and village leaders went to Shouguang, a nearby city, to learn about the cultivation of vegetables. The township provided financial support to farmers who wanted to change from cereals to vegetables. Each village formed a marketing team to sell vegetables in Qingdao and other towns. With the growth in production, the first wholesale market was established in 1997. In 2003, there were 20 wholesale markets in Zhaoge. Since 2000, the business has been getting tougher, due to oversupply which results in low prices. Adding value through processing was needed. In 2002, the first vegetable processing company was established. This is the only large-scale processing company in the township. The company processes scallion, ginger, garlic, parsley and great burdock. There are also about 30 small companies in the township, but these are mostly involved in collecting and cleaning vegetables, particularly ginger. Other companies are active in the township, but there are no clear investment plans.

The township tries to attract companies by offering low prices for building land and providing good infrastructure (electricity, water, heating). Another advantage of this township is the relatively low price of agricultural land. In 2003 the food-processing company rented 1000 mu for an average rent of RMB 120 per mu per year on a 20-year basis. There are 10 villages involved in these contracts, with an average of 100 households per village. It was not always easy to conclude the contracts. The township government stimulates the contracting of land ('to change the farmers into workers'), but in the end it is the villagers who have to agree to it. If two thirds of the village representatives agree with the contract, the whole village will enter the contract. Often the younger farmers are in favour of contracting land, because it leaves them free to do other jobs. The elderly people are reluctant, because they consider their land as income/life insurance. In general the households have about 1.5 mu per person, i.e. about 3-4 mu per household. About half of the land is put under contract, while the other half remains the household's for its own (or partly commercial) food production, mainly vegetables.

Anqiu foreign trade food company

The company was established in 1976 as a state-owned company, but was restructured as a public company in 1999. The company now has about 1500 small shareholders. The total number of staff is 3000. It is one of the 500 largest food-processing companies in China. The company produces over 60 varieties of products in ten categories: frozen meat, cooked meat, food with spice, quick-frozen vegetables, fresh vegetables, frozen flour-based food, canned food, frozen fruit, peanut products and frozen aquatic products. The products are marketed in 20 countries, including Japan, South Korea, the USA, Europe and Australia. The company possesses a large variety of modern processing equipment and is certified according to the ISO 9002 quality certification system.

Contract for vegetable production

The company has two different kinds of production bases: 1) Own production bases for vegetables that are highly sensitive to pollution (e.g. leafy vegetables); 2) Farmer's/contracting production bases for vegetables that are not so sensitive for pollution (e.g. stem and tuber/root vegetables)

Re 1) Own production base

The company rents 15,000 mu of farmers' land and has turned it into its own production base. The rent is based on contracts for a period of 15 years (mostly). The company pays RMB 300-500 rent a year for the first three years, and then an extra RMB 50 per year. The rent depends partly on the soil quality. The company concludes the contracts with the village leadership. The village committee needs the agreement of the farmers (a two-thirds majority of farmers' representatives). The company hires farmers to work the fields for a salary (per day or per field unit). The workers on the production base are not necessarily the former farmers. If they are, they do not work their own fields but are grouped into small teams with a team leader. The payment is partly based on the harvest. They can get an average of 300-500 yuan per harvest. Depending on the crops, there are 3 or 4 harvests per year (e.g. carrots and parsley).

Re 2) Contracted production bases

The company has 20,000 mu of contracted production bases. These contracts are also concluded with village committees. The difference from the aforementioned system is that the farmers still work their own land and the contract period is shorter (5 years). The farmers are bound to deliver the produce to the company. The company pays the regular market price, above a certain minimum price. The company provides the farmers with pesticides and other inputs but not the fertilizers. In order to keep the use of chemicals low, the company also provides extension services.

Crop management

For crop management, the company has 23 experts in its headquarters, covering such areas as agronomy, horticulture and plant protection. These experts visit the production bases regularly to give instructions on cultivation and crop management to the workers and to inspect the work. The company bears the cost of agrochemicals for both types of bases, but not for fertilizer for the contracting bases.

Safe food - organic food

Currently the company has 300 mu suitable for the production of organic asparagus. The intention is to increase the area to 2000 mu in the coming years. The quality of the soil, water and air has been checked twice a year in the three years of transition towards organic production. The company's experts regularly check the practices on the production bases.

Communication with foreign customers

The company has business relations in about 20 countries; 95% of the produce is sold abroad. There are 20-30 regular clients. Their requirements with respect to the quality of products - including the quality of the raw material, and the selection, processing and packaging of the products - are written into the contract. There are no major conflicts because the contracts are built on long-standing relationships. In some cases, the company works with trade agencies in the importing countries, while in other cases there are direct contacts and contracts with the customers. Some of the customers come ten times a year to visit the companies and develop new products together with the R&D department. The company itself controls the whole chain. It checks the agricultural practices by means of the recorded data on the use of water, fertilizers and plant protection agents. Before harvesting, the quality of the products is checked.

Exports

In 2002, the company exported 9000 tons of processed vegetables. Japan and South Korea are the two largest buyers. The types of the vegetables for the overseas markets are fresh preserved, quick-frozen and pickled. The quick-frozen vegetables account for two thirds of the total exports.

Changes in the last 20 years

- in the past, the control was more focused on processing and sanitary aspects at the factory level;
- starting in 1999, the emphasis started shifting towards the control of the raw material, because that appeared often to be the source of the problems;
- the whole chain has steadily been brought under control. This approach was dictated by the international market developments/requirements;
- the number of inspections at production bases has increased, in order to ensure the quality;
- for the same reason, the area of own fields has been increased;
- the competition to produce quality products has increased, but the company is sufficiently competitive.

Challenges for the future

The company indicates that one of the major problems is that the farmers do not care that much about the use of chemicals. They are not aware and/or do not care about the impact of chemicals. In order to increase the farmers' awareness, more training is required. The same applies to the workers on the company's own fields.

The second problem is that the standard fields are too small to be cost-effective. The company is planning to expand its own production base. More favourable government pol-

icy is needed to expand their bases, since developing own production bases requires large investments.

In addition, extra training/education could help to increase the consciousness of farmers with respect to food safety.

Anqiu kangrui food company

The company started in another township in 1996, and built a new factory in Zhaoge in 2001. It is a private company, with a staff of 200. In 2003 they built new cold stores for fresh vegetables. The company has integrated vegetable production, processing and marketing. It mainly produces quick-frozen products, but also canned fruit and vegetables and fresh preserved vegetables. The main fresh products are scallion, chives, garlic, onion, ginger, radish, taro, great burdock, carrots and cabbage. The quick-frozen products are asparagus, taro, great burdock, ginger, garlic, cauliflower, strawberry and fruit. The canned products comprise mainly fruit and asparagus.

Production bases

The majority of the vegetables are produced on the company's 'own' fields, which they rent for RMB 300-500 per mu over a period of 10 or 15 years. At the moment, they have 1000 mu in four fields. Each field has a manager, who is responsible for crop management. The managers hire workers according to needs. The payment is RMB 20-40 per day. At harvest time, they employ about 200 workers in the fields.

The company has also one-year contracts with individual farmers. The company provides the farmers with inputs and technical assistance, and the farmers deliver the product for a fixed price.

Before 1998 they also bought products at the wholesale market but because they are processing for export, they are obliged by Shandong provincial regulations to produce the vegetables on their own fields, so as to be able to guarantee the quality of the products with respect to food safety. The company expects to get ISO 9001 certification in 2004.

Marketing

The major customers are from Japan, South Korea, the USA and Germany. The company has a branch in Japan to facilitate direct sales, which generate a much higher profit than marketing through a Japanese trade company does. Some customers come regularly (once or even twice a month) to inspect the quality. The general manager spends several months a year in Japan for marketing purposes.

Prospects

The company hopes to find new markets and new products, including preserved vegetables. The competition on the domestic market is very high. The company expects to enlarge its own fields according to demand, but it will become more and more difficult to hire a large piece of land.

Sample of a contract agreement

Party A: Anqiu City Deli Agri-Products Processor .

Party B: Mr Song Zhenbao (vegetable grower).

The following agreement is reached under the conditions that the two parties have the same interests and guarantee the economic benefit to each other.

- Clause 1: Party B shall provide Party A with land and labourers. Party A shall provide Party B with the production inputs, such as seeds, fertilizers and agrochemicals.
- Clause 2: Party A shall supply the production inputs to Party B in time when needed, and shall make the plans concerning crop field management and agrochemical applications available to Party B in advance.
- Clause 3: Party B shall strictly follow the plans of crop field management and agrochemical application that are made by Party A. The plans may not be changed under any conditions without the permission of Party A.
- Cause 4: Party A shall not supply fake or low quality inputs to Party B. If it does so, Party A shall reimburse any economic losses incurred by Party B. Similarly, Party B shall perform farming activities in time. If vegetable production/output decreases or nothing can be harvested due to a delay in performing farming activities, Party A shall be entitled to deduct or reject the payments for landuse and salaries to Party B and furthermore, Party B shall reimburse Party A all the costs of the inputs which Party A supplies to Party B.
- Clause 5: After the crops are mature, Party A shall pay Party B for those crops that can meet Party A's standard in the unified purchase floor price or RMB 0.60 per kilogram.
- Clause 6: The two parties shall strictly observe the aforementioned clauses. Any party which commits wrongdoings against this contract shall be penalized.

Two copies of this contract must be signed, and each party shall receive one of the copies. The contract will come into effect on the date of signing.

Party A: (signature and stamp)

Party B: (signature and stamp)

Date: 8 August 2002

Summary of characteristics of production bases:

A: Companies' 'own' production bases

- Processing companies rents land from village/farmers
- Long-term lease contracts (15-20 years)
- Rent is RMB 300-500 per mu
- Farmers in village have to agree by a two-thirds majority
- Fields are used according to the companies' wishes
- Field work is managed by the companies' staff (agronomists)
- Companies hire labour according to the need.
- Former farmers might get a job/temporary job at the production base

- All inputs are provided by the company
 - The whole output is further processed by the any
- B: Contracted production bases*
- Processing companies rents land from village/farmers
 - Short-term lease contracts (5 years)
 - Rent is RMB 200-300 per mu
 - Farmers in the village have to agree by a two-thirds majority
 - Farmers remain responsible for the production on their own plots
 - Companies' staff (agronomists) give instructions on soil treatment and crop management
 - Farmers work on their own plot, but there are also joint activities (e.g. harvesting)
 - Economies of scale allow farmers to have additional jobs
 - Most inputs (except fertilizers) are provided by the companies
 - Farmers are obliged to sell the whole output to the company
 - The companies are obliged to buy the whole output
 - They receive the market price (minus costs of inputs used) or a minimum 'protection' price, mentioned in the contract.

8.6 Summary of case study

- The vegetable industry in Anqiu is of growing importance to the regional economy. The major reasons for this are the suitable soil quality, suitable climate, sufficient clean water and cheap labour.
- The farming system in Anqiu is changing very fast. Around 1995, almost all the arable land (about 100,000 ha) was used for growing winter wheat and maize. Now, 33% is in use for growing cereals, 35% for vegetables, 15% for fruit and 17% for cash crops. These changes are a result of, for example, changes in China's agricultural and trade policy, particularly the abolition of compulsory grain production and the introduction of export licenses for private companies.
- Both the farming system and the marketing structure are changing rapidly. To facilitate the trade, wholesale markets have been established in all major cities and towns. Soon after the establishment of these markets, trade companies from Japan started to both purchase vegetables (especially ginger and garlic) in this area and to introduce new types of vegetables (e.g. taro and burdock).
- Within a few years, many foreign and domestic investors had set up processing plants in Anqiu. These companies purchase the raw material at the wholesale markets and from individual farmers based on short-term contracts.
- The need for a controlled supply of raw material and food safety aspects forced the companies to seek new solutions. One of the solutions was to set up contracted production bases, i.e. villages that produce the required vegetables based on a short-term (5-year) contract. By providing inputs and technical assistance in the area of soil and crop management, the companies were able to better control the quantity and quality of the produce. Despite this, the product quality - and particularly the food safety -

could not be guaranteed, because the individual farmers are still working on their own fields following their own agricultural practices, and do not care about an over-use of agrochemicals.

- Since the lifting of restrictions on subcontracting land for other uses (1999), the companies have strengthened their position in primary production by establishing their own production bases by means of long-term lease contracts (10-15 years) with villages. In these production bases (actually a large farm of about 50-100 ha), the company itself manages the whole production cycle from seed to crop, including the use of fertilizers and agrochemicals. The required labour force is hired according to needs.
- The number of this type of large-scale farm is growing fast, because this system makes it possible to control the whole supply chain. As a result, the companies are able to acquire all sorts of international certifications (e.g. HACCP, ISO 9001, BRC, JAS), which makes it possible to trade all over the world. The provincial and local government are stimulating this development, because it creates extra jobs and income in the rural area.
- Anqiu plays a leading role in the vegetable export markets in Shandong and even in China, and it is expected that its position get stronger. Many large processors are planning to expand their processing capacity and, in line with that, the production capacity on their own or contracted production bases.
- The industry, however, is still moving along a rather traditional path. There is substantial room for further development through outsourcing, process renovation, product upgrading, product value adding, and general improvement in the efficiency of every link in the supply chain.

9. Summaries and conclusions

Over the past three decades, China's economy has experienced tremendous changes, including the vegetable industry. This paper has comprehensively documented the sector development regarding issues such as food safety policy, vegetable production, consumption, marketing, and international trade.

Institutions

There are a dozen public institutions involved in the vegetable sector. The National People's Congress and the State Council are the main legislative bodies for food safety and quality regulations. The main executive institutions at the ministerial level are the Ministry of Agriculture (MOA), State Administration for Quality Supervision, Inspection and Quarantine (AQSIQ), State Food and Drugs Administration (SFDA), and the Ministry of Health (MOH). The scope of MOA regarding food safety focuses on primary production stages, such as feed quality control, environmental friendly production, agrichemical control, etc. Among its other functions, the AQSIQ oversees the food safety issues of importing and exporting products in China. The MOH is responsible for food hygiene, particularly in the food processing and consumption stages. It is clear that the functions of these institutions overlap. SFDA was recently busy improving the co-ordination and control of food safety issues nationwide. The main laws and regulations regarding food safety control include Food Hygiene Act, Quarantine Inspection Act on Plant-Animal Import and Export, Pesticide Administrative Regulation and Bio-safety Administration Regulation on GMOs in Agriculture.

Policy

In line with its reform policy, the vegetable sector in China has experienced different stages of liberalisation as well. First of all, in the early 1980s, the vegetable production was decentralised from the central government control to the local city level. This liberalisation was accompanied with the launching of the so called 'Vegetable Basket Project'. This programme made city mayors responsible for supplying vegetables to the urban population, and aimed to stimulate vegetable production to overcome shortages in supply. By the 1990s, it seemed that the problem of vegetable shortage had been solved. The government started to tackle the limited varieties in the vegetable markets by encouraging greenhouse production in the north of China. Consequently, modern greenhouse facilities and exotic vegetables from abroad were appearing in the Chinese markets. At the beginning of this century, China joined the WTO and was expecting an expanding market share in vegetable trade given China's abundant labour supply. However, China's vegetable export suffered a strong setback from its main markets Japan and South Korea due to the food safety problems. The trade disputes directly triggered Chinese government's policy shifts toward food safety. At the beginning of this century, the government launched a programme, the 'Action Plan for Pollution-free Agricultural Products'. Although the action plan covers all

edible agro-foods, the safety of fresh vegetables was the first problem to be tackled. The Ministry of Agriculture has drafted a series of pollution-free food standards and now manages a certification scheme. The standards cover four aspects: production environment, production process, product performance and post-harvest. The standard for pollution-free products serves as a compulsory standard for agricultural produces in China. Two other certification schemes - namely Green Food and Organic Food - are voluntary standards.

Production

Vegetable production in China has expanded tremendously during the past two decades in terms of both sown area and output. In 1980, the vegetable-sown area in China covered only about 3 million ha with an output of 80 million tons. By 2000, the sown area covered 15 million ha with an output of more than 400 million tons. In the same period, the vegetable output has increased five-fold as well from 80 million tons in 1980. The number of varieties has also increased from a few handfuls to over 40. In addition to the leading varieties, such as Chinese cabbage, cucumber, radish and tomato, exotic vegetables such as chicory can also be seen in the Chinese markets. In terms of regional structure, the top 10 vegetable producing provinces (out of a total of 31) account for 70% of the total national output. Basically, three major production regions can be distinguished in China: (1) the northern region, which includes Shandong, Hebei and Liaoning provinces; (2) the southern region, which is lead by Guangdong, Guangxi and Sichuan; and (3), the central region, which covers Henan, Jiansu and Hubei. Technology, particularly the adoption of greenhouse and hybrid seeds, has contributed substantially to the growth of vegetable production, particularly in the northern regions. For example, while greenhouses covered only 7,000 ha in the whole of China in 1980, in 2000 the figure was 1.7 million ha. In the meantime, professional growers have come into the picture and have enlarged their production by sub renting farmland from the individual households or sometimes the whole village.

Consumption and marketing

Chinese diet culture encourages vegetable consumption. The per capita vegetable consumption in China reached 140 kg in the 1980s. Of course, there is a slight gap between rural and urban areas while rural residents consume a little less than their urban counterparts. During the last two decades, there is a declining tendency, but it is still above the world average of 100 kg. The reform of the vegetable marketing structure started in the late 1980s. Before then, vegetable production, procurement and marketing were part of the central planning system. State-owned vegetable companies and semi-governmental supply and marketing cooperatives were the only legal players in China's vegetable supply chain. By the early 1990s, however, all the state-owned vegetable companies and their shops had been replaced by private traders. All of a sudden, open markets and wholesale markets mushroomed all over the country, both in the urban and rural areas. These new market channels play a dominant role in the vegetable distribution in China.

Trade

For a large country like China, international trade in vegetables is not significant since a comparative advantage can be exported inside the country. Although China's vegetable

trade increased substantially during the last two decades, vegetable exports still account for only about 1% of total production. Nevertheless, the 5 million tons of exports in 2003 makes China one of the largest vegetable players in the international markets. The main export categories are fresh and quick-frozen vegetables, which account for more than half of the total export. The rest are processed vegetables, such as pickled, dried and canned vegetables. The leading export varieties include garlic, onions, beans, edible fungi, and potatoes. Every year China also imports a small quantity of vegetables, mainly refrigerated celery and frozen sweet corn. China's vegetable exporting bases are mainly concentrated in the eastern coastal regions, although there is a tendency to shift toward central and western parts of China. The leading exporting provinces are Shandong, Guangdong, Fujian and Zhejiang. Although China's vegetable export markets include 150 countries and regions throughout the world, its main exporting markets are concentrated in Southeast Asia. Japan is by far the most important vegetable exporting market and accounts for a third of China's total vegetable exports. Other important destinations for China's vegetable export include Hong Kong, Korea, the USA and the Netherlands.

As a labour abundant country, China should enjoy comparative competition advantage in the vegetable trade. Several methods are used to calculate the competitiveness of China's vegetable industry. First, if only the producers' prices of vegetables are compared, the more labour-intensive the vegetables are, the more advantages the Chinese producers have. For example, China's producers' prices for tomatoes are only 2.54% of Japanese prices. However, one should bear in mind that the labour costs in China are rising fast, particularly in the suburban areas of metropolises. Furthermore, the fact that the Chinese Yuan is pegging to the US Dollar will certainly lower Chinese vegetable prices. Three other calculating methods (i.e. revealed comparative advantages, net export effect and domestic resource cost coefficients) all indicate that, in general, most of China's varieties (with the exception of celery, peas and potatoes) could be strongly competitive in the world markets.

Case study

Since China joined the WTO, the Chinese government has encouraged more export-oriented vegetable production along the coastal regions with Southeast Asia as the target markets. Shandong province has taken this opportunity and within a few years has changed itself from the largest agricultural province to the largest agricultural exporting province in China. At the end of this report we present Anqiu, a county-level city in Shandong province, as a case study to demonstrate how a wheat-producing city turns into a modern vegetable production base and, in particular, how this city operates for the export markets. According to the local official's estimate, 50% of Shandong's vegetable exports originate from Anqiu. The main export varieties are stem and root types, such as ginger, scallion, onion, taro, yam, etc. Other export varieties include leaf types (e.g. spinach and lettuce) and fruit types (e.g. cucumber and eggplant). All sorts of vegetable producing and processing companies are present in Anqiu, including those with sole foreign proprietorship, foreign joint ventures and domestic private ownership. They develop all sorts of initiatives to contract farmers and/or their land for large-scale production and better food safety control. The processing industry is dominated by foreign and joint ventures, which produce such products as vegetable juice, mashed and dehydrated vegetables, vegetable powders, etc. The main exporting destinations are Southeast Asia and the Middle East. For instance,

Japan is the largest importer of fresh ginger and scallion from Anqiu, while South Korea is the largest importing country of fresh onions and Chinese cabbage from Anqiu. Another unique feature observed in Anqiu is the companies' desire to have their production bases and their processing factories certified – a direct result of customers demanding food safety assurance. It is not unusual for a company to possess one or more international certifications (such as ISO 14000, ISO 9001, HACCP, JAS, BRC).

Appendix 1 Abbreviations

NPC	National People's Congress (quanguo renmin daibiao dahui changwu weiyuanhui)
AQSIQ	State Administration for Quality Supervision and Inspection and Quarantine (guojia zhiliang jiandu jianyan jianyi zongju)
MOA	Ministry of Agriculture (nongyebu)
SEPA	State Environmental Protection Administration (guojia huanjing baohu zongju)
MOH	Ministry of Health (weishengbu)
SAIC	State Administration for Industry and Commerce (guojia gongshang xingzheng guanliju)
SFDA	State Food and Drugs Administration (guojia shipin yaopin jiandu guanlijv)
IFOAM	International Federation of Organic Agricultural Movement
SDPC	State Development and Planning Commission (guojia fazhan jihua weiyuanhui)
MOF	Ministry of Finance (caizhengbu)
MOST	Ministry of Science and Technology (kexue jishu bu)
VBP	Vegetable Basket Project (cailanzi gongcheng)
APPAP	Action Plan for Pollution-free Agricultural Products (wugonghai nongchanpin xingdong jihua)

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