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WORLD MARITIME UNIVERSITY

Shanghai, China

**RESEARCH ON CONSTRUCTION OF
AGRI-PRODUCTS LOGISTICS SYSTEM
IN WENZHOU**

By

YE YIQI

China

A research paper submitted to the World Maritime University in partial
Fulfillment of the requirements for the award of the degree of

MASTER OF SCIENCE

INTERNATIONAL TRANSPORT AND LOGISTICS

2008

DECLARATION

I certify that all the material in this research paper that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this research paper reflect my own personal views, and are not necessarily endorsed by the University.

(Signature):

(Date):

Supervised by:

Prof. Liu Wei

Professor of Shanghai Maritime University

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ABSTRACT

Title of Dissertation: **Research on Construction of Agri-Products Logistics System in Wenzhou**

Degree: **MSc**

Logistics is the key part of modern circulation, which is considered “The Third Profit Source” except for the raw materials and labor force, for it has the characteristics of comprehensiveness. Agri-products logistics played vital role in exploring rural markets, the development of agri-products logistics not only enables agri-products to fully realize their value and user value, but also achieved value-added services through the logistic process. It reduces the agri-products’ circulation time, processing costs, and enhances the overall efficiency of agricultural production. Compared to the developed countries, China’s agri-products logistics is still on the traditional logistics phase.

This dissertation mainly deals with the issue of how to construct agri-products logistics system in Wenzhou. It will give you the general idea of agri-products logistics in chapter two. And then, chapter three will analyze the current situation of agri-products logistics and further find the causes which restrict Wenzhou’s agri-products logistics development. In the chapter four, it will introduce advanced agri-products logistics experience at home and abroad, and lessons to be learned from the advanced experience in combining Wenzhou’s actual situation. After that, chapter five will introduce an economy scale model to discuss the feasibility of building or expanding agri-products logistics center. In the end, the author will give the advice and countermeasures on how to build agri-products logistics system fitting for Wenzhou’s practical situation.

KEY WORDS : Agri-Products, Logistics, Wenzhou, System, Construction

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LIST OF ABBREVIATIONS

Agri-Products

APL

3PL

WTO

GMOs

USD

SCM

FTZ

Agricultural Products

Agricultural Products Logistics

Third Party Logistics

World Trade Organization

Genetically Modified Organisms

U.S. Dollar

Supply Chain Management

Free Trade Zone

1. Introduction

1.1 Background

Since China's agriculture and rural economy has ushered in a new period of development, along with the rapid development of the national economy, the formal accession into WTO and, the accelerating establishment of FTZ with neighboring countries and regions as well as the deepening reform of important agri-products circulation system such as grain and cotton, thereby, the degree of agri-products marketization and trade liberalization improve rapidly, which urges great internal demand for the modern agri-products logistics. But China's current development of agri-products logistics, compared with developed countries, still exists a large gap regardless of theoretical study or the practical aspect, which makes it far from meeting the demand of agricultural and rural economic development. How to accelerate the development of agri-products logistics has become the new spot of every walks of society. At present, China's agri-products logistics mainly rests on the form of room temperature logistics or normal logistics, and there is great loss in the logistics process for agri-products. Data indicate that the loss rate of China's fruits, vegetables and other agricultural by-products in the logistics links such as harvesting, transportation, storage is 25%-30%, while the rate of loss in developed countries is controlled below 5%¹. China's agri-products logistics has been confronted with several serious

¹ <http://post.n318.com/kjtg/ZJGD/200511/31272.html>

problems, such as severe loss in logistics process, low management and operation level, flow of information is slow, the lack of support from government and inefficient logistics professionals. It seems relatively difficult to establish fresh agri-products logistics system due to many links, high costs and loss. Therefore, carrying out relevant system research and establishing efficient agri-products logistics system will help to solve this issue.

Wenzhou is located in southeastern China, which is famous as a mild climate city. Its unique geographical location and climatic conditions make favorable for the resources availability in a diversified way and it possesses many special agri-products as well. The circulation of agricultural supplies and products plays significant role in the growth of national economy in Wenzhou city, which involves operational efficiency and quality of whole city's national economy, closely related to the fundamental interests of the farmers. However, the development situations and speed of circulation and related logistics activities of Wenzhou's main agri-products, while compared to the eastern region with better logistics development, there is a large gap. It is therefore necessary to conduct a systematic study on the practical situation of Wenzhou city's agri-products logistics, and make an analysis of actual situations, learn advanced experience from developed countries and regions, in order to find out the effective way to construct agri-products logistics with the combination of Wenzhou city's specific situations in the aspects of concept outline, system construction and organization management form of agri-products logistics, make Wenzhou's agri-products enter into international market, promote the development of Wenzhou's agriculture and further meet the consumers' demand.

1.2 Literature Review

Concerning about agricultural products logistics, the article written by Ding Junfa

(2002) entitled *Vigorously Develop Agricultural Products Logistics* noted that the development of agricultural products logistics not only enabled the products that farmers produce to realize the value and use value, but also made the agricultural products value added in the logistics process, and reduced the production and circulation costs of agricultural products, improved the overall efficiency of agricultural products. At the meantime, he held that China's agricultural products logistics possessed the characteristics of large quantities, more varieties, high requirements etc. We should give full attention to processing value-added logistics of agricultural products.

In the article *Research On Logistics Mode of Circulation Industry*, Lv (2006) thought that logistics have four modes in circulation industry, namely, self-conducting logistics, outsourcing logistics, common distribution, vendor distribution. He also pointed out future logistics in circulation industry will develop towards E-commerce, professional logistics, supply chain optimization, and procurement optimization.

Lamber (1998) considered that logistics cost is that the entire process cost of products and services flows from the original starting point to the final consumer place, the main driving factors of warehousing cost are location choice of storage and warehousing. If logistics cost decreases, the economy will be more effectively transfer pricing signal, which will contribute to the further adjustment of agricultural production structure, expel the local shortage and surplus of agricultural products, stabilizing the agricultural products price.

The article *Space optimization of agricultural products foreign trade logistics in Shandong province based on port supply chain* written by Li Xuegong(2007), he proposed manpower planning assumptions of Shandong's agricultural products foreign trade logistics based on port supply chain logistics resources while analyzing agriculture material resources and prominent logistics location advantage, in the meantime, the framework system of incorporating the agricultural products foreign

trade logistics into regional logistics is the objective requirement of establishment of agricultural industry system and adapting international cooperation and competition. It was pointed out that agricultural products foreign trade logistics is the comprehensive logistics system in the particular status, mobilize domestic and foreign resource to realize each node integration in the logistics process to complete the value-added service of the whole supply chain system.

The article *Construction of China's agricultural products logistics mode: Based on wholesale market research* presented by He Feng (2006), he noted that in developed countries, agricultural products wholesale markets are normally more mature and, with the continuous economic development, the operation mechanism or mode of the wholesale market also changes. In terms of experience, the development of wholesale markets to a certain degree will be developing towards different trends. One trend is the US representative, the part function of wholesale market was substituted by production and marketing integration. The other is Japanese typical, the symbol is wholesale market developing to auction market. International experience of promoting market prosperity of agricultural product logistics using different modes under different conditions seems very significant for constructing China's future operation mode of agricultural product logistics market.

The earliest study on agricultural products logistics is American John Crowell, he addressed various factors and costs affecting distribution cost of agricultural products for the first time in his report named *The circulation industry of agricultural products committee report* in 1901, which uncovered the prelude to understanding agricultural products logistics. In the following one century, many experts and scholars conducted study on the agricultural products logistics, Clark, who has profound impact on agricultural products, in his book "Agricultural products marketing", did a research on concentrated, transport, storage, finance, risk, standardized of agricultural products logistics. In the book entitled *The darkness of mainland economy*, the well-known American economist Druker (1962) stressed we should attach great importance to

logistics management of the circulation process, thus has a major propelling role for theory circle and business community.

1.3 Research Objective

Logistics is considered to be “The third profit source” of cost reduction, is the weapon of enhancing service level and promoting products circulation, therefore, agricultural product logistics will become the weapon of reducing cost of agricultural product circulation and enhancing agricultural circulation, improve the competitiveness of agricultural products. This paper will aim at the construction of logistics system of agricultural product, and mainly on some agricultural products logistics system construction, and propel modern agriculture industry and relevant industry as the target, develop each sector and department of agricultural product logistics in a coordinated way, promote the whole city’s construction of agricultural product logistics. In the process, the role of government should be correct, regulate, control. And hope the city’s most of agricultural products truly realize “smooth flow of goods” and “the best value”, and solve the problem of “hard to sell” and “difficult to increase income”, improve the international competitiveness of Wenzhou’s agricultural products.

1.4 Research Methodology

Based on the analysis of logistics mode characteristics of Wenzhou’s agri-products, the dissertation will construct logistics system of Wenzhou’s agri-products and propose relevant policy suggestions with agricultural economics, management, modern logistics. This research paper will employ several research methods: first, combination of comprehensive analysis and typical analysis .Second, integration of

qualitative and quantitative analysis. Third, combination of empirical and norms analysis.

1.5 Structure of the Dissertation

The structure of the dissertation is displayed in Figure 1 as follows:

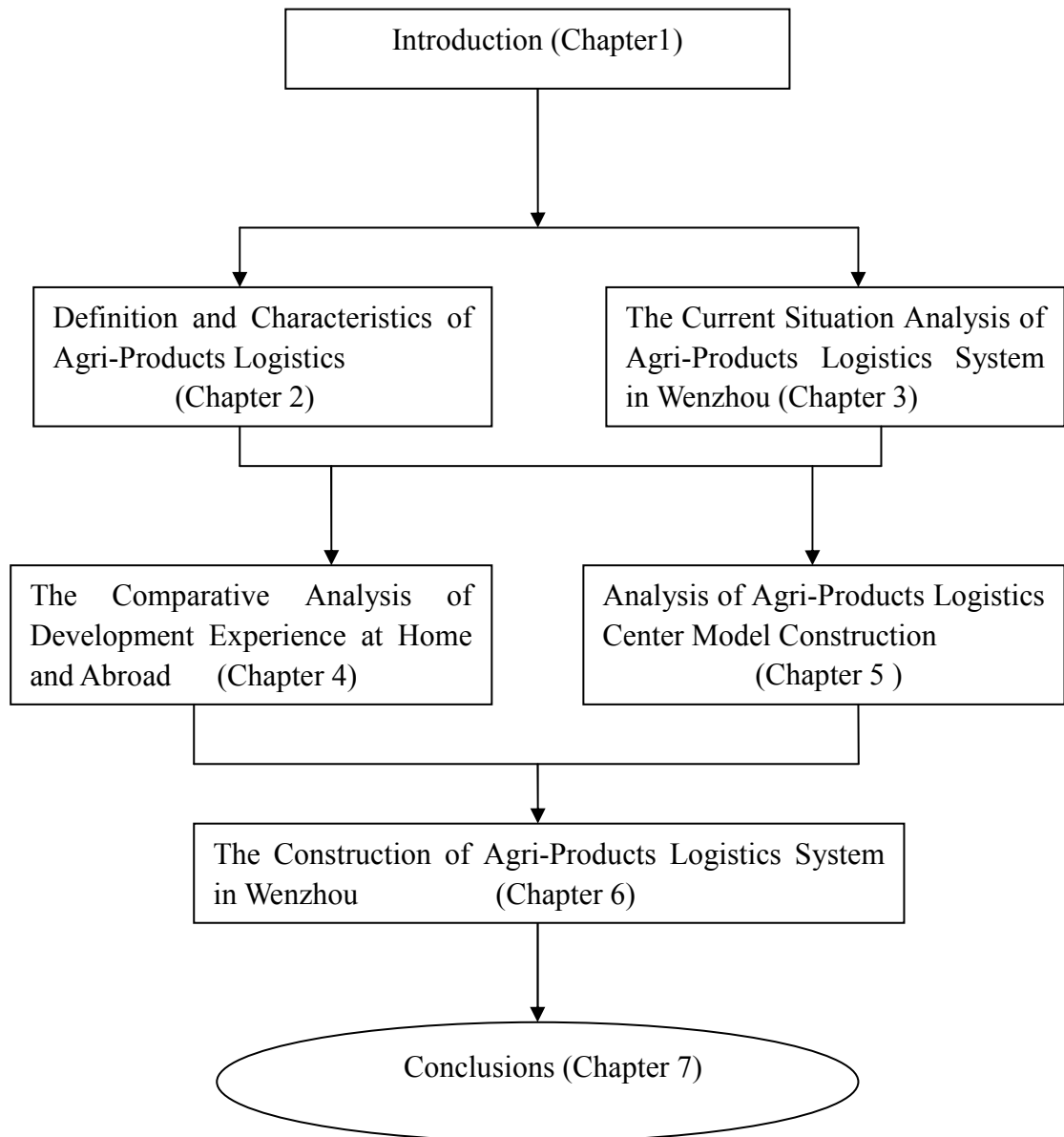


Figure 1 Structure of the Dissertation

Source: Drawn on my own

2. The Definition and Characteristics of Agri-Products Logistics

2.1 Basic Definition

Agri-products logistics could well be defined as physical entities of agri-products and relevant information are physically moved from suppliers to consumers in order to meet the customers' demand. Specifically speaking, it is the integration of transport, storage, handling, packaging, circulation, processing, distribution and information processing, which includes a series of physical movement processes, related organizing and dealing process of technical information, and logistics management activities of each link. In the whole process, it could add value for the agri-products. The development aims of agri-products logistics is to increase the added-value of agri-products, save circulation cost, improve circulation efficiency, reduce logistics loss, and hedge market risks. The development direction is to establish the TPL company which is specializing in logistics operation. In addition to material loss reduction and labor productivity rate enhancement, development of agri-products logistics has become the third profits source. As a matter of fact, APL can be called a systematic project, it is an integrated system of purchasing, wholesale, retail to consumers of agri-products in each link, involving agri-products markets, transport, warehouse, processing, packaging. But it is a system for the purpose of resource integration, value-added, cost-reduction, efficiency promotion rather than the sum of these sub-sectors. Therefore, the agri-products logistics in this paper does not touch the concept of industry, it means APL system. One thing also could not be omitted to

note is that the key point of the agri-products logistics in this paper is not including agricultural means of production and agri-products waste logistics.

2.2 Classification of Agri-Products Logistics

(1) Classification in terms of Agri-products logistics supply chain

① Agri-products production logistics. It refers to the whole process of crop farming, field management, crops harvest, and forms the logistics which consists of equipments, operation and various elements recovery. It could be divided into three forms: pre-production logistics, central-production logistics, post-production logistics.

② Agri-products sales logistics. It means to achieve agri-products sales and improve logistics service through packaging, storage, long-distance transport, short-term distribution, which are mainly based on the logistics rationalization principle to determine transport routes, reserve system, packaging level, agri-products processing operation, delivery option. This logistics process is the key phase of realizing the agri-products value. It can be divided into two forms in terms of whether intermediary body participating or not. One is “Single Stage Dualistic Formula” logistics with no intermediary body participating. This form of direct marketing way refers to that buys and sellers meet directly without intermediaries and lower transaction costs, less cargo loss, which has been acknowledged as the development of agri-products sales logistics.

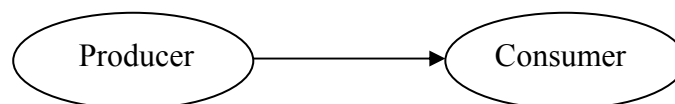


Figure 2 Single Stage Dualistic Formula

Source: Drawn on my own

The other one is “Dual Stage Triple Formula” even “Multistage Multitude Formula” logistics with the intermediary body participating. Due to the contradiction between extensiveness and diversity of agri-products demands and the means to meet the needs, a lot of intermediary organizations and individuals have taken place in the agri-products sales logistics. The common form is “Dual Stage Triple Formula” logistics, which is the popular adoption agri-products market circulation aspect by developed western countries in. Its form is production body—middleman—consumer.

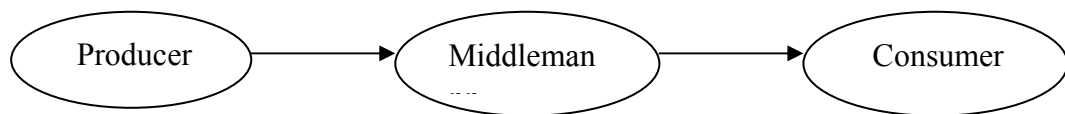


Figure 3 Dual Stage Triple Formula

Source: Drawn on my own

However, if too many intermediaries involved, it would become the “Multistage Multitude Formula” logistics. Take China’s vegetable sales logistics form for illustration, the process is vegetable farmer—production place middleman—market wholesaler—market middleman—retailer—consumer. Agri-products will change place as the sellers change through so many sales links. It would increase the social transaction costs and logistics costs, lower the logistics efficiency because of the large logistics links, long route, numerous handlings and packagings, and big losses. Then intermediaries would divide up the profits, hence the farmers’ interests had been harmed at last.

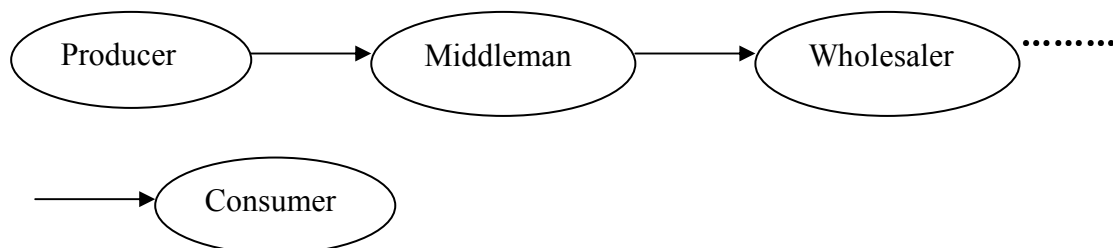


Figure 4 Multistage Multitude Formula

Source: Drawn on my own

③ Agri-products waste logistics. It definitely would bring about substantial waste and useless goods in the agri-products production and sales as well as consuming process. All activities including transport, handling and dealing constitutes agri-products waste logistics.

(2) Classification in terms of operation body

① Agri-products manufacturing enterprise self-conducting logistics. It is the farmers themselves organized cooperatives specializing in marketing. ② Agri-products taken on by sales enterprises. It is the sales enterprises organized logistics business after acquisition of Agri-products. ③ Third party logistics. It is the professional logistics company who takes on logistics business, for instance, sign the contract with TPL company through the broker or agent.

(3) Classification in terms of operation body

① Food crops logistics. Crop is the main material resource for the survival of mankind, people can not only directly consume or processing into other food, but also can be widely used as light chemical raw materials. According to some statistics, the grain output has been in excess of 400 billion kilograms, annual imported grains entering into circulation field about 65 billion kilograms as well. It is the big class of logistics object. ② Economic crops logistics. Its logistics demand is much higher than crops logistics because of high commercial rate. ③ Livestock products logistics. It not only provides meat, eggs, milk and other food for people, but also provides raw materials for light industry, chemicals, leather, pharmaceutical industry, which is largely relying on logistics. It could be further categorized into meat flow, eggs flow, milk flow. ④ Aquatic products logistics. Its demand is mainly from three aspects. First, household consumption. Second, aquatic products processing food, instant food, traveling food. Second, export. The need for technical demands is high, freshwater aquatic products require flexible short-range logistics, whereas marine aquatic

products require processing. ⑤ Forest products logistics. It is an important industrial raw material, large demand on the forest cutting, which is primarily reflected in transportation, handling and carriage logistics.

2.3 Characteristics of Agri-Products Logistics

Agri-products logistics has the unique natural attribute and supply and demand property. Therefore, compared with industrial products logistics, agri-products logistics has obvious different characteristics as follows:

(1) Agri-products logistics has feature such as the high technical requirement, strong specialization, big difficulty. As for the fresh agri-products, the value lies in the degree of fresh, but because of fresh agri-products has high water content and short preservation, easy decaying, which proposed strict technical requirements for the link in storage, packaging, transport.

(2) Value-added processing is primary link of the development of agri-products logistics. The large part of the market value of agri-products is formed after the production filed, this is the biggest difference from industrial products. So it has larger processing value-added potential. Hence, processing part is the main task for the agri-products logistics part, in other words, seizing the processing sectors is equivalent to seizing the logistics' main task.

(3) The main flow of agri-products logistics is from rural to urban areas. As we know, the origin of production is generally in rural areas, whereas the vast consumers are living in the city far from the rural areas. So when the agri-products consumptions have been met in urban areas, so that the commercialization of agri-products could come true. The pre-condition of achieving the commercialization of agri-products is

to transfer the agri-products from village to city. Under the circumstance, agri-products logistics transported the products to the consumers in fast and accurate way, and finally finished the transformation to the commodity that is the process of realization of ultimate value of agri-products.

(4) Distinct seasonal nature. Agricultural production has obvious seasonal nature, which decided the seasonal nature of agri-products logistics, mainly showed in those aspects as follows: A. The seasonal nature of production and transport. The production of agri-products is largely constrained by natural conditions. The instability property made it distinct seasonal nature. First, climate, soil, rainfall in different regions varies, which forms their own varieties suitable for cultivation. The production and quality difference gradually becomes the seasonal logistics. Secondly, the variety of agri-products alter as the season changes in the same area also could form the seasonal logistics. B. The seasonal nature of agricultural means of production. The agri-products production seasonal nature made the transport of means of production timely and imbalance. For instance, the farmers normally purchased the seeds, pesticides and chemical fertilizers before the coming spring cultivation period, rather than purchased in the last autumn or winter for these products have the matter of time and storage.

3. The Current Situation Analysis of Agri-Products Logistics System in Wenzhou

3.1 Current Situation of Wenzhou's Agri-Products Logistics

3.1.1 Basic Characteristics of Agriculture in Wenzhou

The population of agricultural people in Wenzhou has reached 5.99 million, accounting for 80.74% of the whole city. The total farmland are 2.47 million acres, of which 1.9 million acres paddy land and 0.57 million dry land. The per capita farmland is 0.34 acre. So Wenzhou is a coastal city with more people less land, resources shortage. The climate in Wenzhou is subtropical ocean seasonal, neither hot in summer nor cold in winter. Due to the adequate light and fertile land and rich resources, Wenzhou is abounded in much special agri-products such as waxberry, orange, loquat, tea, mushroom. In 2005, the output value of agriculture, forestry, husbandry, and fishery is added up to 11.4 billion RMB, the per capital net income of rural resident is 6,212 RMB².

The obvious characteristics of agriculture in Wenzhou is mainly divided into five special industrial belts, such as fishery special industrial belt with aquaculture, suburban special industrial belt which is specialized in agricultural facilities and

² <http://www.wzagri.gov.cn/html/main/nygk/5843.html>

flowers, plain special industrial belt which is mainly engaged in food, vegetables and fruits, mountainous special industrial belt mainly based on livestock breeding, features base development, special industrial belt which is mainly on various agriculture, forestry, fisheries leisure agriculture. And 15 special agri-products bases have been awarded as China Special Products Base. They are China Tea City in Taishun, China Wuniu Tea City in Yongjia, China Mushroom City in Cangnan, China Oyster City and Shark Processing base in Yueqing, China Horseshoe Shoot City in Ruian, and so on.

3.1.2 Production and Sales Marketing Situation of Main Agri-Products

The agriculture in Wenzhou has been developing rapidly in recent times. The comprehensive production capacity of agriculture is increasing year by year. Over the past five years, grain cultivation area has decreased by 1.58 million acres in Wenzhou, and the reduction rate reached 35.7%. In 2006, the total output of vegetables, fruits, meat and other agri-products are increasing in all round way. The total output of vegetables is 1.63 million tons, which has increased by 91.1% compared to year 2000. The total output of fruits is 0.35 million ton, which has 182.4% increase compared to year 2000. And the meat has reached 0.11 million ton, which has increased by 38.4% compared with year2000³.

3.1.2.1 Grain Production Situation

In the whole Wenzhou city, the cultivated area is 2.43 million acres, sowing area is 2.84 million acres, and total grain output is 0.99 million tons. The sowing area in Wenzhou urban district is 0.13 million acres, and the total grain output is 50,000 tons. At present, the grain shortfall in the whole city is up to 1.25 million tons, and 0.49

³ <http://www.zjagri.gov.cn/html/main/informationView/200601256167.html>

million tons in Wenzhou urban district. It is estimated that 75% grains in whole city and 90% grains in urban district should rely on the supply from other cities. Grains trade in Wenzhou city is too much dependent on other places, the market risk is becoming great.

Table 1 Grains Production Area and Population Situation in Wenzhou

Year	Population (Million)	Cultivated (10000acres) area			Grain (10000 acres) crops						Output(KG) Total Output
		Total	Irrigated land	Dry land	Total area	Spring rice	Early rice	Late rice	Sweet potato	Corn	
2002	6.979	257.1	198.5	58.6	432.8	55.9	136.7	190.4	43.4	2.04	1471619
2003	7.363	247.9	190.6	57.3	372.4	48.3	106.2	170.4	36.5	2.4	1254647
2004	7.388	243.0	186.6	56.4	311.6	22.8	84.5	157.9	34.2	2.5	1137317
2005	7.391	242.9	185.1	57.8	283.6	19.1	71.7	148.6	32.3	2.8	992046
2006	—	—	—	—	250.2	16.2	50.6	140.6	30.4	2.8	—

Source: <http://www.zjagri.gov.cn/html/main/zjModernAgriView/2006012664303.html>

3.1.2.2 Animal Husbandry Production Situation

The animal husbandry industry in Wenzhou is relatively backward in Zhejiang province, about 2/3 pork needs to be imported to Wenzhou. Wenzhou will strive to increase the existing self-sufficiency of market live pigs rate from 33% to 43% in the future five years, and ultimately effectively improve the supply of live pigs market. It has been investigated that the city's total output of pork was 72,100 tons, which has increased by 3.8% compared to previous year. The pigs in pig bed is up to 0.61 million, and the growth rate is 4.9%. The sow in the pig bed is up to 46,000, an increase of 11.1%⁴.

3.1.2.3 Vegetable Industry Development Situation

⁴ <http://www.china-feed.com/08/0402/138,64092.htm>

Since the 10th Five-Year Plan, the vegetable industry in Wenzhou is developing rapidly, and the cultivation area of vegetable ranks first in Zhejiang province. There are three breakthroughs Wenzhou city got, such as vegetable yearly cultivation area more than 1 million acres, yearly total output more than 1.5 million tons, and the proportion of vegetable output to plant industry more than 30%. (See table 2). In the plant industry, the cultivation area, total output and total production value ranks first. (See figure). Vegetable has become one of the leading industry in Wenzhou's agriculture. As for the varieties structure, the production area of leaf vegetables ranks first, the cultivation area is 60600 acres, and the second is solanaceous plant, the cultivation is 82700 acres, and the third is gourd vegetable, the cultivation is 60600 acres. As for the expanding of the vegetable production scale, the speed of Wenzhou's vegetable industrialization construction is accelerating and vegetable associations set up, the specialization degree is also speeding up. There are 11 vegetable industry associations, 60 specialized vegetable cooperatives organizations 27 vegetable leading enterprises, and 12842 vegetable farmers⁵.

Table 2 Vegetable Production Status in Wenzhou (2000-2005)

Year	Cultivation area(10000 acres)	Total output(10000 T)	Total output value (0.1 billion RMB)	Total output value proportion (%)
2000	77.77	114.27	10.6	25.85
2001	104.03	153.88	13.53	30.48
2002	114.47	163.35	13.47	35.94
2003	113.58	167.01	14.46	36.31
2004	108.37	157.96	14.06	31.05
2005	99.09	161.56	16.20	32.72

Source: <http://www.cqvip.com/QK/96109X/2007005/25707808.html>

⁵ <http://www.cqvip.com/QK/96109X/2007005/25707808.html>

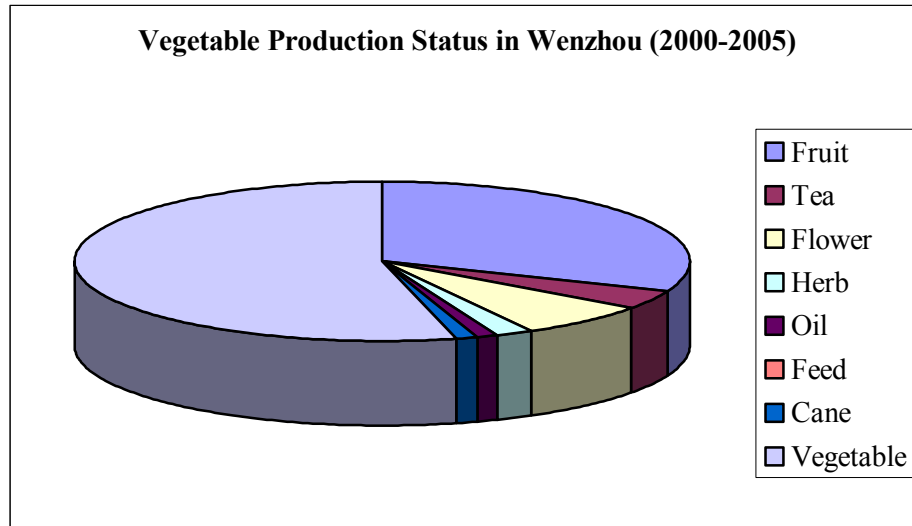


Figure 5 Vegetable Production Status in Wenzhou(2000-2005)

Source: Drawn on my own

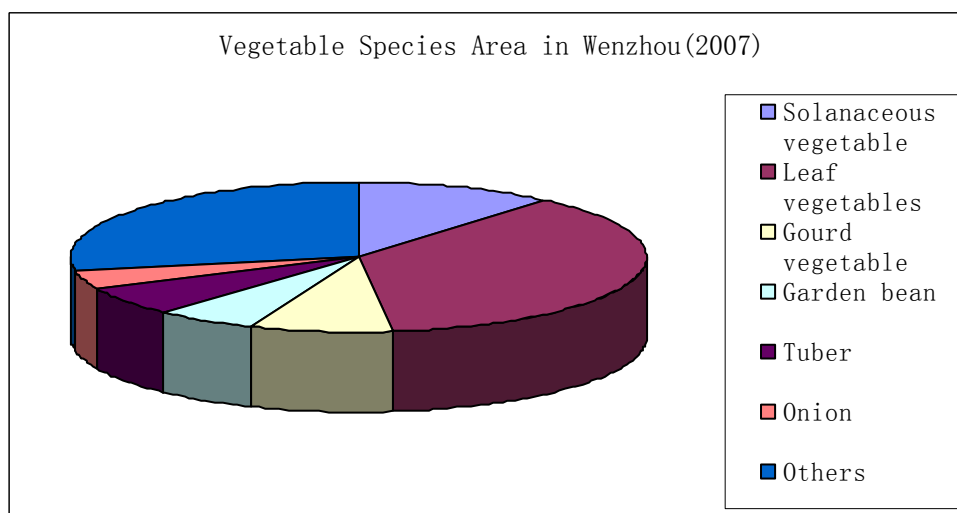


Figure 6 Vegetable Species Area in Wenzhou(2007)

Source: Drawn on my own

3.1.2.4 Fruit Industry Development Situation

The current situation of purchase and sales marketing of fruits and other agri-products are similar to grains, maybe even worse. As the saying goes like this “People regard food as their primary need”, thus government attaches more importance to the grains circulation than fruits, but the new construction of rural area to increase farmers’

income can not merely rely on the grains. In China, the city of Wenzhou is famous for fruits. As per the statistics, it is clear that there is a rapid development in fruit market in Wenzhou.

Table 3 Wenzhou’s Fruits Output (2002-2006)

	Orange	Pear	Peach	Loquat	Waxberry
2002	30.09	21.94	3.54	1.07	4.53
2003	31.57	26.4	4.38	1.68	5.22
2004	41.56	24.36	4.71	1.88	4.99
2005	32.35	25.78	4.8	1.27	5.29
2006	38.24	27.45	5.23	1.43	5.48

Source: Wenzhou Agricultural Yearbook

3.1.3 Agri-Products Wholesale Market Situation in Wenzhou

Since China’s reform and opening up to the outside, agri- products wholesale market has been rapidly developing, which has made big contributions to propel Wenzhou’s market prosperous. According to statistics, there are 570 markets and the annual transaction volume is 47.6 billion RMB. There are 275 agricultural by-products markets, including 232 integrated markets, 43 professional markets. The transaction volume of agricultural by-products is 19.3 billion RMB, accounting for 40.62% of whole city’s market trading volume⁶. A number of agri-products wholesale markets were established in Wenzhou, but most of them are concentrated in large and medium-sized towns. The operation is lacking of standardized rules. Take the grains wholesale market for case, there is still a gap in adapting to grains marketing demand. The main problems are, first, small investment scale, second, backward organizational form. Due to the lack of hardware, capital, talent, the information network system

⁶ <http://www.em.com.cn/user1/emall/archives/2007/1049.html>

which connected Wenzhou city's grains administration department at all levels, the reserves, processing plants, vendors has not been set up. It could hardly meet the need of gains' purchase and sale marketization in the aspects of information collection, analysis, publishing. So are the other agri-products wholesale markets, they also did not far meet the demand of agri-products logistics.

3.1.4 Logistics Infrastructure Status in Wenzhou

The traffic industry has become indispensable factor in Wenzhou's national economy, because three-dimensional transport network of railways, ports, aviation, highways and expressways has been formed and the traffic status has got fundamental improvements. The traffic infrastructure construction in Wenzhou requires rational design under the limited land resources. During the eleventh "Five-Year" period, Wenzhou will speed up industrial restructuring and focus on the development of port industry, strivingly build Wenzhou port into one of China's one of 20 pivotal ports along the coast of China. It is estimated cargo throughput will reach 75 million tons and 1.7 million TEU containers, which make the Wenzhou estuary and gulf harbors transform into deep-water port, and leaps from district port to coastal pivotal port. The completion of Yong-Wen railway and Wen-Fu railway will put Wenzhou into national high-speed railway network coastal passage, which has become the key passage connecting Yangtze River Delta, Pearl River Delta and the linkage of China's economically developed coastal cities. The total length of Wen-Fu railway is 298.4 km, 18 billion RMB investment, of which 69.2 km long of Zhejiang section. The total length of Yong-Tai-Wen railway is 282.4 km, the investment is amounted to 16.3 billion RMB, the Wenzhou section is 95km long, which started up in November, 2005. At the stage, the highway transport remained dominated in various modes of transport in Wenzhou. Wenzhou is China's one of 45 pivotal highway cities, the total mileage of whole city will be in excess of 13,000 kms, modern highway network, convenient

main road network and sound freight station system were initially formed. Building a modern airport is the need of achieving coordinated development of the three-dimensional integrated transportation system. The expansion of Wenzhou airport will be positioned as 4E class national level of civil aviation airport in terms of overall planning and air transport development requirements in order to build Wenzhou airport into major domestic regional airport.

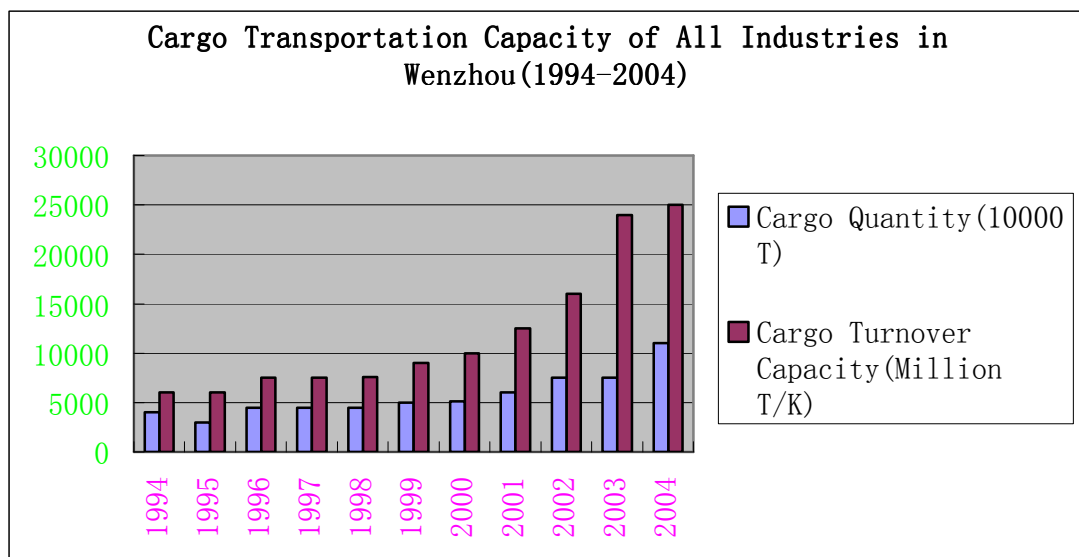


Figure7 Cargo Transportation Capacity of All Industries in Wenzhou (1994-2004)

Source: <http://www.wzjt.gov.cn/wzjtdz/200603/gzyj/06112412254403559.htm>

3.1.5 Modes of Transport Status in Wenzhou

In the end of year 2006, there are 246700 civil autos in Wenzhou, increased 130200 vehicles compared to year 2004, of which 11.57 new registered civil vehicles. There are 187600 passenger service vehicles, increased by 37100 vehicles compared with past two years. There are 59100 lorries, and the increasing vehicles are 11100 vehicles compared to year 2004⁷. In 2007, the aviation throughput is 3.59 million people, the

⁷ http://tjsj.baidu.com/pages/jxyd/22/86/dcf3b3268301b27f83b6d9478b2a296_0.html

growth rate is 17.8% compared to last year. The railway passenger capacity is 4.45 million people, increased by 16.5% and the railway cargo capacity is 1.71 million tons, 163% more than that in 2005. Main port throughput in Wenzhou is 42.57 million tons, more than 8.5% than last year, of which containers throughput reached 351100 TEUs, increased by 24.6%⁸.

3.1.6 Logistics Facility Status in Wenzhou

Logistics site mainly includes: freight station and container yard, warehouses, distribution centers, wholesale markets, packaging processing center, retail stores, and so on. The main activity space in traditional logistics industry are warehouses and roads, railways, ports, airports and freight station in airports. The large-sized road freight station in Wenzhou are mainly “Ouhai Yongrui Consignments Departments” and “Julun Highway Freight Company”. There are 82020 square meters space area, 28000 square meters warehouses, 8380 business using houses area. They provided common transaction premises for scattering transport operators, but most of them still lingered on collecting parking fees and accommodation charges. The roads freight business center is still on the initial developing stage. The relatively large-scale wholesale markets in Wenzhou invigorated the circulation of market, and put together a lot of cargo flow, business flow, information flow and capital flow. It is investigated that main wholesale markets in Wenzhou are Lucheng grain and oil wholesale market, Shuixin vegetable wholesale market, etc. There are many supermarkets and chain stores highly integrated business flow, cargo flow and information flow. The key representatives are “Renben Supermarket, Hualian Supermarket, Lotus Supermarket”, they are the main window to consumers.

⁸ <http://www.wzstats.gov.cn/infoshow.asp?id=6348>

3.1.7 Logistics Information Technology Development Status

Zhejiang Telecom further increased investment and expanded the scale of construction, information technology networks rapidly improved, integrated communication capabilities further enhanced, which has created the basis for the development of the Wenzhou's logistics industry. In 2006, Wenzhou city has been identified as "Using information to stimulate industrialization City". At the end of 2007, exports of bandwidth reached nearly 127 G, 3.47 million telephone users, 7.45 million mobile phones users, 1.09 million bandwidth users, average household owned one telephone, two mobile phones, 84 computers per 100 users. Information industry has become the new growth point of economic development. Recently, Wenzhou has sprung up 120 information trial enterprises, 40 information model enterprises. In 2007, electronic information manufacturing industry has finished total industrial values by 36.3 billion RMB, with an increase of 20.2%⁹. It should be noticed that Wenzhou Zhifang Logistics information CO.,LTD. also was set up.

3.1.8 Industrialization Operation of Agriculture

In recent years, in order to meet the development of rural economy, the structure of varieties of agri-products has been improved, quality has been developing towards excellence. Until 2007, the total values of agriculture, forestry, animal husbandry and fishery reached 14 billion RMB, and the per capita net income of farmers reached 6,500 RMB¹⁰. In the course of agricultural industrialization operation, Wenzhou prominently developed agricultural leading enterprises. It has become key carrier of propelling agriculture industrialization. Through nurturing special industries, optimize the layout of the region and in accordance with the advantages agri-products regional

⁹ <http://www.wzstv.cn/content/view/31675/26/>

¹⁰ <http://www.zjol.com.cn/gb/node2/node802/node803/node166352/node166358/userobject15ai1705719.html>

layout planning. They Guided and promoted leading industries to focus on regional advantages by means of technology, capital, project. The characteristics of differentiation, regionalization, scalization, specialized has been shown in Wenzhou's agriculture. And north-western region with ecological tea, fruit, and livestock industries, aquaculture industry region, grain and vegetables industry of plain valley, and leisure agriculture industry with suburban flowers. The formation of Regionalization layout furthered the differentiation and specialization of Wenzhou's agriculture production. A number of national agricultural special towns have been sprung up, and special large-scale agri-products production bases have been established, such as Ruian's cauliflower, Dongtou's sargassum fusiforme, Pingyang's houseshoe shoot.

3.2 Constraints and Causes of Wenzhou's Agri-Products Logistics

Currently, Wenzhou's agriculture and rural economy has ushered into new stage, yet due to the market system is not sound, low market-led production capacity, on the one hand, the sales performance of agri-products displayed the problems of regional, structural oversupply, hard-to-sell of agri-products, slow growth in farmers' income. On the other hand, the disorder of agri-products production, blindness of restructuring led to new threat agri-products' safety has to face. Therefore, it seems paramount to build new market circulation system and give full play to market regulation for resolving agri-products market circulation issue. Wenzhou is located eastern coastal region, and the traffic conditions are convenient so that becomes the well economic development city. Nowadays, logistics industry has become the new-born industry within the scope of Wenzhou, but the development of agri-products logistics system construction is still on the lower level of the initial stage, many constraints are as follows:

3.2.1 Decentralized Logistics Management System

As an emerging modern logistics, it requires a nice legal policy environment, so is agri-products logistics. In the crucial moment of rapid development of logistics industry, Wenzhou city has not yet worked out feasible corresponding policies and unified layout planning, such as logistics enterprises' qualification, market access, standardized system construction and tax policy. Wenzhou government at all levels is relatively weak in regulating and controlling the agri-products logistics. First, agri-products logistics regulation is lacking of market mechanism. Although government at all levels attached high importance to agri-products logistics construction and development, but lack of field investigation and systematic planning, imperfect market regulation of agri-products, it is difficult to put the legal system in place. Second, lack of uniformity of agri-products logistics regulation and control. Related departments, industries, and enterprises agri-products logistics involved have invested to build their own logistics systems, they are all independent on each other. The government did not exercise unified coordination. So it is imperative government should optimally reengineer the existing logistics resources, and further improve the environment for the development of agri-products logistics in accordance with market economy and the requirement of modern logistics development.

3.2.2 Imperfect Construction of Agri-Products Logistics Infrastructure

Large amounts of funds has been invested on urban expressway and high-grade highways, however, compared to continually increasing agri-products output and the growth rate of requirements for transport facilities, still lags behind. Furthermore, most of the high-grade highways were built focusing on neighboring urban areas, and unsound rural traffic network, unformed inter-modal transportation network, resulting in poor agri-products circulation, so as to greatly increase the agri-logistics costs and operational risks. Standardization level of logistics facilities and equipments was low, and specialized equipments for agri-products logistics were in short supply. The main

transport of agri-products in Wenzhou, open trucks account for 65%, only 10% are sealed box cars, transporting loads for roads refrigerated transport account for 10%, and railway for refrigerated transport is 5%¹¹.

3.2.3 Imperfect Agri-Products Wholesale Market System

The market hardware facilities, transaction standards and the modernization process should be further improved. Current agri-products circulation mode is in accordance with the route of “acquisition of origin—distribution market of origin—distribution market of sales—urban and rural retailers, which has the typical characteristics of primary market. Agri-Products wholesale market is the main carrier of agri-products’ cargo flow and business flow, however, the logistics system of agri-products wholesale market is extremely lagging behind, and could not meet the need of agriculture marketization. Firstly, the incompatibility between market system construction pace and agriculture marketization process. For example, most agri-products belong to fresh perishable products, which required advanced storage facility. The fresh agri-products could only be preserved by water or ice due to the low fresh preservation technology. The sales markets are mainly small stand, big trading based operation, which is lacking of the basis and condition of development of modern circulation methods. Secondly, market does not operate according to marketization. Most markets belong to collective enterprises, no enterprise restructuring, charged agent system phenomenon exists widespread. Thirdly, majority of markets for agri-products are on the operation of venues and facilities rental and other income-based property management, market derivative products are placed second. The market itself is actually “big market, small business operators” rather than main body of agri-products circulation. The scattered marketing behind the big market could hardly form a joint force, which made agri-products circulation

¹¹ <http://www.cadcc.com.cn/article/2007/11/20/1051537349.shtml>

disorderly and inefficient.

3.2.4 Integration of Production and Sales Marketing Operation

From the perspective of farmers' marketing team, there are three problems existing: First, their low quality. They are the persons who are lack of necessary circulation knowledge and the capacity of collecting information processing. Second, low level of organization, decentralized management and information monopoly. Third, low transportation capacity and high market risks, poor ability to resist risks. As an intermediary circulation organizations are just at the initial stage, non-standardized operation and marketing capacity. The agri-products processing enterprises are few and small scaled, it required the substantial improvements in agri-products capacity.

3.2.5 Low Information and Standardization Level

Modern logistics needs sound and perfect logistics network system. Only by maintaining logistics systematic, consistent between network nodes can ensure best logistics solutions. First, many wholesale markets do not own specific information network platform related to modern logistics. Limited usage degree and unsound network made it hard to give full play to market efficiency, which has become the important factor of restricting agri-products logistics development. Second, for farmers, they could become the innocent victims of market for the reason of lack of accessing to effective information guiding production. As the asymmetric agri-products information between transportation owners and farmers of production place, which lead to the price gap between production and sales places. It became the price fraud for producers and consumers. Third, agri-products standardization level. Non-brand, non-packaging, non-class of most products in market circulation, which

brought great difficulty for the transition from agri-products circulation to modern logistics. The low processing technology level and short agri-products logistics chains resulted in the vast majority of unprocessed agri-products entering into consumer market and afterwards low value-added agri-products.

3.2.6 Talents and Professional Knowledge

In particular, Wenzhou logistics industry is lack of logistic professionals. The existing related logistics employees with low-quality, aging knowledge, and old-fashioned ideas are the tough problems of restricting Wenzhou's logistics development. For agri-products logistics, due to the special nature of products, it proposed far higher requirements for personal quality, service. The current logistics employees are from warehousing or transportation employees, they do not possess appropriate expertise. Whereas the operation and management of newly-established logistics companies is lacking of related modern logistics management notions and experience, most of them still follow traditional circulation modes.

According to the above-mentioned analysis, Wenzhou city still has not truly built the agri-products logistics system, let alone logistics management. Therefore, exploring a new industrial system, solving the problems of production and sales discordance through further logistics industry development has important practical significance of strengthening basic position of agriculture, "Three-Rural" issue solving and farmers income raising and narrowing the gap between urban and rural areas.

4. The Comparative Analysis of Development Experience at Home and Abroad

4.1 Foreign Agri-Products Logistics Development Experience

4.1.1 The USA

The USA is considered the first nation which put forward the notion of logistics management, and currently also the most developed countries in terms of logistics industry in the world. The specific characteristics of the USA's agricultural products logistics are stated as follows:

1. Sound infrastructure and advanced technology system

The USA's transportation facilities are relatively perfect, especially noted, highways, railways, water transportation and shipping are well connected and extended in all directions. The high connections degree of road network could directly lead to every household of countries, and highways are easy to be seen everywhere around the rural and urban areas. Furthermore, the railway transport is also very convenient for the reason that specialized railway lines have been built in some agricultural products purchasing stations, depots and processing plants. Take Foster Farms for example, one feedstuff enterprise affiliated to Foster Farms Company, directly discharges the corn shipped from central and western areas via railway to production line, in doing so, it

not only improves the market operation efficiency but also saves storage and loading & unloading costs. The improved means of transportation ensures the smooth flow of agricultural products. At present, the USA has gradually developed modern logistics equipment technology system which is based on the core of information technology and supported by storage and transportation technology, packing technology and other professional technologies. Special storage and transport, handling equipment, cold-chain equipment are put to use during the whole logistics process, it greatly reduces the loss rate of agricultural products. The American agricultural products handling equipment mainly are movable rubber belt conveyor, low busload bucket elevator and spiral conveyor. The vegetable and fruit logistics consists of the stages of pre-cooling after harvest, cold storage, refrigerated trucks transport, wholesale station cold storage, supermarket refrigerator, consumer's refrigerator. The loss rate of entire logistics chain is merely 1%-2%. The USA has a highly advanced information flow system, it has built the largest agricultural computer network application system in the world, since 1990s, the government appropriates 1.5 billion annually to build agricultural information network and promotion of online application, the system has covered 46 states, 6 provinces of Canada, and 7 countries exclusive of USA and Canada. It connects the Agriculture Department of USA, Agriculture Organizations of 15 States in USA, 36 universities, and many agricultural enterprises, the users can share the information resources of network via telephone, TV, computer and other terminal equipments¹².

2. Comprehensive agri-products logistics service system

In the USA, the agricultural social service system seems relatively sound, it has been demonstrated kinds of characteristics, such as multi-form, multi-level, multi-category, serialization, specialization and diversification. It encompasses many activities such as agricultural production, processing, storage, transport and sales. As long as farmers

¹² Jia Huimian,CaoYinge. America and Japan agricultural products logistics development experience and enlightenment to China[J],Logistics Science and Technology,2006(07)

are in need, there will be services provided regardless of whatever links of logistics. The agricultural products are mainly sold to consumers by farmers via production market or wholesalers of central market, sales to consumers through retailers are placed second, the direct sales channel least. The main body of participating in agricultural products logistics service are marketing cooperatives of farmers involved, Governmental Commodity Credit Corporations, agri-business consortiums, production markets or wholesaler, retailer, agent, processor, future speculator of central market. They generally are large-scale, taking on many functions of agricultural products' transport, storage, handling, processing, packaging and information transfer in the USA. It has built a mechanism for assorted information transfer, production organization, rational flow of production factors, automatic mechanism between agricultural production and market, which promote the rapid development of agricultural products logistics.

The American agricultural association plays a big role in the agricultural products logistics. The USA's agricultural products logistics are mainly achieved by large numbers of professional agricultural associations, such as U.S. Sunkist Association, Washington Apple Association, the American Wheat Association, U.S. Potato Association, U.S. Meat Export Association, and so on. These associations has played great role in maintenance of industry image, promotion of industry marketization and production and marketing of agricultural products. They regulate market and adjust the demand and supply relations, give strong support for farmers, and communicate with government on behalf of farmers by the means of uniting logo, drawing up uniform standards, adoption of uniform pricing and application of market rules. Take U.S. Sunkist Association for instance, each week, the association makes an adjustment for reunification of price and the professional risk forecaster predicts the changing situation of global market, and determines the annual planting plan, in order to supply Sunkist orange in the whole year, it also adopts technology promotion, and formed two quarters of orange harvest periods, and make sure that the goods will not be out of stock in the four seasons of year. Due to the fruitful work Sunkist did, it

makes possible to enjoy high reputation and strong competitiveness in the global market.

3. The positive role of government

The U.S. logistics industry is mainly propelled by each logistics association, which came into being spontaneously in the development of economy, and the business enterprises consciously take part in the field, however, government did not have much intervention in the early stage. Although government doesn't get directly involved in the farmer production, yet they exert strict and effective regulatory measures for public domain. For instance, government urges GMOs must be declared, and test harmful substances content in the soil and river on a regular or irregular basis and, strictly control the emissions from farm waste. In addition, government also provides authoritative information services. There are 0.1 million people from the Ministry of Agriculture scattering around all corners of the country, and the agricultural statistics system learnt well about all the crop's varieties, sizes, growth, yield output in each land of each farm. Then the information will be released on a regular basis to guide farmers how to produce and manage by summing up and handling. U.S. government attached great importance to research and development of agriculture and public agriculture, and investment in rural education projects. In order to get rid of the tough problem of domestic surplus agricultural products, the price supporting measures, tariff policy, food aid for developing countries were all implemented, and the government also put forward the "New Farmers Program" so as to enhance the farmers' quality in 1998. It is estimated that the annual budget for export subsidies would be in excess of 60 billion USD¹³.

¹³ Jia Weili. Research on China's agricultural products logistics issues:[Degree paper].Tai An,Shandong: Shandong agriculture university library,2005.

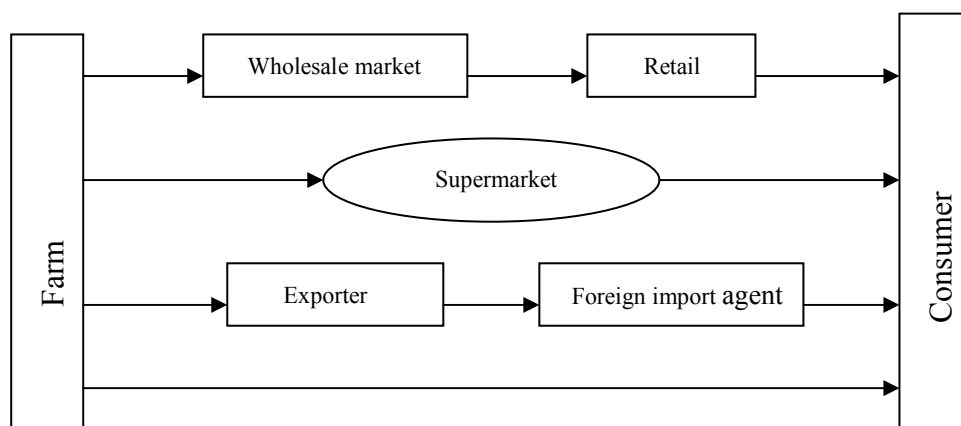


Figure 8 USA Agri-Products Circulation Process

Source: Drawn on my own

4.1.2 Japan

Japan is one of perfectly rapid country for modern agricultural products logistics development, the agricultural products logistics has the following characteristics:

1. The auction system of agricultural products wholesale market

The auction system of agricultural products wholesale market is the most evolution in the Japan’s agricultural products logistics system development. The agricultural production could merely be built on the base of small-scale operation as Japan has large population and less land. Therefore, the conflict between small-scale and big circulation in Japan’s agricultural production has still remained difficult to resolve. Under the circumstance, Japan paid much attention to the construction of wholesale market of agricultural product and developed it towards auction market, for they thought it concerned the national economy and people’s livelihood. Osaka Central wholesale market advertised itself as the “Kitchen of Osaka People”, and Tokyo Central wholesale market thought itself as the “Flow base of 12 million people’s

living life”. The establishment of Japan’s agricultural products wholesale market requires strict examination and approval system, and the construction of central wholesale market, local wholesale market and other wholesale markets should comply with “Wholesale Market Law” and other rules. The market openers are mainly local public body, joint-stock corporation, agricultural cooperative. To reflect the principle of market transaction of “open, fair, just”, Japanese government has repeatedly revised and modified the “Wholesale Market Law” and implemented in a strict way. The middleman is the bidder of the auction, if too few, monopoly will manipulate the price, if too many, will be excessive competitiveness. So the government has to strictly examine and control the qualification and quantity of enterprises of entry to wholesale market, which has ensured the transaction in accordance with law. In order to make the logistics in the market highly efficient, the wholesale markets are equipped with sound storage facilities, distribution facilities and processing facilities, etc as well as make good use of computer information processing technology, which has actually evolved into agricultural products logistics center. The powerful logistics functions attracted large supermarket chains and wholesalers to participate in the trading. Currently, there are 88 central wholesale markets and 1500 local wholesale markets in Japan, and most of agricultural by-products are through the wholesale markets¹⁴. The wholesale market has become important foundation of Japan’s protection of interests of producers and consumers, promotion of agriculture production, development of modern circulation, economic prosperity, and social stability. Practice has proved that Japan has found an efficient developmental way of agricultural products wholesale market which is time-saving and cost-saving of transaction.

2. The positive role of Agriculture Association

¹⁴ He Feng. China’s agricultural products logistics mode construction: based on the research on wholesale market[J]. Agriculture technology economy, 2006(05).

Japan's Agriculture Association is the economic organization which is jointly organized by individual farmer voluntarily, and also a farmer's economic group with strong economic power. As the most widespread agricultural cooperative organizations, it is exceptionally beneficial to enhancing the development of agricultural products logistics and reducing government's social management costs. The Agriculture Association takes advantage of its own organization system, and other modern edges such as preservation, processing, packaging, transport, information network as well to take the role as the intermediary of place of origin between producers and wholesalers by putting together the agricultural products and implementing one-off program. The whole process is the key link of farmers' entering into circulation filed. There are agricultural products wholesale markets directly taken part in or organized by the Agriculture Association in many cities in a very active way. It is reported that 80%-90% of Japan's total agricultural output had to enter into wholesale markets, and the wholesale fairs organized by Agriculture Association system accounts for more than 60%¹⁵. The Agriculture Associations established a number of selections, processing procedures, packaging plants, pre-cold stores, cold stores, transport centers and local wholesale markets, supermarkets, and set up 74 branches of central wholesale markets in the whole country in order to increase the added value of agricultural products and the rationalization of sales process and improve efficiency. All above mentioned had created benign conditions for farmers' organizing agricultural products production and sale in a smooth way.

3. Advanced agricultural products logistics management system

The fast development of Japan's logistics has direct bearings with government's macro-management for logistics industry. In order to vigorously support logistics industry, Japanese government adopted a number of macroeconomic policies in recent years. For instance, they carried out their own modern logistics construction and

¹⁵ Liu Wenjie, Wei Heng. The Experience and Enlightenment of Foreign Agricultural Products Logistics[J]. China Technology Information, 2005(24).

reasonably planned for the logistics facilities land in the large, medium-sized cities, ports, major highway hubs. And also launch various infrastructure construction including highways, coastal harbor facilities, aviation hub port and railway transport network. In the meantime, the administration function of the production and circulation of production management, post-harvest processing, listed transport, retail consumption are all attributive to the administration of Ministry of Agriculture. In the country level, the provincial Ministry of Agriculture is responsible for circulation administration of agricultural products, whereas in the province or city level, the local Agriculture department responsible for the function. The agricultural products logistics management system could eliminate multiple management and reduce the problems of conflicting policies from different departments, finally bring down the administrative costs, as well as improve the circulation and administration efficiency.

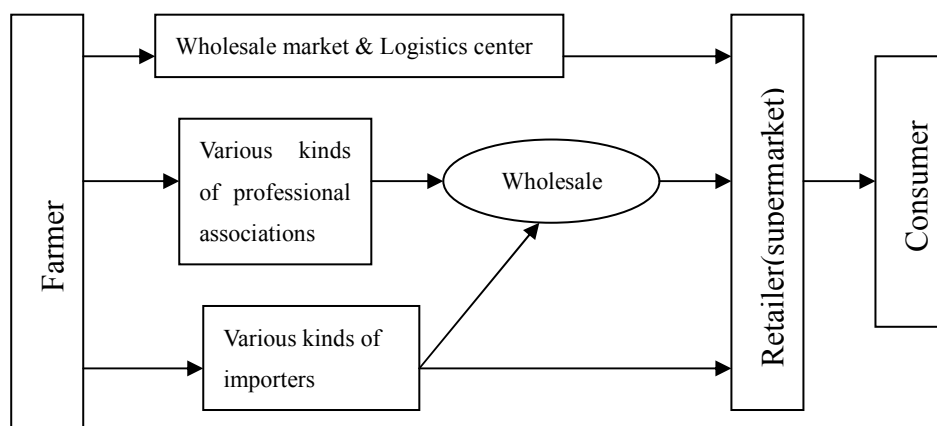


Figure 9 Japan Agri-Products Circulation Process

Source: Drawn on my own

4.1.3 The Netherlands

The Netherlands has been deemed as optimum center for providing logistics service for huge agricultural products logistics market in Europe. Due to the fast speed of agricultural products logistics development, and take the Netherlands for illustration,

we introduce the successful experience of agricultural products logistics development and its detailed developmental traits are described as follows:

1. Implementation of virtual electronic SCM of agricultural products logistics

The agricultural supply chain has been formed by connecting agricultural means of production supplier, manufacturer, farmer, wholesaler, retailer through network, and then each link of supply chain could be actually operated and provide business circle and consumers with brand agricultural products suppliers and retailers so as to complete the logistics activities required by customer orders. The net users can share supply chain information, and the information transparency, accuracy, timeliness are all improved so that the supply chain becomes that more vibrant. Therefore, it seems imperative to timely improve the logistics planning, management, deployment, and optimization. The state-of-art electronic exchange information and ordering system for electronic trading market of agricultural products, coordinated intermodal logistics center, integrated agricultural preservation center, flowers and gardening center are founded, which makes it possible to serve for vast clients around the globe.

2. Establishment of various agricultural products logistics centers

As the European logistics center, the Holland made best use of this advantage and established many agricultural logistics base with different labor divisions. Thanks to the Rotterdam port is adjacent to key vegetable and fruit cultivation areas, thus, it definitely is considered a significant logistics base. It is investigated that in excess of 58% of agricultural products and food products are transported through Rotterdam port¹⁶. Amsterdam-Schiphol airport is another major agricultural products logistics hub as the flowers planted in Netherlands are transported to worldwide regions through the airport. There are other agricultural logistics centers with different labor

¹⁶ Liu Wenjie, Wei Heng. The Experience and Enlightenment of Foreign Agricultural Products Logistics [J]. China Technology Information, 2005(24).

divisions, such as Fulasen port specializing in fruit wholesaling, Haimshfen port dealing with frozen food and Aamsten port engaging in aquatic products. To cater for the higher requirements of the European clients for the fresh, diversity and convenient delivery, so the European agricultural products retailers put forward unprecedentedly stringent demand for the delivery time, speed, products reliability, quality. Accordingly, the agricultural products distribution center was founded to resolve above problems. The basic operation principle is as follows, build a transit point of agricultural products near the market, the goods are firstly put together in the transit point station, and then distributed through the station. The efficient way made it sure that the abundant supply, rational distribution, timely transport and reliable supply. The main task for distribution center is that after receiving the agricultural products, operate the classification, deployment, segmentation, package and storage in terms of specific conditions, norms of transaction and distribute to every client. Most agricultural products in Holland are transported by roads, which require frozen technology equipment and sufficient volume of equipment. Suffice it to say, the modern advanced refrigeration and frozen equipment could fully guarantee the high-quality service of transport, storage and distribution of agricultural products.

4.2 Development Experience of Agri-Products Logistics in Certain Areas of China

China's logistics industry is still in the developing stage, and agricultural products logistics development in each region varies. Developmental experience of agricultural products logistics of Shenzhen Agricultural Products Co., Ltd and Shouguang Vegetable Wholesale Market are introduced as follows.

4.2.1 Shenzhen Agricultural Products Co., Ltd

Shenzhen Agricultural Products Co., Ltd is the leading enterprise of national industrialization operation of agriculture, which is mainly engaged in investment, operation, and management of agricultural products wholesale market. The early founded Shenzhen Buji agricultural products wholesale market, opened up the Buji Mode of “enterprise running market, enterprise managing market, market enterprisization”, which had been pinpointed and promoted in the nationwide. The main worthwhile experience is stated as follows:

1. Construction of big national platform for the agricultural products circulation

Constructing agricultural products wholesale market system and developing big circulation of agricultural products are the main business for Shenzhen Agricultural Products Co., Ltd. In addition to the three wholesale markets set up in Shenzhen, Shenzhen Agricultural Products Co., Ltd has managed and built ten big agricultural products wholesale markets in Jiangxi, Shanghai, Shandong, Anhui, Guangxi, etc through capital investment and management output. Now the national agricultural products wholesale market system has been founded, which has covered Pearl River Delta, Yangtze River Delta, Southwest and Northwest and other regions. The Shenzhen Buji agricultural products wholesale market has rapidly grown into the largest one in China, through many years’ exploring and development, it has successfully built the industrial mode of “company+ selling wholesale market+ production wholesale market+ intermediary organization+ base+ farmer”. And at the same time, it should be noted that the company’s other agricultural products markets also have made good success, such as the transaction volume of Nanchang agricultural products wholesale market has accounted for 80% of Nanchang market, which has radiated into the center of South China. And the Shandong shouguang vegetable wholesale market’s daily trading volume has reached more than 5 million

kilograms, which has provided impetus to the development of 0.8 million mu vegetable planting base. The sale volume of wholesale market in each region of China can arrive to 40,000 Ton, which drives 10 million farmers nationwide selling the agricultural products in a very smooth way¹⁷.

2. Wholesale market of agri-products as centre of Integrated Supply Chain

Shenzhen Agricultural Products Co., Ltd has always insisted the developmental strategy of “Agricultural products wholesale market as core, built nationwide agricultural products market system, and set up three transaction platforms of auction, electronic business, logistics distribution, expanding to manufacture and retail fields in order to achieve professionalization, industrialization, networking, modernization of agricultural products operating. Through 18 years’ development, the company has become the large comprehensive agricultural products enterprise group with multi-national vertical integration by the ways of acquisitions, mergers, and extension of the agricultural products circulation chains. In the supply chain operating system, the company explored two different methods dealing with contract incompleteness. Firstly, long-term contract deals with contract incompleteness. In the preconditions of providing good market services and standard trading environment, and agricultural products company manages market through enterprise, which has attracted large jobbers, standardize the behavior of agricultural products company and jobbers by leasing contract, in some extent, reduce the incompleteness degree of market contract. Secondly, integration of production and marketing method deals with the contract incompleteness. Agricultural products company enabled the external transaction into internal by acquiring premium production agricultural enterprises and setting up the original place of production of wholesale market. The foundation of trustful, loyal “relationship alliance” and complete supply chain by several times’ gaming between agricultural products company and jobbers, jobbers and jobbers finally effectively

¹⁷ Anonymous. Actively develop agricultural products circulation in Shenzhen Agricultural Products Co., Ltd. www.baidu.com,2005/04/30

reduced the transaction costs.

3. Agri-products circulation modernization driven by informationization

To improve the circulation efficiency of agri-products, the company adopted modern information technology and vigorously promoted innovation of circulation. Firstly, implementation of E-commerce of agri-products. The Buji wholesale market opened up the “China E-commerce of agri-products”, everyday 0.3 million words information are published and provided users with latest information about supply and demand of domestic and foreign agri-products, latest policy of agri-products’ production and circulation and market price in each place. All those factors have made it possible for Buji market to become the information center of agri-products in China and Southeast Asia. Through the E-commerce of agri-products transactions, not only got rid of the constraints of time and space of bulk agri-products transaction, but also effectively make the convergence of origin of production market and sale market and finally lower the operating costs of the real economy. Secondly, implementation of auction of agri-products. The Futian agri-products wholesale market made the agri-products transfer from “general goods” to “quality goods”, so as that the transaction way of bulk agri-products took the lead with international market. The reason why the auction not only is high-transparent and reliable, but also fair, just and high-efficient and cost-saving is that the auction process set strict demands on agri-products to be “quality classification, weight standardization, packaging normalization”. Thirdly, construction of distribution service platform of agri-products logistics. The company specially set up the modern fresh agri-products distribution center and introduced numbers of processing distribution to operate. The daily processing distribution vegetables and fruits could add up to 1500 tons, which accounts for 1/3 of wholesale market with vegetables and fruits¹⁸. It became the largest fresh agri-products processing distribution base in South China. The way of entering into logistics

¹⁸ Jia Weili. Research on China’s agricultural products logistics issues:[Degree paper].Tai An,Shangdong: Shandong agriculture university library,2005.

distribution field formed nationwide and multi-level agri-products circulation system.

4. The extension from agri-products wholesale to production and retail links

In order to improve the chain of agri-products wholesale markets and production & sale convergence, Shenzhen Agricultural Products Co., Ltd put forward the development strategy of “Two Extensions”. Firstly, extend to agri-products production sector. The first way is to extend to production sector through acquisition of premium production enterprises. On the other hand, to achieve the extension to manufacturing field, combine production, wholesale, processing, storage, fresh preservation, transport through investing on the agri-products production base and managing thousands of agri-products wholesale markets. The affiliated production processing companies have driven the agri-products development from the aims of upgrading quality and technological use, which has nurtured many famous agri-products brands. Secondly, extend to modern retail chains. The company has explored many chain operation modes such as comprehensive supermarkets, discount stores, shopping centers on the road of community-based, differentiated, large-scale, multi-form. In 1997, the company began to set up the Minrui supermarket, positively propelled farmer’s market supermarketization. The company ranked third in terms of chains sector in Guangdong province, it put the advantage of Buji and Futian agri-products wholesale markets extend to every household in the form of direct marketing. The 150 supermarket chains the company has founded, which has formed large-scale chain marketing network around Peal River Delta, and the yearly sale volume is in excess of 2 billion RMB.

5. Establishment of agri-products access system

The company had founded modern pesticide residue testing center for the aim of strictly testing the quality of by-products of accessing into market transaction. In the meantime, certain correspondent punishment measures are made to restrict the quality

of products. The affiliated agri-products wholesale market adopted enterprise management method, so wholesale market should obey the specific regulations and crack down on the behaviors of regulation violations. And standardize the procedures and processes of each transaction body, making sure that their legal interests could be protected. To make the whole market operate in the way of fair, just, open in an orderly and clean environment, the regulations had been made in the aspects of sanitation, security, transport and living service combining the agri-products market features.

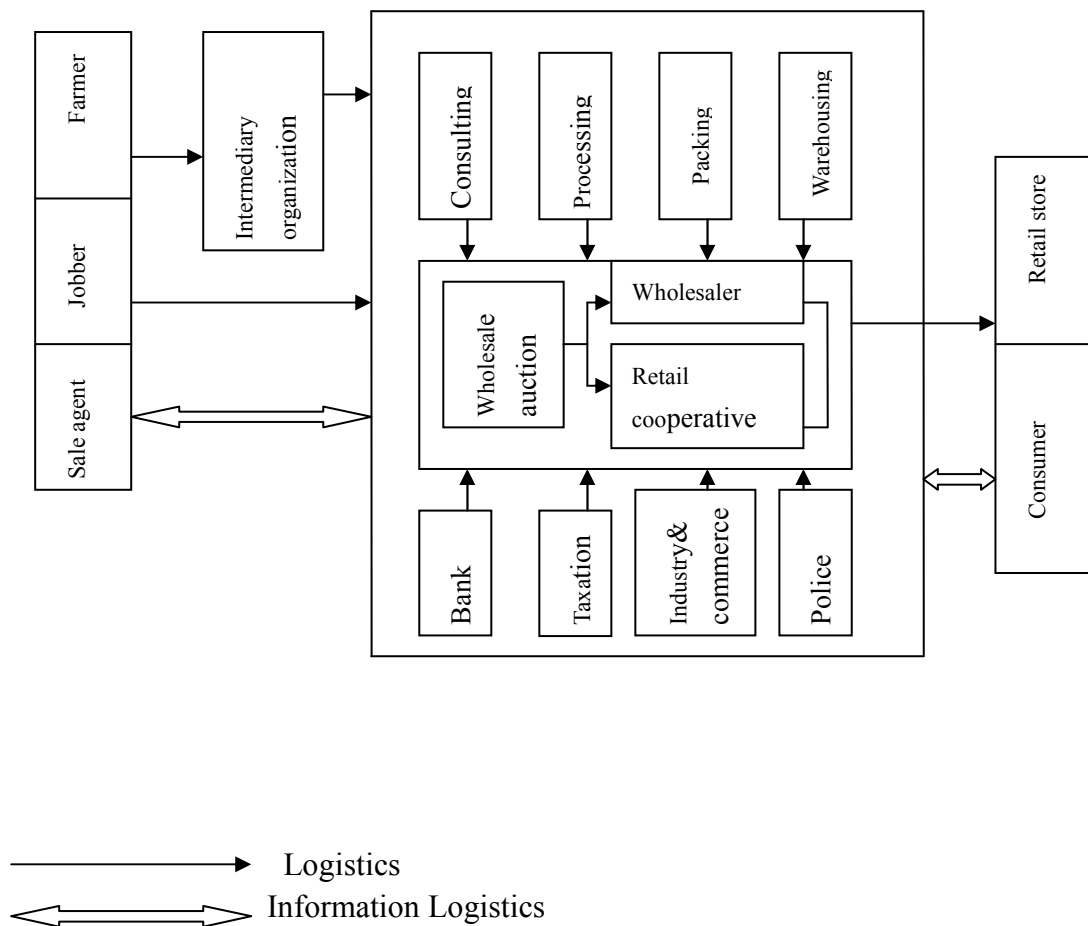


Figure 10 “BuJi Mode” Operating Flow

Source: Drawn on my own

4.2.2 Shouguang Vegetable Wholesale Market

Shandong Shouguang Vegetable Wholesale Market Co., Ltd is considered the leading national enterprise of agriculture industrialization. In 2003, it cooperated with Shenzhen Agricultural Products Co., Ltd, and founded comprehensive wholesale market with joint stock system, which has become the largest vegetable distribution center. The successful experience of logistics operation of Shouguang Vegetable Wholesale Market are as follows:

1. Large-scale, high grade, wide-range of market

Shouguang vegetable wholesale market covers 600 acres, has all-sealed steel frame Trading Floor with 32,000 square meters, trading service building with 7200 square meters, special franchise area with 5000 square meters, vegetable dealing center with 20000 square meters, vegetable electronic auction center and office storage system and tile roof transaction room with 8000 square meters. The selling vegetables are up to 1.5 billion kilograms, and the trade volume is 2.8 billion RMB¹⁹. There are more than 300 varieties of vegetables and becomes the largest vegetable distribution center, pricing center, information exchange center in northern China. The well-sold market has been approved by leaders and social professionals. Shouguang vegetable wholesale market is famous for Large-scale, high grade, wide-range in China.

2. Sound market facilities and complete functions

Since the comprehensive joint-stock wholesale market has been set up, the market operated in terms of corporate operation and management department does not take part in any transactions. The sound market facilities provided sorting, packaging, transport, refrigeration, processing, distribution for main body participated in the

¹⁹ Jia Weili. Research on China's agricultural products logistics issues:[Degree paper].Tai An,Shangdong: Shandong agriculture university library,2005.

trading activities. Shouguang wholesale market has built transaction service hall with nearly 0.1 million square meters, the facilities are all equipped such as TV monitor, computer information networking, cold storage. The market transaction is advanced, the agri-products achieved the full electronic transaction through electronic auction and E-billing. The large-scale by-products quality testing center made a sample for vegetables on a weekly basis with a complete device, advanced equipment, strong ability to detect. To make sure that the security of market transaction, security guards are watching all day long approved by provincial police bureau. The market vegetable association is founded mainly on the purpose of maintaining interests of dealers and assisting market managing officers operate market and provide services for the traders. In addition, the cleaners and other auxiliary service facilities such as catering, accommodation, professional trucks and many freelance staff are well equipped, which has provided for the wholesale market with effective management and service, and then save ample vegetable circulation costs.

3. High degree of Market information construction

Information is thought to be the life of logistics, especially for the timely fresh agri-products in the circulation aspect. The whole circulation process requires accurate and fast information as guarantee. Shouguang vegetable wholesale market called on the special vegetable associations and cooperatives and other vegetable suppliers to set up their own special office and website for collecting and distribution of plenty of market information. Since the foundation of information website, Shouguang vegetable wholesale market has provided clients for all-round information with latest market supply and demand information, market transaction price, and own magazines. It also developed social services and related secondary and tertiary industry has been launched, in doing so, which has achieved the win-win between enterprises and farmers by the development target of “build a professional market, promote one professional production, cultivate one pillar industry, form a regional economic zone”.

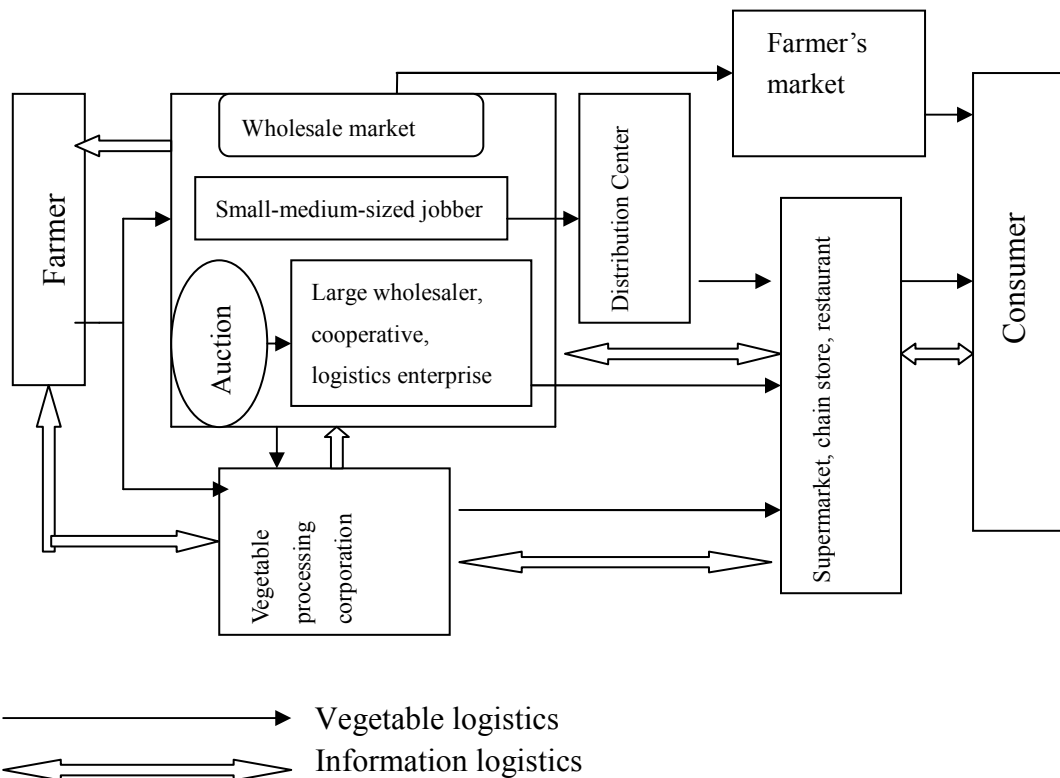


Figure11 Schematic View of Shouguang Vegetable Wholesale Market Logistics

Source: Drawn on my own

4.3 Enlightenment and Experience for Wenzhou

Through the introduction of foreign countries' logistics development experience, it could be well learned from the USA that Wenzhou should consolidate the construction of agri-products logistics infrastructure, logistics technology and service system, agri-products logistics marketization and informationization degree. It also might be pretty enlightened from Japan that Wenzhou should strengthen to build the agri-products wholesale markets and agriculture associations, promote the agri-products logistics management system. The Netherlands' visual agri-products SCM, agri-products logistics center with sound facilities, high-developed cold-chain logistics are also the valuable experience Wenzhou should learn. One thing also should not neglected is domestic region's successful agri-products logistics experience. In addition to the foreign experience mentioned above, which is

overlapped applied to domestic regions, we should also learn that applying agri-products SCM to guide agri-products logistics and develop E-business agri-products logistics by combining E-business and logistics from Shenzhen Agricultural Products Co., Ltd and Shouguang Vegetable Wholesale Market. In order to develop Wenzhou's agri-products logistics, it is necessary to learn from those advanced development experience of foreign and domestic regions.

5. Analysis of Agri-Products Logistics Center Model Construction

5.1 The Significance of Constructing Agri-Products Logistics Center Model

In order to build agri-products logistics system in Wenzhou, it should be focused on building rational scaled logistics center. Because it will not only save logistics costs, enhance regional-level functions, and strengthen regional social economic functions. But how much degree logistics center should maintain, very few scholars have studied on that. If logistics center is too much scaled and investment put on it, and it is difficult to recover back the costs, it will reduce efficiency of logistics center. If too less scaled, it is also possibly for logistics center not to meet development demands. Therefore, rational operational scale of logistics center will do great good to optimize the input and output, improve the regional efficiency of logistics center. Due to the large number of agri-products logistics centers, concerns the vital interests of farmers, it should specially be evaluated in order to avoid the massive wastes and facilities idling. Economy scale optimization model of agri-products logistics center has to be established to rationally optimize operational scale of logistics center.

5.2 The Definition of Economy Scale of Logistics Center

Economy scale of logistics center refers to there objectively exists operation scale of production capital investment and labor input most economic and efficiency output in

logistics center most optimized. As the increasing of logistics center' size and production concentration and supply, it will result in the unit logistics costs reduction and the enhancement of economic efficiency of logistics center. After logistics center scale is beyond certain scale range, the required production input cost increased, investment recovery time lengthened, and unit logistics cost will be added. Within some logistics scale range, unit logistics cost input decreases as the logistics scale increases because of the role of intensive management. While logistics scale expanded to some degree, it will lead to abundant idling production facilities, un-economic of logistics scale, and unit distribution cost increases as logistics scale expands. It will cause the rule of incline and then decline of unit logistics cost input. Therefore, there do exist optimal range of economic benefits, and enable the scale benefits of logistics activity to be maximized (See figure 12). It should be noted that unit logistics cost are mainly including unit capital and labor input.

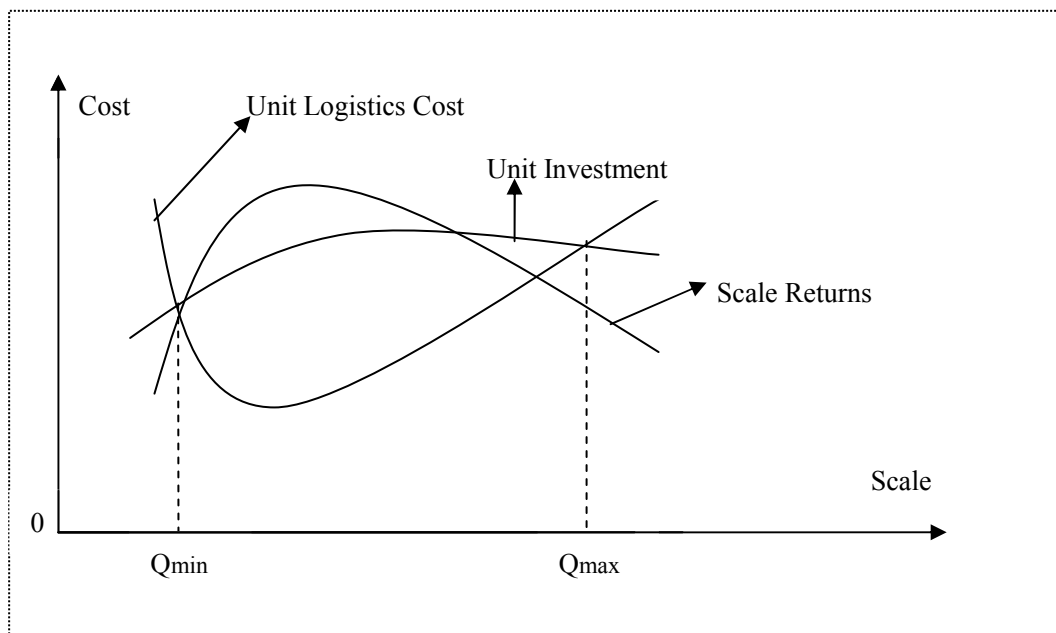


Figure 12 Relation between Scale and Cost

Source: Drawn on my own

In theory, the scale of logistics center reached the best efficiency between the cross-point of unit investment cost and unit logistics cost. Seen from the figure 12, scale benefits of logistics center will change from incremental to declining tendency.

It will reach an optimal logistics center economy scale between Q_{min} and Q_{max} . Scale benefits ratio can be depicted by economy scale of logistics center, it means unit logistics output changes caused by unit input factor increased in terms of reasonable percentage. We will establish economy scale optimization model of logistics center by using production function and scale returns ratio.

5.3 Economy Scale of Logistics Center Model

In 1920s, Cobb and Dauglas put forward the famous C-D Production Function. It has been widely used in economic benefits and scale of manufacturing enterprises, but few experts will put it apply into logistics economy activity. The research will be conducted on Economy Scale of Logistics Center Model based on production function and scale benefits ratio in the following.

5.3.1 Assumption of Model

- (1) In a period of time, technology level of logistics center remains unchanged
- (2) Assume the labor input of certain agri-products logistics activity engaged by logistics center is X_1 , capital input is X_2 , labor and capital input is related to logistics products categories.
- (3) Single business in logistics center, the capital and labor input of unit logistics activity are fixed.
- (4) Total benefits of logistics activity in logistics center should be output as logistics center operation.

According to Figure 12, total benefit of logistics activity is similar to operation scale changing curves. So we can describe the logistics center operation scale using logistics activity benefits changes situation in logistics center.

5.3.2 Model Building and Solutions

The general form of production function can be expressed as:

$$y = y(x_1, x_2, \dots, x_n) \quad (1)$$

The main input factors in logistics center are fixed capital and variable capital x_2 , labor x_1 , according to definition, scale returns ratio ξ can be described as follows:

$$\xi = \frac{\Delta y}{y} \frac{x_1}{\Delta x_1} + \frac{\Delta y}{y} \frac{x_2}{\Delta x_2} + \dots + \frac{\Delta y}{y} \frac{x_n}{\Delta x_n} \quad (2)$$

While $\Delta x_1 \rightarrow 0$, then $\Delta y \rightarrow 0$, scale returns ratio could be expressed as:

$$\bar{\xi} = \lim_{\Delta y \rightarrow 0} (\xi) = \frac{\delta y}{\delta x_1} \frac{x_1}{y} + \frac{\delta y}{\delta x_2} \frac{x_2}{y} + \dots + \frac{\delta y}{\delta x_n} \frac{x_n}{y} \quad (3)$$

C-D Production Function is most representative while describing production theory of scale returns ratio, it can be expressed as follows:

$$y = Ax_1^\alpha x_2^\beta \quad (4)$$

In the expression, A means technology level; y means returns output in logistics center, reflect operation scale size in logistics center; α means labor input elastic coefficient, β means capital input elastic coefficient. According to expression (4), expression (3) can be expressed as follows:

$$\bar{\xi} = A\beta x_1^\alpha x_2^{\beta-1} \frac{x_2}{Ax_2^\beta x_1^\alpha} + A\alpha x_1^{\alpha-1} x_2^\beta \frac{x_1}{Ax_1^\alpha x_2^\beta} = \alpha + \beta \quad (5)$$

5.3.3 Determine Scale Returns Ratio Range

As the continuity of the production function, y can be differentiable at the origin, its derivative in the origin direction L is:

$$\frac{\delta y}{\delta L} = \frac{\delta y}{\delta x_1} \cos(\alpha_1) + \frac{\delta y}{\delta x_2} \cos(\alpha_2) + \dots + \frac{\delta y}{\delta x_n} \cos(\alpha_n) \quad (6)$$

$$\cos(\alpha_1) = \frac{x_1}{\rho}, \cos(\alpha_2) = \frac{x_2}{\rho}, \dots, \cos(\alpha_n) = \frac{x_n}{\rho}$$

$$\rho = \sqrt{x_1^2 + x_2^2 + \dots + x_n^2}$$

In the expression, $\alpha_1 \square \alpha_n$ respectively means direction angle of direction L; ρ means the length of direction L. Two sides of equality sign in expression (6) both times ρ / y , and based on expression (3), it can be concluded as follows,

$$\xi = \frac{\delta y}{\delta L} \frac{\rho}{y} \quad (7)$$

It could be seen from expression (7) that scale returns ratio ξ can be expressed as elastic coefficient of overall input of capital and labor factor, reflects the effect degree that various production factors input change has influence on logistics center's benefits output, and it mirrors the reasonable degree of operation scale in logistics center. $\xi < 1$ means production of logistics center is lack of elasticity, logistics center should not expand the scale; $\xi \geq 1$ means production of logistics center is rich in elasticity, as the output of logistics center increases, the input factor and cost will go down, logistics center should expand the scale at this moment.

According to Figure 12, logistics center scale is related to investment cost of unit logistics center. The scale returns ratio does have a maximized value, when logistics center scale reaches the value, and again expand the scale, the profits of logistics center will go down. While $\xi \geq 1$, operation in logistics center will be on the benign stage, therefore, ξ should keep in the reasonable range.

Logistics center operation with rich elasticity is the pursuing goal of enterprises' development. Thus, the lower limit of ξ can be 1, and its relation with logistics center operation scale is drawn as follows. (See Figure 13)

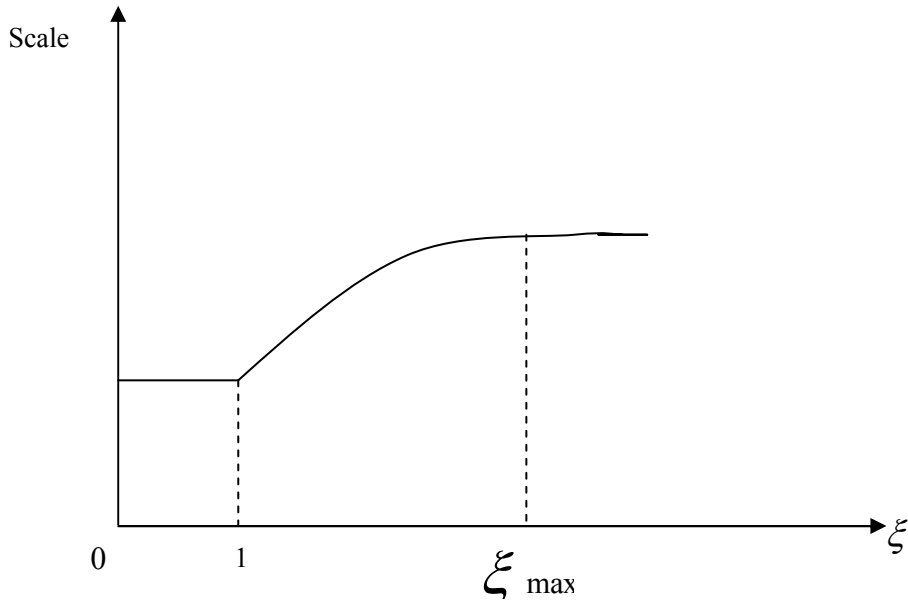


Figure 13 Relation between Scale and ξ

Source: Drawn on my own

Assume the slope of production function curve is θ , the θ value is fixed for concrete capital and labor input, it can be concluded from expression (7) as follows,

$$\bar{\xi} = \lim_{\Delta y \rightarrow 0} (\xi) = \frac{1}{\theta} \frac{\delta y}{\delta L} \quad (8)$$

The maximized value of scale returns ratio can be described as follows,

$$\xi_{\max} = \max\left(\frac{1}{\theta} \frac{\delta y}{\delta L}\right) \quad (9)$$

The gradient of production function along the direction L can be stated as follows,

$$\text{grad}(y) = \frac{\delta y}{\delta x_1} i + \frac{\delta y}{\delta x_2} j + \dots + \frac{\delta y}{\delta x_n} k \quad (10)$$

It can be further expressed in terms of expression (9) and (10)

$$\xi_{\max} = \frac{1}{\theta} \text{grad}[y(x_1, x_2, \dots, x_n)] \quad (11)$$

It can be learned from expression (11), the derivative of scale returns ratio along production function gradient direction is the maximum, then get the solution of

maximum scale returns ratio. When logistics center is at the optimal operation scale, ξ should meet $1 \leq \xi \leq \xi_{\max}$ (12)

Expression (12) can evaluate whether logistics center operation scale economic or not, judge logistics center needs further expand scale or just maintain current situation.

5.4 Case Study

Different products' capital and labor input in logistics center has different effects on benefits yield and scale returns ratio in logistics center. Therefore, main products should be determined in logistics center at first. Take Wenzhou Vegetable Logistics Center' spinach logistics as research object, then calculate the optimal operation scale in logistics center. The capital and labor input of Wenzhou Vegetable Logistics Center 2000—2005 (See Table 4) Unit: (Ten Thousand RMB)

Table 4 Labor and Capital Input

Year	2000	2001	2002	2003	2004	2005
Fixed capital	121.0	317.5	213.0	799.5	601.7	702.4
Flowing capital	298.3	327.4	798.2	496.3	93.6	21.4
Labor input	788,103	6,786,350	9,377,340	9,576,623	8,987,235	7,453,613

Source: <http://www.wzagri.gov.cn/programs/database/nytjzl.jsp>

5.4.1 Determine Production Function

Suppose enterprise's production technology remains fixed, C-D production function can be expressed by index form, but for logistics and enterprise production are irregular which are in line with the non-linear production features. In theory, the ideal production function is cubic equation,

$$y = a + bx_1x_2 + cx_1^2x_2 + dx_1x_2^2 - ex_1^3x_2 - fx_1x_2^3 \quad (13)$$

In the expression (13), a, b, c, d, e, f are all undetermined coefficients.

5.4.2 Calculation With Matlab Program

Calculate undetermined coefficient value by using table 4 and Matlab program. The calculation result of the production function of different capital and labor input can be seen in table 5.

Table 5 Calculation Result

Year	x_1	x_2	x_1x_2	$x_1^2x_2$	$x_1x_2^2$	$x_1^3x_2$	$x_1x_2^3$
2000	88	463.2	4076	358000	18880773	315657842	8745574000
2001	70	440.0	30800	2154300	135500	150920000	5963000000
2002	93	1098.2	102132	949560	112162021	883344857	12320000000
2003	94	363.2	34140	3209352	1239983	301668108	4503657684
2004	90	470.4	42336	3810200	12310540	342921600	9367947500
2005	80	635.5	50680	4054400	1991154	32435200	2033901100

Source: Matlab program

The input unit of x_1 , x_2 is in accordance with standard unit input. According to logistics center operation scale model, the sandwich matrix M of production function coefficient is

$$M = 10^7 \times \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.0001 & 0 & 0 & 0 \\ 0.0002 & 0 & 0.0011 & 0.0001 & 0.0002 & 0.0003 \\ 0.0032 & 0 & 0.0088 & 0.0030 & -0.0034 & -0.0032 \\ 0.0875 & 0 & 1.2318 & 0.0450 & -0.0937 & -0.2034 \end{bmatrix}$$

Calculate inverse matrix M^{-1} , put it into production function formula, then get the benefits yield matrix Q under different capital and labor input,

$$Q = 10^3 \times [0.8549 \quad 3.9312 \quad 4.3541 \quad 4.9673 \quad 4.6898 \quad 4.8934]$$

Production function coefficient matrix H is

$$H = Q \times M^{-1} = 10^3 \times [3.8647 \quad 0.0097 \quad -0.0002 \quad 0 \quad 0 \quad 0]$$

The undermined coefficient is calculated as follows,

$$a=3864.7, b=9.7, c=-0.2, d=0, e=0, f=0$$

The production function of Wenzhou Vegetable Logistics Center is calculated as

$$y = 3864.7 + 9.7x_1x_2 - 0.2x_1^2x_2$$

Theoretically, maximum scale returns ratio ξ_{\max} is 2.18, in the period of 2000—2005, scale returns ratio value in logistics centre is respectively 1.563, 1.547, 1.754, 1.996, 2.153, 2.118 .

Based on the calculation result, we can know that as the capital and labor input in logistics centre increases, scale returns ratio of logistics center will display the feature of increase first and then decrease, the result is within the range of optimal model, it could be concluded that the operation scale of Wenzhou Vegetable Logistics Center is in the reasonable range. Currently, it had better not expand the scale.

6. The Construction of Agri-Products Logistics System in Wenzhou

Due to the circulation particularity and operation risks of agri-products, especially in the each link of fresh supply chain there is uneven allocation of profits and risks, so it is necessary to develop modern logistics in the agri-products circulation. Modern logistics has enjoyed good reputation of logistics distribution with large-scale, fast, wide-range radiation, high-efficient. So it is significant for exploring rural market to develop modern logistics, it not only could provide accurate information for business body and reduce the uncertainty and blindness in the process of market operation., but also effectively improve circulation speed of agri-products and reduce the circulation cost of agri-products. In doing so, it can make agri-products value-added in the circulation process, and ensure the fundamental interests of farmers, promote the agriculture modernization process and further enhance the overall efficiency of agricultural production.

6.1 Determining Operational Mode of Agri-Products Logistics

6.1.1 The Expected Development Goal

Wenzhou should learn from the advanced experience and development mode of foreign and domestic countries, use modern information technology and management tools, transform and expand existing agri-products wholesale market and standardize

the logistics distribution system of agri-products base market and build a new logistics distribution system in the light of Wenzhou's actual situation. Make sure the benign interactions of logistics links in promoting transportation, warehousing, circulation processing, logistics information, packaging, handling, distribution. To make the rich agri-products sell throughout the nationwide and across the world, truly improve the income of farmers and people's living quality, Wenzhou should build an efficient agri-products logistics system, which will be in line with economic development and people's living conditions even international market norms.

Therefore, Wenzhou's agri-products logistics system construction should adhere to the principle of market-oriented, production and processing of agri-products as the main subject, logistics demand as the support, reduce whole society's logistics costs and improve logistics efficiency in maximum limit, in order to promote and support healthy development in Wenzhou and other eastern areas and guide the agri-products production and promote the construction and development of pollution-free agri-products. Specifically speaking, Wenzhou should take full advantage of current infrastructure and information platform to create good conditions for the development of agri-products logistics; Establish rules and regulations, legal framework and policy system in accordance with agri-products' own characteristics. Build agri-products logistics distribution center and agri-products' logistics network system based on the key economic regions such as Lucheng, Longwan, Ouhai, Yueqing, Rui'an, etc; Strength farmers' status in agri-products logistics, and build their own organizations and increase farmers' access to market information and analysis capabilities and expand their own transportation team; Forster and develop the production and marketing enterprises with competitiveness, reasonable operation and social demand adoption.

6.1.2 The Construction of Modern Agri-Products Logistics System Mode in Wenzhou

The overall assumption for Wenzhou’s modern agri-products logistics system, which is on the basis of Wenzhou’s actual situation, such as agri-products’ circulation system and government management system and the advanced experience and typical modes learning from foreign and domestic agri-products logistics is drawn as follows.

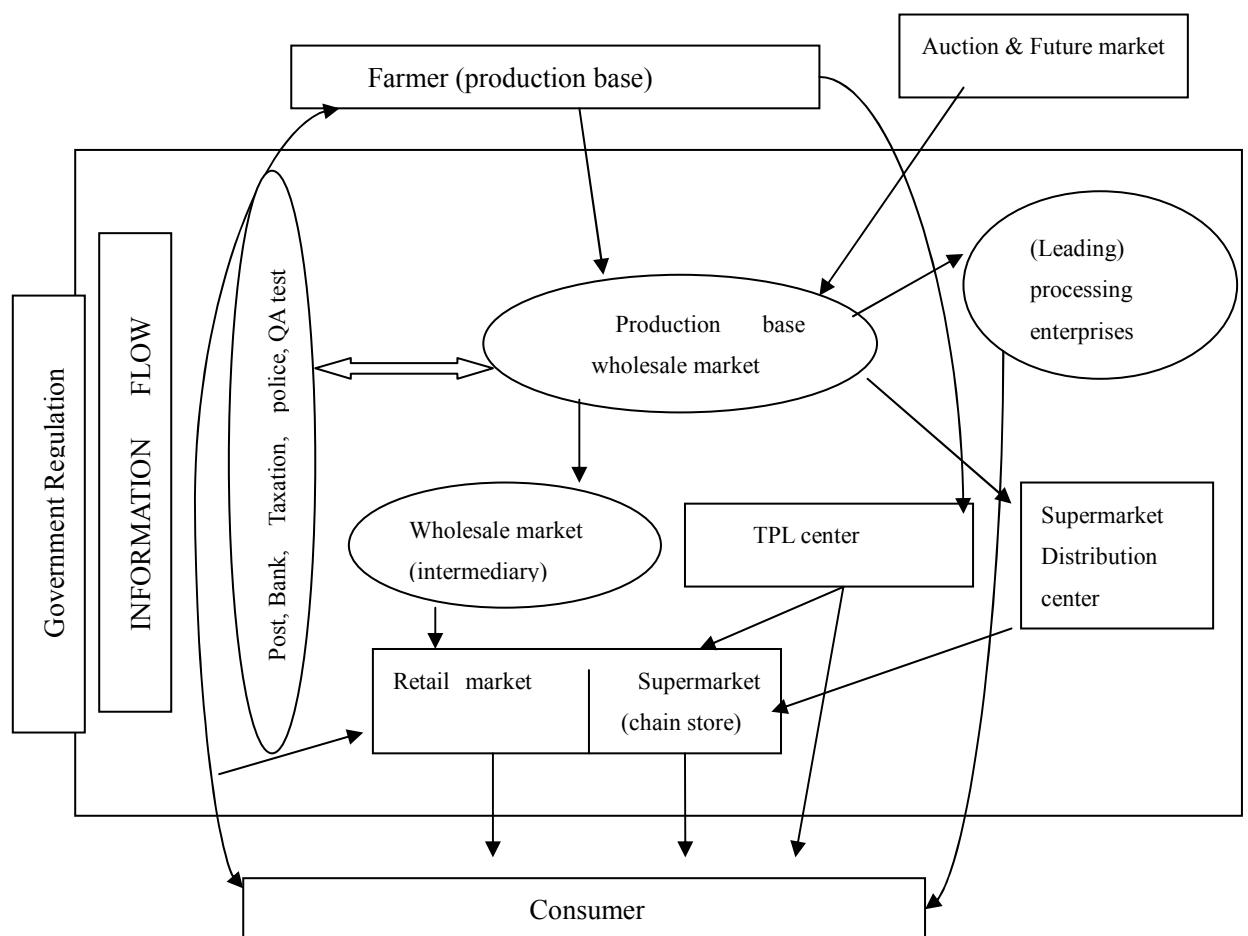


Figure 14 Mode Assumption of Wenzhou’s Agri-Products Logistics System

Source: Drawn on my own

The agri-products logistics system construction is the systematic project, which is mainly based on modern wholesale market, vertical integration of agri-products logistics focused on business and also the combination of emerging logistics channel

and standardized traditional circulation channel. In the system, products that the farmers or agri-products production base produced will directly enter into wholesale market with no strict restrictions in order to attract more operators with different economic elements. They would provide all kinds of services for agri-products logistics, including telecommunications, banking, taxation, accommodation, etc. At the same time, advanced means of transactions will be adopted, such as auctions, futures, etc. The TPL company will supply transport, warehousing, packaging, and other logistics services for operators, and provide information services as well.

The concrete procedure is ①Emerging logistics channel: Farmer (Agri-products production base)—Production place wholesale market—TPL center or supermarket distribution center—Retail market or supermarket chains—Consumer. ②Traditional ways of circulation: Farmer (Agri-products production base)—Production place wholesale market—Intermediary wholesale market—Retail market or supermarket chains—Consumer.

The function of government is to correct, regulate, coordinate the market behavior of enterprises, farmers, organizations, and provide financing, education and other services in order that they could provide a benign external environment for the smooth operation of the system.

6.2 Major Suggested Measures

6.2.1 Study on the Transport Demand Law for Agri-Products

According to statistics, the average highway transportation price of agri-products in China is 0.18 RMB/ton km in 1978, 1.00 RMB/ton km in 1990, 0.25 RMB/ton km. The average railway transportation price of agri-products is 0.0273 RMB/ton km

during mid-1980s, 0.0348 RMB/ton km during mid-1990s, and 0.0401 RMB/ton km in 2004. Production concentration degree of agri-products, (also called region specialization degree) refers to the quotas of certain agri-products output of certain region accounting for certain agri-products in the output of whole country. There are two ways to measure, the calculation formula of the first method is as follows,

$$d_i = \sum_j^r \beta_j \quad (1)$$

It is difficult to get the specific reference of agri-products output in Wenzhou, so in the paper, we just analyze it by using part agri-products output of whole country's province, city. In the formula (1), d_i means concentration degree of certain agri-products; j means certain province, β_j means the percentage of agri-products output in the province j accounting for entire country output; r means the ranking of provincial output accounting for entire output in the positive sequence. The value r can be determined by empiric value, usually take 3 to 5, we had better take $r=5$ here. That means the sum of top five in the positive order of certain agri-products concentration degree d_i .

Calculate main agri-products concentration degree d_i in terms of main agri-products output data in each area in 1985, 1990,1995,2000,2002. See table 6

Table 6 Main Agri-Products Concentration Ratio(%)

Year	Rice	Wheat	Corn	Bean	Cotton	Oil	Sugar	Vegetable	Fruits	Meat	Poultry eggs	Aquatic products
1985	53.6	60.9	55.3	62.4	77.5	48.8	76.9	—	56.5	45.6	—	63.6
1990	52.0	59.0	57.0	59.2	71.2	47.2	73.9	33.0	52.8	44.3	51.7	61.0
1995	51.6	63.9	56.9	50.6	70.9	51.7	76.1	43.9	50.2	41.8	56.1	61.0
2000	46.9	68.3	50.2	49.1	76.2	52.4	84.2	48.5	50.5	40.4	58.5	62.0
2002	47.3	68.9	50.7	53.4	75.8	52.0	83.0	48.8	47.2	40.9	58.3	60.2

Source: Calculated based on relevant data of China Agricultural Yearbook

The calculation formula of the second method is as follows,

$$S_i = \frac{1}{n} \sum_{j=1}^n (\beta_j - \bar{\beta})^2 \quad (2)$$

In the formula (2), S_i means concentration degree of certain agri-products, n means province numbers, j means the j province, β_j means the percentage of agri-products output in the province j accounting for entire country output; $\bar{\beta}$ means the average value of β_j . The bigger the S_i value is, the higher concentration degree and great logistics demand will be, vice versa.

Calculate main agri-products concentration degree S in terms of main agri-products output data in each area in 1985, 1990, 1995, 2000, 2002. See table 7

Table 7 Main Agri-Products Concentration Ratio(%)

Year	Rice	Wheat	Corn	Bean	Cotton	Oil	Sugar	Vegetable	Fruits	Meat	Poultry eggs	Aquatic products
1985	17.4	22.5	16.2	32.0	36.4	12.7	56.5	—	17.7	10.4	—	22.5
1990	15.7	19.8	17.6	31.7	30.3	10.3	42.0	5.5	15.6	9.8	13.4	20.5
1995	15.3	24.5	16.5	19.7	29.6	13.7	74.5	9.8	14.2	8.8	17.4	20.5
2000	12.3	28.4	12.3	18.8	45.1	12.9	62.1	11.8	13.1	6.8	18.1	20.5
2002	12.4	30.4	12.8	23.5	40.9	13.1	70.5	11.6	10.7	6.9	18.1	19.4

Source: Calculated based on relevant data of China Agriculture Yearbook

It can be reflected from those two tables, first, main agri-products concentration degree in terms of main agri-products output data in each area in 1985, 1990, 1995, 2000, 2002 by two methods is relatively the same. But compare with the first method, the second method seems scientifically rational for the first calculation carries kind of subjectivity element. Second, compared with 1985, the decreasing concentration degree of agri-products are rice, corn, fruit, bean, meat, and aquatic products in 2002. And the increasing concentration degree of agri-products are wheat, cotton, oil-bearing crop, sugar, vegetable, fruits, eggs. Therefore, firstly, in the aspect

of transport routes, lengthening road transport route and improve quality exerts different impacts on different concentration degree of agri-products production. The concentration degree of wheat, cotton, oil-bearing crops, sugar, vegetable, fruits, eggs are going up, whereas rice, corn, fruit, bean, meat, and aquatic products are going down. Second, in the regard of freight rate, since the 1980s, the agri-products freight rate of railway increases, and highway is decreasing, although railway freight rate is lower than highway's, but due to tight railway capacity and increased freight, some agri-products such as rice, corn, bean, fruit, meat and aquatic products transported by railways had began to transform into highway transport, the highway capacity of agri-products is soaring. Under the circumstance, it to some degree affected trading efficiency and reduced concentration degree of agri-products production.

These data indicate that: (1) The relying degree on highway transport of agri-products is larger than railway. (2) The fruit and vegetable' dependency degree on highway transport is larger than others. (3) Rice, cotton, oil and other un-perishable agri-products can be transported by railway for the reason that the transaction efficiency is higher.

According to the analysis mentioned above, Wenzhou government should discretely think over and plan in terms of distribution of special agri-products in different regions while consolidating infrastructure construction. The government should appropriately increase highway construction in the orange industrial belt rather than simply increase railway transport capacity. However, in the rice and cotton planting area, they should both develop highway and railway transport. In this way, Wenzhou can improve the efficiency of agri-products production, transaction, and reduce transaction cost with limited resources.

6.2.2 Strengthen the Study on Growth Law of Logistics

As the agri-products harvest increases, it is bound to increase the logistics volume. Research on yield growth law of agri-products, and master logistics volume changes law of agri-products, which has great impacts on promoting logistics project and scientific management.

Take orange production in Wenzhou for example, orange is the leading product of Wenzhou's agri-products development. The number of orange yield has direct bearings on the demand of Wenzhou's agri-products logistics. Orange logistics belongs to the scope of fresh products logistics with relatively concentrated maturity period, tight transport time and large density. Therefore, if we could provide accurate forecast for orange yield each year, we could greatly enhance logistics efficiency and get more profits because we could prepare well for the various aspects such as market, transport, flow, storage, etc in advance.

The study on growth law of orange yield in Wenzhou from 1995 to 2006, build mathematical model which is output changes as time changes, and forecast the next year's output by year. The orange statistics in Wenzhou is shown as follows.

Table 8 Orange Output in Wenzhou

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	
Output	16.3	19.78	24.65	25.59	27.6	29.07	29.5	30.04	30.09	31.57	41.56	32.35	38.24

Source: Wenzhou Agricultural Yearbook

(Unit: Ten Thousand Tons)

According to the data variation, we can clearly see that it demonstrated positive correlation, and it could be described as y (output) and x (year) relationship by straight line.

$$y = -2775.5 + 1.4023x$$

Correlation coefficient $R=0.8408$, it reached significant level of Correlation.

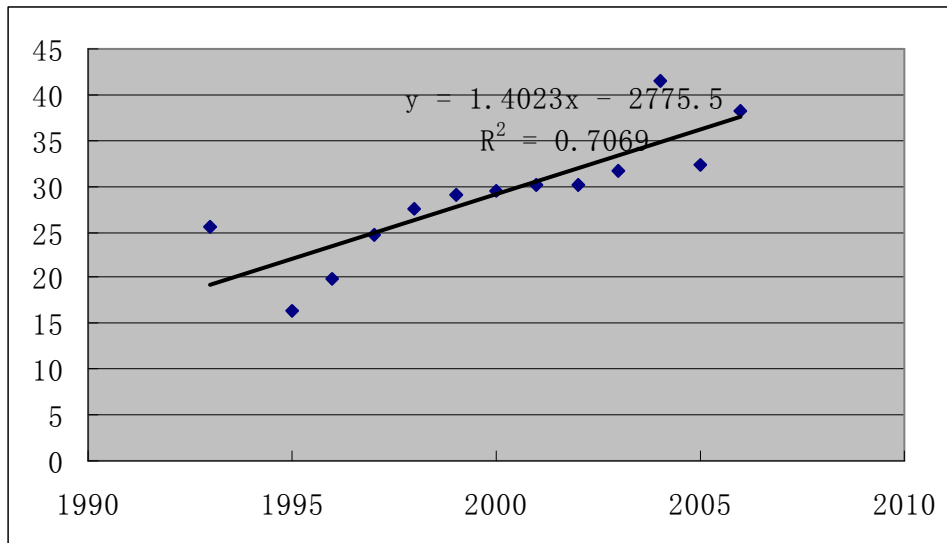


Figure 15 Wenzhou Orange Output (1995-2006)

Source: Drawn by Microsoft Excel

According to the development momentum of Wenzhou's orange industry, farmers' enthusiasm and introduction of new varieties and technology, we can see orange output will continue to increase in the long period in terms of the law. To verify output of 2007, put it into linear programming equation mentioned above, the forecasting value of orange output is 389200 tons, the actual forecast accuracy reached 0.8307. Thus, building mathematical model can provide necessary foundation for logistics' scientific management.

As the economic development of Wenzhou city, the quality and output of orange industry shows strong growth momentum. Studying on the relationship between cultivated area and output of orange has great influence on the development of Wenzhou's fruits logistics. Yueqing has become the big orange production county in Wenzhou, the per capita income has jumped the second in Wenzhou owing to the development of orange industry.

The cultivated area of orange is increasing year by year, and so is output. The

statistics data is shown as follows.

Table 9 Orange Cultivated Area and Output in Yueqing(1995-2006)

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Cultivated Area(acre)	8091	8426	9345	11579	13335	16307	20000	19783	19283	19809	19936	22483
Output (Ton)	15104	24580	38077	50058	65000	85033	101400	112000	112900	120000	130000	155545

Source: Wenzhou Agricultural Yearbook

According to the data variation, it can be clearly seen that it still demonstrated positive correlation, and it could be described as y (output) and x (cultivated area) relationship.

$$y = -48215 + 8.4314x$$

Correlation coefficient $R=0.9816$, it reached most significant level of Correlation.

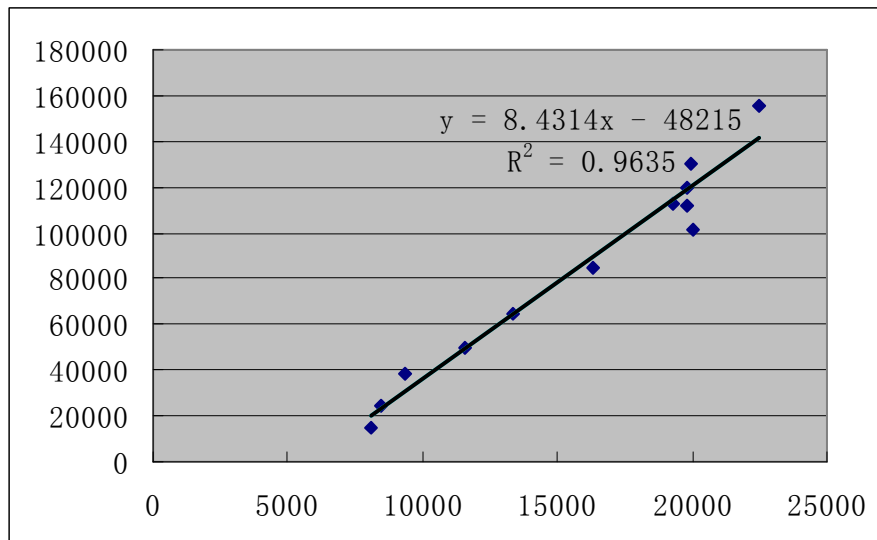


Figure 16 Relation between Orange Cultivated Area and Output in Yueqing

Source: Drawn by Microsoft Excel

To forecast one county's main agri-products logistics volume in Wenzhou, it could make each link of logistics operate in a planned, orderly way, and ensure agri-products flow into market in a fast, reasonable, effective way. It will greatly

speed up the scientific agri-products logistics management in Wenzhou.

6.2.3 Upgradation of Existing Agri-Products Wholesale Market

Wenzhou's agriculture is operating by thousands of small-scale decentralized management structure, which will not change in the short term. The small batch of agri-products from households requires wholesale market of production place, it put together the agri-products transport to sales wholesale market through long-distance. Then they have to transport them to urban areas in order to meet the urban residents' demands. It has been investigated that 90% of vegetables in Wenzhou is circulated through agri-products wholesale market. The characteristics of production and marketing of agri-products decides on the fact that wholesale market would become the key central part of agri-products circulation. It has played great role in solving the problems of "hard to sell and purchase of agri-products". There are some ways to upgrade wholesale market:

6.2.3.1 Improvement of Planning and Layout

Agri-product wholesale market of production place as the important component of commodity market with characteristics of obvious geographical and agricultural industry, we should guide special agricultural industry on the base of the current situation of agricultural production. Attention should be paid to arrange market construction with the combination of government's overall planning and department planning, and government should attach full attention to industrial and commercial, business, agriculture and cooperative departments, formulate agri-products market system construction and avoid redundant construction. To distinguish industrial scale, transport conditions, foreign introduced capacity and openness degree in terms of agri-products' different circulation traits, then build new market or further develop based on the existing market. We should improve market function, strengthen radiation capacity, and propel the new investment support, combined with specific

local realities, finally plan and build agri-products wholesale market of production place.

6.2.3.2 Improving the Modernization Level

First of all, promote the market system innovation. We should continuously deepen market operation and operating system reform, actively promote modern enterprise system which is mainly based on shareholding system and joint stock cooperative system; Gradually promote the new mode of “enterprise run market, market enterprisization”, propel enterprise management of market; The market which is not conforming with the requirements of modern enterprise system and no clear legal persons of enterprise market could not be registered. Secondly, they should actively introduce modern marketing methods such as agents, distribution, auctions and online transaction, gradually change the old-fashioned stall-based transaction way. Thirdly, accelerate market information construction. Promote computer, network application knowledge, introduce information technology talents, explore market internal information resources; Actively guide and support agri-products wholesale market to deal with transactions through on-line intelligent management. Last but not least, strive to creat brand market. To enhance brand value-added of market, it is important to integrate brand agri-products business management and standard market management, then establish good market image.

6.2.3.3 Foster and Develop Market Players

The individuals and organizations participating in the activities of agri-products wholesale market are belonging to market players. The strength and developing level is the key of overall functional development of agri-products wholesale market. The main channel of improving farmers’ status in the logistics system is to foster and develop market operating body of agri-products. According to agriculture bureau statistics, there are 902 professional cooperatives, 41600 enrollment farmers, impetus

to farmers 28400 farmers, and 500 economic entities, 0.1 billion fixed capital in Wenzhou. The scope of business covers many fields such as agriculture, forestry, animal husbandry, fisheries. The leading industry such as fruit industry and husbandry industry respectively accounts for 29% and 25%. Per capital income reached 10350 RMB, which has become the highlight of the farmers getting rich. (See Table10)

Table 10 Wenzhou’s Farmer Professional Cooperatives Profile

Year	Professional cooperatives	Member of society(10000person)	Average increasing income(RMB)	Impetus to farmers(10000person)	Area of base (10000 acres)
2004	186	1.65	699	14.7	39.4
2005	367	2.41	793	17.1	53.9
2006	610	3.08	946	27.4	67.6
2007	902	4.16	1192	28.4	72.5

Source: <http://www.caein.com/index.asp?xAction=xReadNews&NewsID=33617>

First of all, strengthen farmers’ transportation and sale team. Farmers could directly sell out the agri-products in the wholesale market of production place. And establish agri-products operation organization or find agents to sell, make the farmers’ operating gradually develops in the right track. At the meantime, many departments concerned should provide convenient conditions and corresponding preferential policies for farmers’ engaged in agri-products transportation and sale business. Secondly, establish company+association+farmers’ organization mode. Agri-products association is main market operators of production, processing, sale of agri-production, and is a non-profit agricultural intermediary service organization for the common interests. It is the bridge of linking farmers, agriculture enterprises, market and government. The utmost task for the association is to maintain agri-products’ industry interests. There are two functions of the association, one is intermediary of communicating enterprises and government. The other is to provide multi-services.

6.2.3.4 Enhance International Competitiveness

First, we should carry out foreign trade based on the large agri-products wholesale market and make efforts to enter into international market by selling special agri-products. Second, strengthen the cooperation with foreign and domestic market operation institutions, adopt market operation mechanism conforming with international practice, introduce advanced management and marketing idea, actively attract foreign investment and guide foreign and domestic enterprises set up wholesale market and develop general distribution and general agent business. Third, actively promote agriculture standardization production, focusing on developing pollution-free green products, and conduct in accordance with international standards, finally make the products get the ‘passport’ of entering into international market.

6.2.3.5 Play Great Role in Industrialized Agricultural Operation

In addition to agri-products circulation, there are other functions for agri-products wholesale market in the agriculture industrialization, first, agri-products’ processing. The successful approach is to integrate agri-products processing leading enterprise and trading leading enterprise into wholesale market. Take Weifang city in Shangdong province for illustration, there are 500 agri-products wholesale markets, of which are both agri-products distribution and agri-products processing base. They played great role in exploiting market, promote agricultural restructuring and agriculture industrial management. Second, we should make good use of the form of “market+base+ and “market+professional cooperatives”, establish combined cooperation relationships in the aspects of agricultural services, information consulting, new crop varieties promotion. Promote market itself development when market’s leading role for agriculture.

6.2.4 Enhance Agri-Products Circulation Efficiency

Agri-products logistics has not drawn sufficient attention for a very long time, but as the continuous development of the information technology and social division of labor, the mix of logistics and business flow has been difficult to cater for the development of agri-products circulation, it is the inevitable trend of professional agri-products logistics as the sole system in the circulation field. We can go deep into it through following aspects.

6.2.4.1 Separation of Business and Logistics Flow, Reduce Circulation Cost

Developing professional agri-products logistics can greatly improve agri-products circulation efficiency. Under the conditions of insufficient market information, the upstream enterprises could not accurately know the needs of downstream business, producers could not accurately predict the near and long-term consumption of consumers. The following figure can simply express the relationships between them.

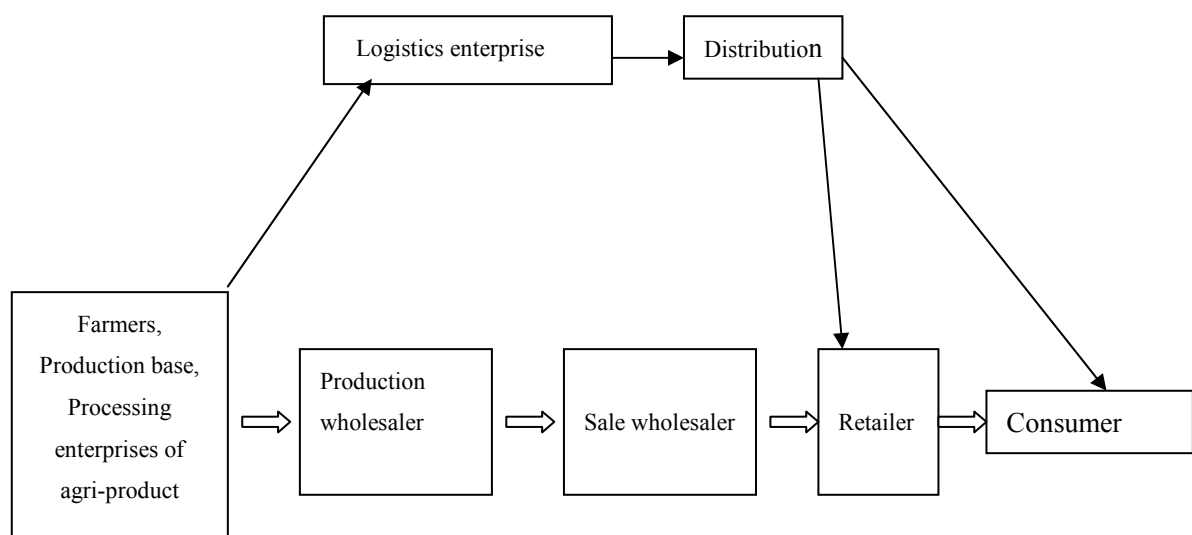


Figure 17 Simple Logistics and Business Separation Agri-Products Logistics Mode (sharp arrow represent logistics flow, and round arrow business flow)

Source: Drawn on my own

In the above figure, we can see the simple separation of agri-products' logistics and business flow. The ownership of agri-products will arrive in consumers from farmers and agri-products production enterprises through negotiation, auction, and other various transaction ways. The professional agri-products logistics enterprises will provide corresponding logistics services delegated by agri-products production base, finally deliver the goods into the cargo receiver through distribution center. The ownership of agri-products here is flowing from upstream to downstream link, but the physical movement of agri-products does not operate strictly accompanied by ownerships. In doing so, it could greatly reduce loading, unloading, storage, transport, and effective control of redundant construction in the middle step, and save logistics cost.

6.2.4.2 Develop Modern Agri-Products Transaction Way

The innovation of agri-products transaction way requires the development of professional agri-products logistics. Nowadays, the agri-products transaction way is not confined to spot transaction. The agri-products future transaction way is increasingly accepted by people for it could increase transparency of trading information, help farmers learn supply and demand situations of agri-products, guide farmers to adjust production structure, and avoid the blindness of production, reduce the seasonal price volatility of agri-products concentrated listed in the market. In the future trading, logistics and business flow is definitely required to separate. The development of professional agri-products logistics is the guarantee of completing future trading smoothly and also the pre-conditions of development and the innovation of modern agri-products transaction way.

6.2.4.3 Formulate Quality Safety Plans of Agri-Products Circulation

The special agri-products features decide on the high requirements for logistics. Firstly, the seasonal production characteristics requires the timeliness of the logistics. Secondly, we must ensure agri-products green logistics so as to guarantee safety. Thirdly, meet the special logistics transport way of agri-products, such as the bulk transport of grains, fresh preservation transport of vegetable and fruits, frozen transport of meat, constant temperature transport of milk products. Therefore, it is necessary to draw up circulation quality safety plan of agri-products, including quality and safety standard, market access system, detection system, quality and safety monitoring system, cold-chain system of agri-production construction.

6.2.5 Foster and Develop Leading Enterprises of Agri-Products Circulation

We should actively promote the reform of supply and marketing cooperatives, and bring out the best in the agri-products circulation. The cooperatives have solid strength in the agri-products processing and circulation aspects for its operating service outlets are covering all rural areas, and large number of workers. The technical staff should develop urban and rural markets, strengthen the service function for farmers, make good use of existing network facilities, bring the advantage of cooperatives in the agri-products circulation into play. And they should lead farmers to market relying on local resources and leading products and integration of production, processing, sale. Each cooperative should develop leading enterprise with core competitiveness, and realize each town-level cooperative develop into one leading enterprise. Furthermore, it is imperative for them to strengthen the contact with professional associations, base, farmers, and form a common community with farmers.

6.2.6 Increase Proportion of Supermarket Sales and Enhance Value-added Processing

In our traditional minds, the main place of purchase and sale of agri-products is farmer's market for the reason that we could bargain and get the goods with low price there. The sales channel of farmer's market will possibly exist for quite a long time, but in the urban area, as the increasing concern for the personal health and food safety, people like to go to supermarket to purchase vegetables. The development of agri-products entering into supermarket has become inevitable tendency at present. Although traditional farmer's market brought great benefits for consumers, there are also many drawbacks. They are summarized as follows: First, urban management and environmental protection. Second, consumption risks. It is an escapable problem of purchasing in the farm's market. Because agri-products' price, quality, trading behavior are all hard to guarantee. Third, ineffective logistics and potential high cost. To maintain one farmer's market operate smoothly, the costs are amazing because of the waste disposal, environmental protection, urban management.

It can be seen from figure 16 that the agri-products in supermarket must go through processing, such as cleaning, classification, packaging, and then make agri-products value-added. Although the price of agri-products in supermarket is relatively high, the sanitation and safety also have accordingly protected. From the fresh preservation perspective, there is advanced refrigeration equipment in supermarket, the quality of agri-products is obviously superior to agri-products in the farmer's market. On the other hand, from the enterprise perspective, only the agri-products enter into supermarket can they play the brand effect and truly achieve optimal price for better quality. Agri-products entering into supermarket is the prelude to the development of China's agriculture and participating in the market competition and access to international market.

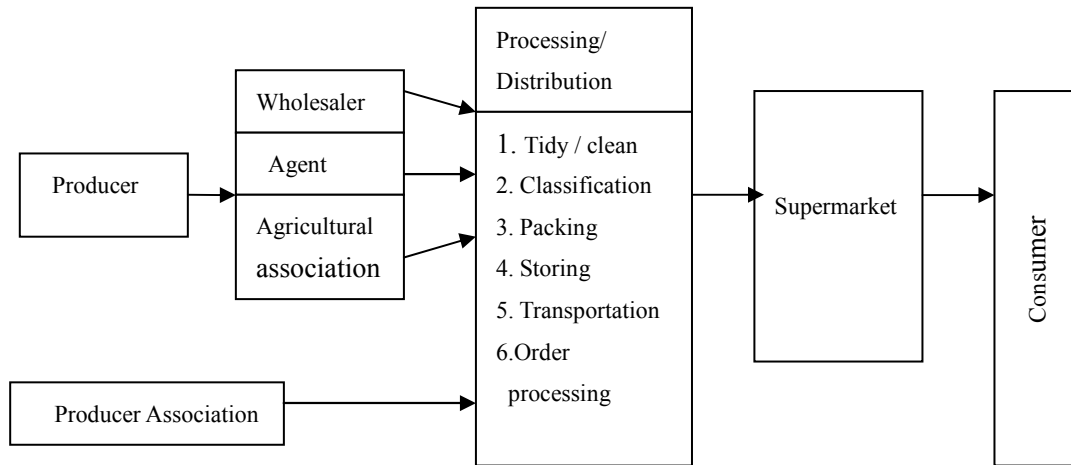


Figure 18 Supermarket Agri-Products Logistics Process

Source: Drawn on my own

6.2.7 Develop Agri-Products 3PL Organization

The third party logistics (3PL) implies a long term cooperation agreement between two companies, who consider each other as partners and where the solutions are elaborated jointly with the purpose to meet the demands of the transport buyers. Generally the target is to develop a business alliance which creates a win-win situation for both partners²⁰.

The development of Agri-products logistics is largely dependent on improving service level. Service can not only stay in the transport, warehousing and other functions, they should strengthen packaging, circulation processing, logistics information processing, and explore other value-added function, such as billing, forecasting, logistics consulting, and so on.

3PL operation mode can reduce the distance of production and marketing, the

²⁰ www.transportstudier.dk/udgivelser/pdf/3.part_sum.pdf

information flow can ensure timeliness, fast of supply, meet the demands of agri-products operators and different consumers, adjust the distribution design so as to cater to customers. It also can ensure the smooth flow of agri-products. Currently, most 3PL firms in Wenzhou are merely restructured from traditional transport firms or storage firms, it not only could not improve service quality, but reduce quality service owing to the over-competition, not to mention the value-added service they will provide. In the agri-products transport link, many logistics services can be delegated by 3PL companies. The merits of 3PL are threefold. First, it can save the input cost of purchasing fixed assets for transportation, and improve efficiency. Second, the approach could make transport link more secure, because professional logistics firms have accumulated much experience, which will help circulation efficiency and reduce costs. Third, it also can create more job opportunities from the perspective of social development. Therefore, government should provide benign environment for 3PL development in order to enhance efficiency and satisfaction of logistics service. The roles of 3PL played in the agri-products logistics is shown as follows.

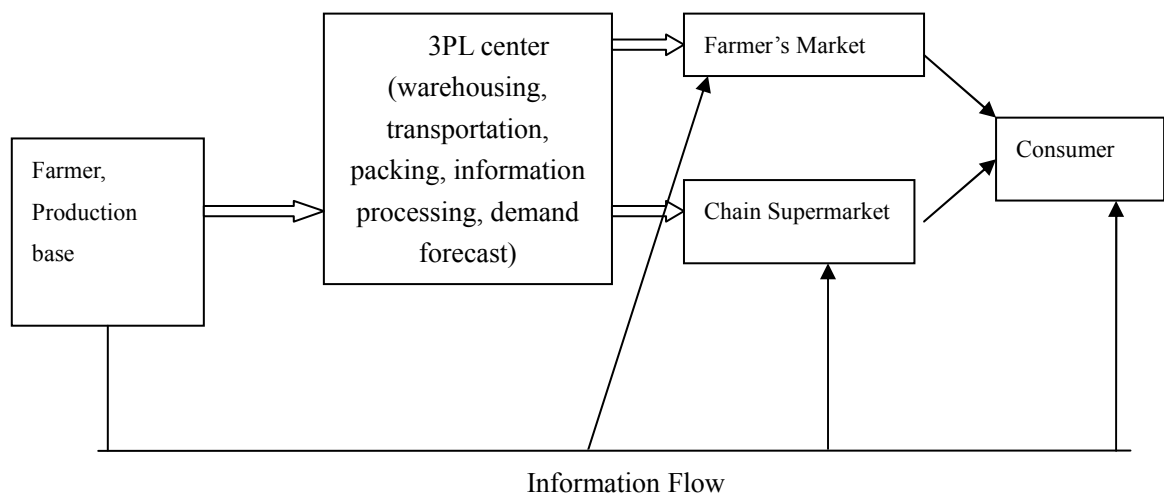


Figure19 Agri-Products Logistics Operation Mode Based on 3PL

Source: Drawn on my own

6.2.8 Strengthen Government's Role

The role of government should be reflected in operational policies, regulations, taxation and other macro-control, but they can not intervene in the agri-products circulation process. The detailed information will be stated as follows.

6.2.8.1 Macro-management

Logistics is the multi-industry which is cross-sectoral and cross-industry, its development involves business, transport, railway, civil aviation, customs, and other related departments. Each department is all working for logistics, and arose the problems of overlapping organizations and conflicting policies from different departments. It is lack of unified planning and overall coordination. There is need to set up special modern logistics group and ensure each link flow smoothly.

6.2.8.2 Infrastructure

The smooth operation of agri-products circulation requires favorable infrastructure support. The infrastructure construction of agri-products circulation includes agri-products wholesale market construction, agri-products storage, transport conditions and devices construction. The infrastructure construction should be carried out in an overall planning and rational distribution. Infrastructure is still lagging behind, which has become the weak link of restricting Wenzhou's rapid economic development. Although large amounts of money has been invested in the infrastructure construction, as the development of agricultural economy, present infrastructure is far from meeting the need of agri-products logistics construction. Therefore, Wenzhou's government should promote and make good use of existing railway, highway, and other transport networks, vigorously develop multi-modal transport, build freight station with storage, transport, provision of information,

installation in the integrated transport node. At the meantime, government should speed up building network information system of agri-products circulation.

6.2.8.3 Generate Agri-Products Logistics Professionals

For agri-products logistics, it put forward strict requirements for the practitioners of logistics industry, such as quality, service level and so on. Lack of talents is the biggest constraints for the development of China's agri-products logistics. It will be paramount task for Wenzhou to bring up professional logistics talents relying on Wenzhou's technology and talents advantage. There are more or less five colleges in Wenzhou, it is recommended that colleges should set up logistics management major, and other related majors. All logistics employees must receive vocational education, and could work for logistics related company after passing logistics certificate examination. Only government's favorable educational system can solve the problem of logistics professionals shortage.

7. Conclusions

This research paper studies on the agri-products logistics theory of foreign and domestic country, system building, management mode, and advanced typical case, and also make a comparative analysis. The basic characteristics of agri-products logistics, current situation and constraints of Wenzhou's agri-products logistics have been elaborately addressed and analyzed. More importantly, agri-products logistics center model has been analyzed by building economy scale model in order to learn whether to build or expand agri-products logistics center in Wenzhou. In the end, Wenzhou's agri-products logistics system construction in line with the current agricultural economic development has been put forward on the basis of above analysis. That is, a new system combining with vertical integration of emerging logistics channel and traditional standard channel, specialized farmer associations, leading enterprises of agri-products as a link, modern wholesale market dominates using advanced technology and modern equipment. Some countermeasures and suggestions have been already proposed in Chapter Six for the help of construction of agri-products logistics system in Wenzhou.

In fact, agri-products logistics system construction is a very tough and complicated issue. And it is hard to fully realize the target just to solve those problems mentioned above. Agri-products logistics system construction must require advanced logistics facility, logistics management, favorable system environment and sound legal system, and so on, yet author does not have in-depth research on these aspects in this paper. In

China, agri-products logistics under market economy in practice is not too long, and is still in its infancy in theory study. With so many unsolved problems, it seems that agri-products logistics system construction is a complex systematic process, as well as a profound change and challenge. Therefore, enormous energy should be put into so as to continuously explore and study on it. The author will try best to explore those related problems in the future, and dedicate himself to the career of agri-products logistics modernization construction.

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Appendices

Appendix 1 Main Agri-Products Output in Each Region 1985

Region	Rice	Wheat	Corn	Bean	Cotton	Oil	Sugar	Vegetables	Fruit	Meat	Eggs	Aquatic product
Beijing	25	73	107	2	4	39	21	—	179	15	—	16
Tianjin	17	44	55	5	24	68	0	—	68	7	—	49
Hebei	78	744	689	39	628	869	198	—	1062	86	—	127
Shanxi	6	295	210	18	73	444	248	—	452	22	—	3
Mongolia	8	149	160	29	0	794	2541	—	68	36	—	18
Liaoning	263	3	448	55	24	540	226	—	807	61	—	583
Jilin	184	10	793	91	0	483	877	—	64	32	—	30
Heilongjiang	163	377	412	314	0	283	3152	—	31	35	—	66
Shanghai	154	22	4	1	48	153	0	—	40	20	—	206
Jiangsu	1639	829	222	56	479	1087	362	—	340	160	—	675
Zhejiang	1358	90	13	11	81	441	1100	—	446	84	—	1048
Anhui	1163	606	66	70	166	1457	83	—	139	87	—	173
Fujian	681	17	0	9	0	173	5367	—	294	50	—	761
Jiangxi	1476	10	1	15	62	288	1971	—	107	64	—	160
Shandong	63	1496	938	80	1062	2678	91	—	2127	129	—	814
Henan	226	1528	537	103	547	961	179	—	574	72	—	64
Hubei	1572	345	115	24	492	729	369	—	217	101	—	375
Hunan	2339	29	20	22	101	423	1478	—	256	148	—	319
Guangdong	1561	8	7	12	0	615	23333	—	1219	140	—	1183
Guangxi	986	1	92	14	0	228	9829	—	388	72	—	189
Sichuan	1926	626	578	34	113	1511	2652	—	817	301	—	129
Guizhou	324	30	158	11	1	319	160	—	101	51	—	13
Yunnan	483	62	249	10	1	118	4801	—	211	59	—	26
Tibet	0	12	1	0	0	14	0	—	4	7	—	0
Shan'xi	88	423	292	18	43	298	79	—	335	30	—	6
Gansu	2	315	74	6	5	263	616	—	199	25	—	1
Qinghai	0	63	0	0	0	99	8	—	20	11	—	4
Ningxia	42	59	14	3	0	53	385	—	35	3	—	2
Xinjiang	31	315	139	2	187	342	407	—	492	18	—	9
Overall output	16858	8581	6394	1054	4141	15770	60461	—	11632	1926	—	7049

Source: China Agricultural Yearbook (1986)

Notes: Unit of rice, wheat, corn, bean, vegetable, meat, eggs (10 Thousand Tons); Unit of oil, cotton, sugar, fruit, aquatic product (Thousand Tons)

Appendix 2 Main Agri-Products Output in Each Region 1990

Region	Rice	Wheat	Corn	Bean	Cotton	Oil	Sugar	Vegetables	Fruit	Meat	Eggs	Aquatic product
Beijing	22	102	131	3	3	31	0	112	264	27	26	52
Tianjin	28	62	74	7	15	47	0	91	101	12	19	108
Hebei	91	928	829	53	571	749	123	501	1756	130	51	219
Shanxi	5	319	305	30	112	394	432	197	406	32	16	10
Mongolia	31	262	393	48	0	694	2364	109	69	54	12	30
Liaoning	369	45	798	43	14	175	498	289	1113	90	45	1074
Jilin	289	13	1530	93	0	694	2394	109	69	54	12	60
Heilongjiang	332	502	1066	344	0	172	6320	395	49	56	31	148
Shanghai	181	30	7	1	12	182	7	135	94	38	15	184
Jiangsu	1729	930	233	46	464	1124	222	598	493	1494	90	1183
Zhejiang	1321	87	13	23	64	484	628	418	1070	96	19	1390
Anhui	1340	598	147	55	236	1291	88	473	270	119	32	291
Fujian	765	31	3	11	0	177	3443	587	758	74	13	1186
Jiangxi	1616	8	2	16	57	549	1943	445	233	112	17	307
Shandong	83	1661	1252	77	975	2121	50	630	2463	222	124	1678
Henan	270	1640	960	87	676	1523	101	734	639	135	60	105
Hubei	1790	391	122	26	517	958	346	599	269	147	52	710
Hunan	2517	29	23	24	120	722	1278	615	566	204	28	530
Guangdong	1687	22	14	14	0	589	21655	815	3286	203	19	2076
Guangxi	1239	2	119	14	0	252	15018	424	916	104	7	323
Hainan	144	0	3	1	0	45	3715	109	153	15	1	167
Sichuan	2251	702	679	33	115	1556	2404	976	1271	443	47	233
Guizhou	360	72	177	13	1	439	209	335	167	74	5	22
Yunnan	509	107	281	10	1	133	6623	254	320	79	5	46
Tibet	0	16	1	6	0	17	0	12	55	9	0	0
Shan'xi	100	464	334	29	78	334	598	252	620	47	18	21
Gansu	3	371	143	7	8	337	724	116	385	40	9	4
Qinghai	0	74	0	0	0	120	8	10	22	15	1	3
Ningxia	52	78	37	2	0	62	478	30	5	7	2	11
Xinjiang	47	391	209	4	469	390	2244	133	799	31	6	23
Overall output	19171	9937	9885	1109	4508	16134	72144	10781	18745	2861	795	12295

Source: China Agricultural Yearbook (1991)

Notes: Unit of rice, wheat, bean, corn, meat, eggs (10 Thousand Tons); Unit of oil, cotton, sugar, fruit, aquatic product (Thousand Tons); Unit of vegetable (10 Thousand Acres)

Appendix 3 Main Agri-Products Output in Each Region 1995

Region	Rice	Wheat	Corn	Bean	Cotton	Oil	Sugar	Vegetables	Fruit	Meat	Eggs	Aquatic product
Beijing	17	100	133	4	3	33	0	3923	452	376	285	81
Tianjin	39	65	81	10	11	40	0	4342	199	212	241	154
Hebei	90	1060	1183	94	370	1099	124	23350	4319	3107	2053	396
Shanxi	4	270	404	38	91	223	397	5882	1026	609	361	17
Mongolia	40	202	518	67	0	702	2635	3488	181	819	188	48
Liaoning	262	63	825	44	24	197	504	12975	2200	2224	1028	1979
Jilin	297	19	1497	90	0	256	836	5938	280	1345	489	110
Heilongjiang	470	271	1213	437	0	201	5008	3381	127	1357	790	253
Shanghai	159	24	5	3	4	158	49	2653	217	578	148	291
Jiangsu	1799	893	271	88	562	1595	234	18155	1013	3059	1753	2195
Zhejiang	1219	54	14	30	63	500	658	9409	2146	1212	317	3181
Anhui	1270	699	272	72	301	1918	179	10068	526	1973	512	752
Fujian	725	19	7	21	0	233	2486	7839	2393	1266	270	2573
Jiangxi	1487	8	9	37	118	1036	2000	9207	427	2194	334	840
Shandong	91	2061	1543	127	471	3150	12	41724	7177	5859	3174	3809
Henan	296	1754	958	121	770	2980	207	20912	2116	3330	1400	181
Hubei	1731	364	150	65	586	1894	736	18426	1147	2794	879	1509
Hunan	2438	27	39	47	224	1120	1415	11346	1169	3455	466	863
Guangdong	1472	7	22	20	0	710	15916	17038	4145	3050	311	3543
Guangxi	1260	3	155	36	1	454	25557	13020	2666	2502	147	1033
Hainan	161	0	4	2	0	76	3359	1633	360	319	22	432
Sichuan	2098	731	630	125	112	1702	1796	13895	2153	6257	792	420
Guizhou	425	108	239	31	1	588	272	3608	209	1055	58	33
Yunnan	512	138	340	78	1	196	10563	4055	557	1282	69	84
Tibet	1	25	1	5	0	34	0	95	5	115	7	1
Shan'xi	64	410	282	31	40	382	10	4181	2839	791	401	38
Gansu	5	255	126	34	23	317	1070	3796	803	627	124	8
Qinghai	0	70	0	13	0	162	0	383	27	184	12	2
Ningxia	46	69	61	5	0	56	495	990	116	121	39	18
Xinjiang	47	394	239	13	994	494	2881	3382	1143	524	95	44
Overall output	18525	1016	1120	1788	4470	22506	79399	279094	4213	5259	1676	24888
		3	3						8	6	5	

Source: China Agricultural Yearbook (1996)

Notes: Unit of rice, wheat, corn, bean (10 Thousand Tons); Unit of oil, cotton, sugar, vegetable, meat, eggs, fruit, aquatic product (Thousand Tons)

Appendix 4 Main Agri-Products Output in Each Region 2000

Region	Rice	Wheat	Corn	Bean	Cotton	Oil	Sugar	Vegetables	Fruit	Meat	Eggs	Aquatic product
Beijing	9	67	59	5	2	38	0	530	586	56	16	75
Tianjin	15	60	41	4	18	33	0		283	29	26	242
Hebei	66	1208	995	75	300	1470	115	4796	6773	419	357	810
Shanxi	3	215	355	58	45	448	210	1034	2045	64	40	26
Mongolia	72	182	629	110	2	1164	1413	922	214	143	24	72
Liaoning	377	36	551	50	6	296	287	1851	2500	225	140	3385
Jilin	375	16	993	141	0	390	444	988	486	216	80	140
Heilongjiang	1042	96	791	490	0	438	2548	1645	192	151	75	382
Shanghai	137	25	4	3	1	164	68	427	255	55	17	289
Jiangsu	1801	796	237	105	315	2257	283	3500	1764	328	181	3088
Zhejiang	990	55	20	45	29	579	985	1562	1704	118	37	4695
Anhui	1222	707	219	104	274	2851	321	1979	1106	298	107	1598
Fujian	633	11	11	28	0	258	827	1161	3564	138	41	5279
Jiangxi	1492	8	9	36	68	967	1368	1286	423	184	34	1271
Shandong	111	1860	1468	108	590	3569	1	8372	9666	560	366	6982
Henan	319	2236	1075	140	704	3926	326	5075	3647	502	270	322
Hubei	1497	234	217	71	304	2872	1017	3108	2166	249	103	2343
Hunan	2393	23	125	59	158	1394	1158	2012	1505	435	52	1338
Guangdong	1423	4	76	26	0	788	12532	2308	6435	322	33	5932
Guangxi	1227	3	184	45	1	586	29379	1779	3601	276	15	2399
Hainan	150	0	5	3	0	101	3398	304	1055	38	3	831
Chongqing	533	101	198	24	1	311	91	821	817	154	28	200
Sichuan	1634	532	547	93	59	1930	1668	2382	2525	556	100	513
Guizhou	477	104	342	40	1	743	667	622	311	124	7	62
Yunnan	568	152	473	40	1	270	14206	618	770	205	11	166
Tibet	1	31	1	3	0	40	0	18	7	14	0	2
Shan'xi	95	419	414	31	27	388	18	631	4938	83	43	61
Gansu	6	266	211	38	58	417	397	606	1216	59	11	14
Qinghai	0	44	1	7	0	194	0	61	22	21	1	1
Ningxia	62	75	82	5	0	70	4	178	193	19	8	37
Xinjiang	60	400	269	26	1456	601	2650	680	1519	84	19	59
Overall output	18790	9966	10620	2013	4420	29553	76355	51257	62288	6125	2245	42614

Source: China Agricultural Yearbook (2001)

Notes: Unit of rice, wheat, corn, bean, vegetable, meat, eggs (10 Thousand Tons); Unit of oil, cotton, sugar, fruit, aquatic product (Thousand Tons)

Appendix 5 Main Agri-Products Output in Each Region 2002

Region	Rice	Wheat	Corn	Bean	Cotton	Oil	Sugar	Vegetables	Fruit	Meat	Eggs	Aquatic product
Beijing	3	24	46	4	3	46	0	589	669	71	15	74
Tianjin	11	44	71	6	62	34	0	634	299	45	25	286
Hebei	56	1100	1035	61	402	1513	147	5898	7485	458	398	871
Shanxi	2	243	435	49	75	384	185	1185	2213	65	46	29
Mongolia	56	122	822	140	3	1089	1950	876	177	146	28	78
Liaoning	406	16	858	57	3	565	398	2247	2344	254	160	3748
Jilin	370	8	1540	185	0	461	762	1044	803	204	84	105
Heilongjiang	921	89	1071	611	0	528	4376	1678	320	144	85	418
Shanghai	109	10	3	4	1	99	87	552	277	52	17	327
Jiangsu	1710	645	262	106	363	2170	347	4449	1946	349	187	3344
Zhejiang	780	25	22	42	22	470	1134	2024	2512	148	44	4807
Anhui	1328	684	357	147	337	2823	314	2264	1739	317	115	1634
Fujian	558	7	11	26	1	259	1179	1354	4249	142	41	5587
Jiangxi	1452	4	6	30	67	824	1308	1412	652	195	35	1382
Shandong	109	1547	1316	76	722	3404	2	9679	8624	627	399	6950
Henan	337	2248	1190	115	765	4207	279	5938	4270	570	302	362
Hubei	1470	151	187	65	323	2453	919	3451	2231	278	112	2723
Hunan	2219	18	119	61	153	1193	1804	2482	1831	473	63	1493
Guangdong	1203	3	54	24	0	764	13155	2552	6989	349	33	6281
Guangxi	1219	2	161	41	1	560	45934	1946	4558	249	15	2551
Hainan	139	0	5	3	0	100	3748	323	1391	40	3	1093
Chongqing	490	93	197	28	0	350	121	831	910	153	32	212
Sichuan	1504	459	525	109	24	2015	1715	2685	3067	568	121	648
Guizhou	348	87	343	41	1	725	740	699	397	139	8	75
Yunnan	543	134	482	94	0	275	17337	832	856	236	13	193
Tibet	1	28	2	3	0	45	0	23	6	17	0	1
Shan'xi	80	405	375	31	43	411	31	765	5147	87	46	71
Gansu	6	312	219	39	70	419	289	742	1370	70	12	15
Qinghai	0	45	1	11	0	234	0	69	16	23	1	2
Ningxia	67	96	104	10	0	108	0	202	169	19	9	49
Xinjiang	59	383	333	26	1477	444	4668	909	1982	100	23	64
Overall output	17456	9032	12132	2242	4918	28972	10293	60334	69517	6588	2463	45473

Source: China Agricultural Yearbook (2003)

Notes: Unit of rice, wheat, corn, bean, vegetable, meat, eggs (10 Thousand Tons); Unit of oil, cotton, sugar, fruit, aquatic product (Thousand Tons)