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An Empirical Study on the Logistics Barriers to Manufacturers in China

by

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An Empirical Study on the Logistics Barriers to Manufacturers in China

(중국 제조업체의 물류애로요인에 대한 실증적 연구)

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by

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요 약

시대의 변화와 경제의 발전이 계속되면서 중국 제조업자들은 글로벌 공급사슬에서 중요한 역할을 하고 있으며 세계 경제 발전에도 큰 기여를 하고 있다. 또한 중국은 세계의 공장이라고 불리우며 경제적 규모가 계속 커지고 있다.

그러나, 중국은 여전히 제조 분야에서 굉장히 많은 물류 애로요인들을 가지고 있다. 이러한 물류애로요인들은 제조업자들이 기업경영의 다른 분야보다 제대로 관리하기 힘들고 더 복잡하다고 느끼고 있다. 수많은 사례들에서, 이미 존재하거나 잠재적인 애로요인들은 결과적으로 주문주기 지연, 물류비용 증가, 그리고 고객 불만족으로 나타난다. 그러므로, 물류애로요인들은 제조업자들이 경쟁우위를 갖기 힘들게 만든다고 볼 수 있다.

본 연구의 목적은 물류애로요인들과 기업의 애로요인를 줄이기 위한 대응방안에 대하여 분석하는 것이다. 더 나아가 대응방안이 중국의 제조분야의 물류애로요인의 심각성과 관련이 있는지 밝혀내려고 하였으며, 이러한 상관관계를 기대하는 것은 타당하다고 생각된다.

연구 자료는 설문 조사를 통하여 수집하였고 응답 방식은 리커트 5점 척도를 사용하였다. 설문지는 중국 제조업체에 근무하는 300명 이상의 전문가들에게 배포하였으며, 조사기간은 2014년 1월부터 5월까지 약 5개월 동안 진행되었다. 설문지에는 연구목적과 연구대상을

명시하였으며, 설문조사에 참여의사가 있다면 응답자는 각 항목에 모두 응답한 후 회신을 요청하였다.

물류애로요인을 독립 변수로 정하였으며, 세부적으로는 구매, 운송수단, 주문과정, 창고 서비스, 재고관리, 포장서비스, 물류정보, 정치문화 등에 대한 애로요인을 포함한다. 종속변수는 기업의 물류애로요인 대응방안으로 정하였으며 기술체계 향상, 관리능력향상, 공급사슬 재배치, 경영문화습득을 포함한다.

분석기법은 기술통계, 신뢰도 분석, 요인분석, 상관분석, 신뢰구간 유의성검정, 다중회귀분석, 분산분석을 사용하였다.

키워드: 제조업, 물류장벽(물류애로요인), 물류비용, SCM, 중국

Chapter 1 Introduction

1.1 Background

For the past three decades, especially since China entered the World Trade Organization (WTO) in 2001, China's economy has developed at top speed. However, as a company becomes larger and more complex, the supply chain of manufacturers gets more massive and more complicated in China.

China mostly has a well-organized industrial system, but lacks a well-organized supply chain. Specifically, logistics services are not dependable in China. Third-party logistics (3PL) support a narrow range of services. Reserve logistics and green logistics are still in their infancy. Because of lack of funds, environmental awareness, enforceable laws and government supportive policies, reserve logistics and green logistics will continue to be short slab in the logistics process. The quality of infrastructure is still low nationwide. Lack of standardized equipment and automatic equipment leads to inefficiency in loading and unloading, transportation services, and warehousing services. Compared with developed countries, high fines and unreasonable highway tolls in China lead to higher logistics cost in transportation services.

In the short term, the Chinese logistics industry will be starved of experts. However, most universities only pay attention to theoretical knowledge but ignore practical experience in the Chinese education system.

Not only multinational corporations but also Chinese manufacturers have encountered considerable barriers in political and business culture. Complicated business practices, convoluted communication channels between the enterprise and the government, and lack of shared understanding of the best logistics practices are the primary problems encountered.

Because of these existing logistics barriers, the share of logistics costs in China's GDP is nearly twice the world's average level. A comprehensive analysis of logistics barriers is important to design an effectively supply chain. And it will help Chinese manufacturers to improve their competitive positions in international competition.

1.2 Research Purpose

The purpose of this thesis is to describe logistics barriers and a firm's actions to reduce logistics barriers. Moreover, we intend to examine whether the actions are related to the severity of the barriers in the Chinese manufacturing sectors. It is reasonable to expect such a relationship.

The paper is organized as follows. The background and research purpose are in section 1. Section 2 introduces the background for the research. Section 3 develops a theoretical model for the relationship between logistics barriers and what manufacturers have done to reduce logistics barriers in China. Section 4 illustrates research methodology, which includes scales and measures, data collection, and selection of variables. Section 5 discusses the results of the analysis. Finally, section 6 illustrates the conclusion, limitation and suggestions for further research.

Chapter 2 Background for the research

2.1 Description of Logistics in the Chinese Manufacturing Sector

As time progresses and the Chinese economy advances, Chinese manufacturers play a key role in the global supply chain and make great contributions to global economic development. At the same time, China is called the world's factory and its economics of scale constantly expand. But Chinese companies still have a host of logistics barriers in the manufacturing sector.

When Chinese manufacturers are heavily involved in international competition, price wars are often viewed as the main instrument to gain a competitive advantage. With a lack of technical advantage and capital, survival is the most considerable thing for many small-sized and medium-sized firms. Thus, Chinese manufacturers focus more on short-term gains rather than long-term benefits. They focus on purchasing, distribution networks, order processing and warehousing services more than inventory control, information services, packaging services, reverse logistics and green logistics.

Compared with Britain and United States, Chinese third-party logistics services are still in their initial stages with a narrow range of services. 3PL services mainly support basic services for low profit. Thus large companies tend to employ self-built logistics. But due to lack of funds, private firms pay more attention to outsourcing.

Although a wealth of local suppliers exists, Chinese manufacturers still have to import a host of high-tech parts that the local suppliers cannot support. Importing parts results in longer lead time, high safety stock, high risk cost and complicated logistics solutions. In previous studies, Katsuhiko HAYASHI (2010) indicated that importing high-tech parts from Japan limits the advantages of the JIT system in Sichuan FAW Toyota Motor Co., Ltd.

Lack of experts and a lack of a general consensus of the best logistics practices are the primary problems encountered in the logistics management process. Previous studies have demonstrated these viewpoints. JR Carter (1997) identifies that training is important because few Chinese staff have adequate logistics management skills, inventory control experience, and order processing experience. And Muhammad (2012) indicates that lacking a shared understanding of the best practices is the most influential management barrier in reserve logistics.

Reverse logistics and green logistics are still in their early stages. The Chinese government is paying attention to reverse logistics and green logistics, but a host of

existing problems are troublesome. Due to a lack of funds, environmental awareness, enforceable laws and government supportive policies, reserve logistics and green logistics will continue to be short slab in the logistics process.

2.2 Description of Logistics Costs

Logistics costs include transportation costs, warehousing costs, inventory carrying costs, package costs, administration costs, opportunity costs, risk costs, and indirect costs.

There are three main measurement approaches to calculate logistics costs. The first approach is statistics-based, and creates an estimate for logistics costs as a share of GDP. The second approach is accounting-based, and evaluates logistics performance by resource-planning software. The final approach is survey-based, and logistics costs are tallied from self-reported company data.

Table 1

The share of logistics costs in China's GDP from 2009 to 2013

Year	Logistics costs	GDP	Share of GDP
2009	6.08 billion	34 billion	17.8%
2010	7.1 billion	39.7 billion	17.8%
2011	8.4 billion	47.1 billion	17.8%
2012	9.4 billion	51.9 billion	18.1%
2013	10.2 billion	56.8 billion	17.9%

Note: Sourced from China Federation of Logistics & Purchasing

This thesis examines the logistics cost from the first approach. It can be seen from table 1 that logistics costs represented approximately 17.9% of China's GDP, compared with 11% in Japan, 8% in the United States, and 7% in the EU in 2013. It is clear that the percentage of logistics costs of China's GDP is nearly twice the world's average level.

2.3 Description of Logistics Barriers

This thesis divides logistics barriers into 2 categories, hardware logistics barriers and

software logistics barriers.

We describe the hardware logistics barriers as the logistics actions which require a host of facilities and equipment, such as warehouses, trucks, forklifts, goods shelves, conveyor belts, application servers and logistics systems. Hardware logistics barriers include transportation services barriers, warehousing services barriers and logistics information services barriers.

Software logistics barriers mean the logistics actions need more exhaustive specialized knowledge, technical know-how, reliable and timely data, cultural understanding, and management skills. Software logistics barriers contain purchasing barriers, order processing barriers, inventory control barriers, packaging services barriers, and political and business culture barriers.

Table 2

Summary of logistics taxonomy, author's commentary and previous studies

Area of concern	Issues	Author's commentary	Previous studies	Source
transportation	Efficiency, costs, availability, timeliness, dependability, infrastructure, equipment,	Poor quality infrastructure countrywide, perfect infrastructure in developed areas; high highway toll	Infrastructure and service poor; equipment OK; dependability issue very poor	JR Carter et al., 1997; Katsuhiko et al., 2010
warehousing	Efficiency, costs, size, location, dependability, availability	Lack of automatic equipment	Acceptable location, service, facilities, computer system	JR Carter et al., 1997
information	Reliability, accuracy, timeliness, accessibility	poor information quality	Quality compromised by systematic incentives to distort data	Handfield RB et al., 1993
purchasing	Availability, quality,	Acceptable quality and	Availability and price acceptable;	JR Carter et al., 1997;

	dependability, pricing, responsiveness, after service	price	quality, dependability &responsiveness poor	Razzaque MA, 1997
order	Dependability, pricing, skills, responsiveness,	Acceptable dependability	Lack of communication infrastructure; hard to access required information	JR Carter et al., 1997
inventory control	Dependability, costs, skills,	A part of firms lack of skills and computer technology	Acceptable management methods, allocation plan, skilled staff	JR Carter et al., 1997; Katsuhiko et al., 2010
packaging	Dependability, costs, skills, standardization,	Lack of standardization and automation; unrecyclable; acceptable costs	No details	No details in previous studies
Political and cultural –OR- politics and culture	Law, taxes, fines, communication skills	Acceptable law, tax; complicated business culture	Bear “unheard of”, avoid “lose face” in China	Handfield RB et al., 1993; Roy A et al., 2001

Note: 1. Hardware barriers include transportation, warehousing and information.

2. Software barriers include purchasing, order, inventory control, packaging, and politics and culture.

Compared with previous studies, we found many factors of logistics barriers have been improved.

Lack of standardized equipment and automatic equipment leads to inefficiency in loading and unloading. Katsuhiko HAYASHI (2010) described that compared to Japan, there is a lack of standardized transport equipment such as palettes and folding containers which leads to inefficiency loading and unloading in China. Moreover, Carter (1997) identifies that infrastructure, dependability and transportation services are unreliable, and equipment is acceptable. Katsuhiko (2010) identifies that intermodal

transport service and dependability of transportation services are very poor in inland China. However, as time goes by, although service dependability is still unreliable, transportation infrastructure is constantly improving in China. Specifically, a transportation network is acceptable in developed areas. But compared with developed countries, high fines and unreasonable highway tolls in China must lead to higher logistics costs in transportation services.

In warehousing services barriers, Carter (1997) identifies location, warehousing service, facilities, and computer systems are acceptable. But we found that many small-sized and medium-sized firms lack standardized equipment and automatic equipment.

In logistics information services areas, the quality of information remains unreliable and untimely. As Handfield RB (1993) identifies that distorted data leads to the poor quality of information.

In purchasing areas, Carter (1997) and Razzaque MA (1997) identify availability and price are acceptable, while quality, dependability and responsiveness are poor. According to the interview, we felt that quality, dependability and responsiveness are improved.

In order processing sectors, JR Carter (1997) identifies Chinese manufacturers' lack of communication infrastructure, and Chinese manufacturers' difficulty in accessing required information. Fortunately, according to the investigation, we found that these problems are improved.

In inventory control sectors, JR Carter (1997) identifies that management methods, allocation plans, and skilled staff are acceptable. However, there is a huge gap in the inventory control level between different manufacturers.

In political and business culture barriers, unreasonable fines and lack of enforceable law have emerged, and business culture is complicated. We can find similar viewpoints in previous studies, such as Handfield RB (1993) and Roy A (2001). Due to the difficulty in changing cultural tradition, we can find obvious changes in business culture areas.

2.4 Efforts to Reduce Logistics Barriers in China

Based on previous studies, we divide a firm's actions to reduce logistics barrier into 4 categories: "technology system upgrades", "management skill upgrades", "redesigning supply chains", and "knowing business culture well".

Technology system upgrades are a better way to reduce logistics barriers. Introduction of a technology system, such as the ERP system, EDI system and WMS, can improve order processing level, inventory control level, warehousing service level and logistics information level. We can find similar viewpoints in previous studies, such as Shawn P. Daly (2003), Katsuhiko HAYASHI (2010) and Wisner (2012).

Management skill upgrades are the second main approach to reduce logistics barriers. Management skill upgrade means establishing administrative rules, assessing performance and training staff. Many respondents revealed that training staff can improve the staff's specialized knowledge, technical know-how, and cultural understanding. What's more, establishing administrative rules and assessing performance can make an effective and dependable organization. We can find similar viewpoints in previous studies. JR Carter (1997) identifies that training is important because few Chinese staff have adequate logistics management skill, inventory control experience, and order processing experience.

Redesigning supply chains is the third main approach to reduce logistics barriers. Redesigning supply chains includes selecting suppliers and carriers carefully, rearranging delivery schedules, using 3PL services, implementing early supply involvement, and unifying package standards. Traditionally, selecting suppliers and carriers carefully is a good way to optimize supply chains, which reduces risk and cost, and improves the efficiency of the distribution network. Moreover, because of TOYOTA's success in procurement management, early supply involvement catches more attention in supply chain management. Early supply involvement is an efficient way to increase safety and quality of products, and reduce cost and lead time. In previous studies, Katsuhiko HAYASHI (2010) states that early supply involvement makes valuable contributions towards procurement logistics services for Japanese auto manufactures in inland China.

Some factors hinder redesign supply chain in inland China. More specifically, delivery schedules and logistics services are difficult to control in China. JR Carter (1997) identifies that transportation and logistics services are not controlled by carriers but these services are controlled by the government. Moreover, HAYASHI (2010) identifies that operational and management problems make rail transport unreliable. Furthermore, tracking the rail containers is impossible.

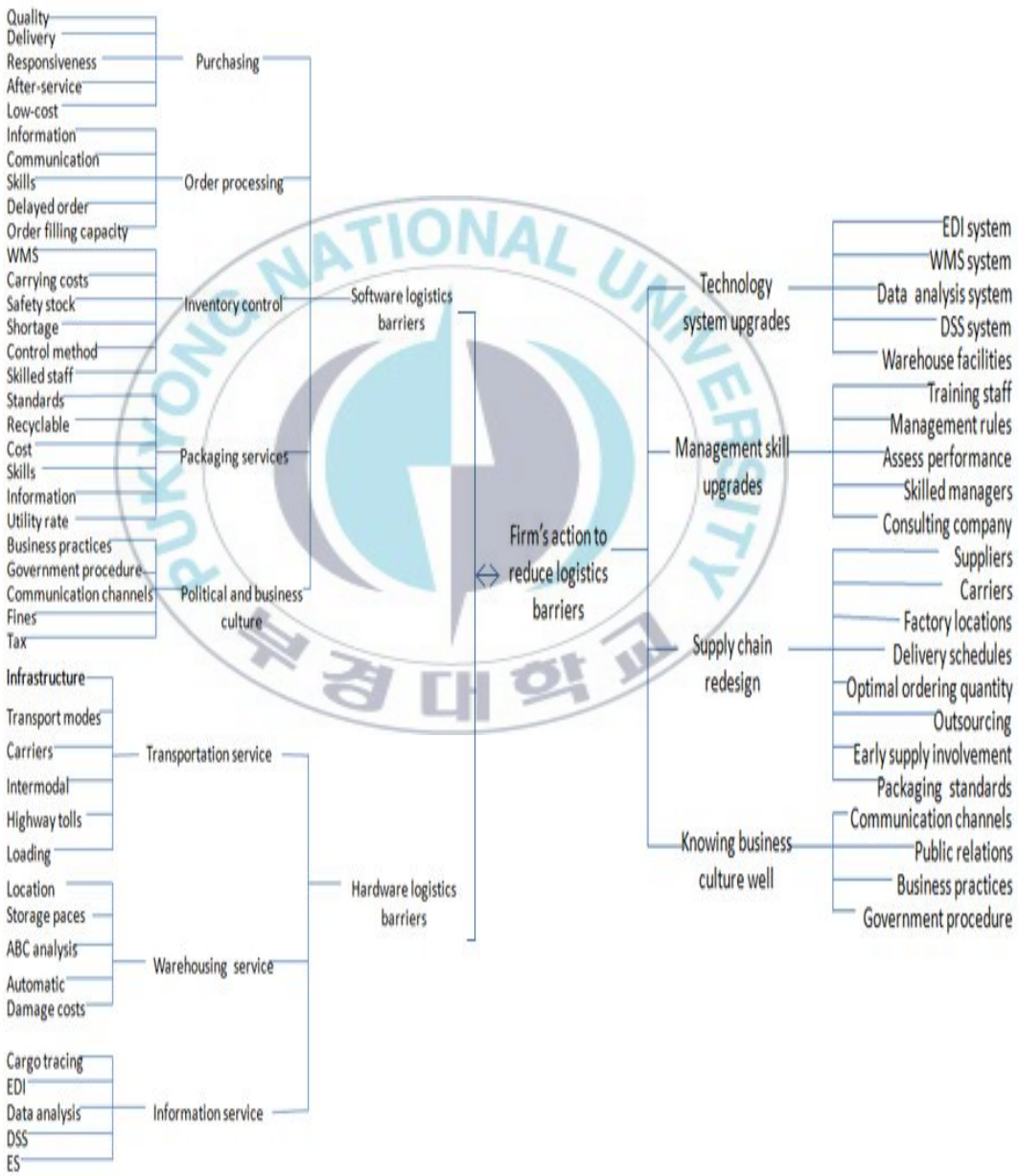
Finally, learning about more business culture is an efficient tool to reduce logistics barriers. Business culture includes business practices, communication skills, government procedure, law, taxes, and fines. In Chinese business culture, unreasonable fines and lack of enforceable law have emerged, and business culture is complicated. Personal relationships are important in Chinese business practices. Honesty and modesty are significant conditions in relationships. Businessmen prefer to do business with people they know. Vast networks of social connections could help manufacturers save a lot of time and money in China. Moreover, saving face is important in Chinese communication. Respecting diversity is a good way to communicate. If you choose an unacceptable communication mode, you will be strongly resisted by your cooperative partner, which can result in endless negotiation. In previous studies, Handfield RB (1993) and Roy A (2001) identify that bearing "unheard of" and avoiding "lose face" are

important rules in Chinese business culture. Moreover, JR Carter (1997) identifies that adopting Chinese business practices means cultivating better relationships with local suppliers and carriers.

Chapter 3 Research Model

Fig 2

Research framework



3.1 Software Logistics Barriers Factors

This thesis divides logistics barriers into 2 categories: software logistics barriers and hardware logistics barriers.

Software logistics barriers mean that logistics actions need more exhaustive specialized knowledge, technical know-how, reliable and timely data, cultural understanding, and management skills. Software logistics barriers contain purchasing barriers, order processing barriers, inventory control barriers, packaging services barriers, and political and business culture barriers.

3.1.1 Purchasing

Purchasing barriers include: 1) suppliers' lack of quality dependability, 2) suppliers' lack of delivery dependability, 3) suppliers' lack of responsiveness to needs, 4) suppliers' lack of after-service dependability, 5) lack of low-cost suppliers.

3.1.2 Order Processing

Order processing barriers include: 1) lack of available suppliers' information, 2) lack of communication infrastructure, 3) lack of order processing skills, 4) delayed order processing, 5) suppliers' lack of order filling capacity.

3.1.3 Inventory Control

Inventory control barriers include: 1) lack of WMS, 2) high level of inventory carrying cost, 3) high level of safety stock, 4) inability to identify shortages ahead of time, 5) lack of inventory control methods, 6) lack of skilled Inventory control staff.

3.1.4 Packaging Service

Packaging services barriers include: 1) lack of unified packaging standard, 2) lack of recyclable packages, 3) high cost of packages, 4) lack of packaging management skills, 5) lack of package information, 6) low utility rate of unit package.

3.1.5 Political and Business Culture

Political and business culture barriers include: 1) complicated business practices, 2) complicated government procedure, 3) complicated communication channels between

the enterprise and the government, 4) high fines in logistics activities, 5) lack of tax preferences.

3.2 Hardware Logistics Barriers Factors

We describe the hardware logistics barriers as the logistics actions which require a host of facilities and equipment, such as warehouses, trucks, forklifts, goods shelves, conveyor belts, application servers and logistics systems. Hardware logistics barriers include transportation services barriers, warehousing services barriers and logistics information services barriers.

3.2.1 Transportation Services

Transportation services barriers include: 1) lack of transportation infrastructure, 2) lack of alternative transportation modes, 3) lack of alternative carriers, 4) lack of intermodal services, 5) high highway tolls, 6) lack of loading/unloading efficiency.

3.2.2 Warehousing Services

Warehousing services barriers include: 1) lack of appropriate warehouse locations, 2) lack of storage spaces, 3) lack of ABC inventory classification, 4) lack of automatic warehouse equipment, 5) high level of damage cost and shrinkage cost in warehousing services.

3.2.3 Logistics Information Services

Logistics information services barriers include: 1) lack of cargo tracing services, 2) lack of EDI systems (electronic data interchange), 3) lack of data analysis systems, 4) lack of DSS (decision support system), 5) lack of ES systems (expert system).

3.3 Firm Action Factors

Based on previous studies, we divide a firm's action to reduce logistics barriers into 4 categories: technology system upgrades, management skill upgrades, redesigning supply chains, and knowing business culture well.

3.3.1 Technology System Upgrades

Technology system upgrades include: 1) introduce EDI systems, 2) introduce WMS, 3) introduce data analysis systems, 4) introduce DSS, 5) introduce adequate warehouse facilities.

3.3.2 Management Skill Upgrades

Management skill upgrades include: 1) providing training to staff, 2) establishing administrative management rules, 3) assessing performance, 4) employing more skilled managers, 5) consultations with a consulting company.

3.3.3 Supply Chains Redesign

Redesigning supply chains include: 1) more carefully reselecting suppliers, 2) more carefully reselecting carriers, 3) more carefully reselecting factory locations, 4) more carefully rearranging delivery schedules, 5) more carefully redesigning optimal ordering quantity, 6) more carefully making outsourcing decisions, 7) implementing early supply involvement, 8) unifying packaging standards.

3.3.4 Knowing Business Culture Well

Knowing business culture well includes 1) knowing building communication channels well, 2) knowing public relations and crisis management well, 3) knowing business practices well, 4) knowing government procedure well.

Chapter4. Research Methodology

To evaluate logistics barriers and firms' actions to reduce logistics barriers in the Chinese manufacturing industry, we selected manufacturing firms that demonstrated a certain level of logistics barriers in the logistics process.

Consequently, the manufacturers who participated in this survey were selected from cities in key regions of China with the highest concentration of the major industries. Beijing, Tianjin, Shandong, Jiangsu, Shanghai, Zhejiang, Guangdong, Fujian, and Sichuan were selected for survey. These provinces and cities have the most advanced industrial business, with well-developed infrastructure, advanced communications networks, and available logistics services in comparison with most other places.

The industry sectors chosen for this survey all have long-term manufacturing experience and, therefore, the logistics barriers in these sectors were expected to be widespread. Using these selection rules, we targeted 9 Chinese industry sectors: the light industry, the machine building industry, the electronics industry, the automotive industry, the ship–building industry, the chemical industry, the pharmaceutical industry, the logistics industry, and the construction industry.

4.1 Scales and measures

The survey questionnaire administered to Chinese manufacturers includes 3 sections with general questions, 43 items on the logistics barriers and 22 items on firms' actions to reduce logistics barriers. The 8 categories of logistics barriers investigated are purchasing, transportation services, order processing, warehousing services, inventory control, packaging services, logistics information services, and political and business culture. The 4 categories of firms' actions to reduce logistics barriers investigated are technology system upgrades, management skill upgrades, redesigning supply chains, and knowing business culture well.

A five-point Likert scale was employed to measure the eight categories of degree of logistics barriers variables and the four categories of firms' actions variables in the target firms. All analyses were carried out using the SPSS 19.0 for Windows package.

4.2 Data collection

The survey questionnaire with several logistics activity related variables, was designed and distributed to manufacturing companies between January and May 2014.

The target manufacturing companies were identified from the list of manufacturers in each province within 9 industry sectors.

Data was collected by a questionnaire interview. Questionnaires were sent to over 300 professionals in Chinese manufacturing. 128 professionals completed the questionnaires. Therefore, the effective response rate was about 42.67%.

Details of respondents are shown in Table 3. Among the participants, less than 3 years and between 3 and 5 years made up the two biggest groups of working age. Together they comprised over half of participants. Less than 3 years working age accounted for 32%. And between 3 and 5 years working age accounted 25.8%. The proportion of working age between 10 and 20 years was 8.5%, which is the smallest group of working age.

Regarding respondent positions, the proportion of functional-level staff was the biggest group, which accounted for 61.7%. While 26.6% were functional-level managers, 9.4% were business-level managers. The proportion of corporate-level managers, only 2.3% of respondents, was the smallest item.

Regarding educational degrees, bachelors and masters made up the two biggest items. Together they comprised over half of participants. Bachelor degrees accounted for 32.8%, while master degrees accounted for 29.7%. Moreover, associate degrees accounted 18.8%, senior high school diplomas accounted for 17.2%, and doctors accounted for 1.6%. No participant got had only a junior high school diploma.

Of the total of 128 respondents, over 58.6% were from manufacturers which employed more than 1000 employees. 3.1% were from manufacturers which employed between 50 and 100 employees. About 15.6% were from manufacturers which employed between 100 and 500 employees. 14.1% were from manufacturers which employed between 500 and 1000 employees and 8.6% were from manufacturers which employed less than 50 employees.

Table 3

Sample characteristics

	Sample	
	Total	Percentage (%)
Respondent working age		
<3 years	41	32
3 to 5 years	33	25.8

5 to 10 years	14	11
10 to 20 years	11	8.5
> 20 years	29	22
Respondent position		
Functional-level staff	79	61.7
Functional-level manager	34	26.6
Business-level manager	12	9.4
Corporate-level manager	3	2.3
Educational degree		
Junior High School diploma	0	0
Senior High School Diploma	22	17.2
Associate degree	24	18.8
Bachelor	42	32.8
Master	38	29.7
Doctor	2	1.6
Number of employees		
<50 workers	11	8.6
50 to 100 workers	4	3.1
100 to 500 workers	20	15.6
500 to 1000 workers	18	14.1
>1000 workers	75	58.6
Years since establishment		
<5 years	7	5.5
5 to 10 years	20	15.6
10 to 20 years	32	25

>20 years	69	53.9
Industry sectors		
The light industry	8	6.3
The machine building industry	15	11.7
The electronics industry	16	12.5
The automotive industry	6	4.7
The ship–building industry	0	0
The chemical industry	35	27.3
The pharmaceutical industry	1	0.8
The logistics industry	20	15.6
The construction industry	3	2.3
Others	24	18.8

In terms of years since establishment, about 53.9% were from manufacturers which have been established for over 20 years. 25% were from manufacturers which were established between 10 and 20 years ago, while 15.6% were from manufacturers which were established between 5 and 10 years ago. The proportions of respondents from manufacturers which have been established for less than 5 years was the smallest, which represented only 5.5%.

Of the total 128 respondents, 27.3% were from the chemical industry, and 0.8% of respondents were from the pharmaceutical industry. Moreover, no participant was from the ship–building company.

4.3 Selection of Variables

This study selects the variables from previous studies. Details of variables' sources are shown in Table 4.

4.3.1 Independent Variables

43 items of the logistics barriers were identified as independent variables. Details of independent variables are shown in Table 4. The logistics barriers were classified as 8 factors including purchasing (PUR - 5 variables), transportation services (TRA - 6 variables), order processing (ORD - 5 variables), warehousing services (WAR - 5 variables), inventory control (INV – 6 variables), packaging services (PAC – 6 variables), logistics information services (INF – 5 variables), and political and business culture (P&C – 5 variables).

A five-point Likert scale ranging from “not at all” to “very much” was employed to measure the degree of barriers.

4.3.2 Dependent Variables

22 items on firms’ actions to reduce logistics barriers were identified as dependent variables. Details of dependent variables are shown in Table 4. We divided 22 items into 4 dependent variables including technology system upgrades (TEC – 5 variables), management skill upgrades (MSU – 5 variables), redesigning supply chains (RSC – 8 variables), and knowing business culture well (KBC – 4 variables).

A five-point Likert scale was also employed to measure the firms’ actions against the logistics barriers.

Table 4

Summary of variables

Variables	No.	Factors	Source	Measure
Purchasing (Independent)	PUR1	Suppliers' lack of quality dependability	JR Carter et al., 1997	5-point Likert scale (1=Not at all,5=very much)
	PUR2	Suppliers' lack of delivery dependability		
	PUR3	Suppliers’ lack of responsiveness to needs		
	PUR4	Suppliers’ lack of after-service dependability	Author’s viewpoint	
	PUR5	Lack of low-cost suppliers		
Transportation	TRA1	Lack of transportation infrastructure	JR Carter et	5-point Likert scale

services (Independent)	TRA2	Lack of alternative transport modes	al., 1997	(1=Not at all,5=very much)
	TRA3	Lack of alternative carriers		
	TRA4	Lack of intermodal services		
	TRA5	High highway tolls	Author's viewpoint	
	TRA6	Lack of loading/unloading efficiency		
Order processing (Independent)	ORD1	Lack of availability suppliers' information	Author's viewpoint	5-point Likert scale (1=Not at all,5=very much)
	ORD2	Lack of communication infrastructure	JR Carter et al., 1997	
	ORD3	Lack of order processing skills		
	ORD4	Delayed order processing		
	ORD5	Suppliers' lack of order filling capacity		
Warehousing services (Independent)	WAR1	Lack of appropriate warehouse locations	JR Carter et al., 1997	5-point Likert scale (1=Not at all,5=very much)
	WAR2	Lack of storage spaces	Author's viewpoint	
	WAR3	Lack of ABC inventory classification		
	WAR4	Lack of automatic warehouse equipment		
	WAR5	High level of damage cost and shrinkage cost in the warehouse		
Inventory control (Independent)	INV1	Lack of WMS	Author's viewpoint	5-point Likert scale (1=Not at all,5=very much)
	INV2	High level of inventory carrying cost		
	INV3	High level of safety stock		
	INV4	Inability to identify shortages ahead of time		
	INV5	Lack of inventory control methods	JR Carter et al., 1997	
	INV6	Lack of skilled inventory controls staff		
Packaging	PAC1	Lack of unified packaging standard		5-point Likert scale

services (Independent)	PAC2	Lack of recyclable packages	Author's viewpoint	(1=Not at all,5=very much)
	PAC3	High cost of packages		
	PAC4	Lack of packaging management skills		
	PAC5	Lack of package information		
	PAC6	Low utility rate of unit package		
Logistics information services (Independent)	INF1	Lack of cargo tracing services	Author's viewpoint	5-point Likert scale (1=Not at all,5=very much)
	INF2	Lack of EDI (electronic data interchange) systems	JR Carter et al., 1997	
	INF3	Lack of data analysis systems	Author's viewpoint	
	INF4	Lack of DSS (decision support system)		
	INF5	lack of ES (expert system)		
Political and Business Culture (Independent)	P&C1	Complicated business practices	Author's viewpoint	5-point Likert scale (1=Not at all,5=very much)
	P&C2	Complicated government procedure		
	P&C3	Complicated Communication Channels between the enterprise and the government		
	P&C4	High fines in logistics activities		
	P&C5	Lack of tax preferences		
Technology system upgrades (Dependent)	TEC1	Introduce EDI systems	Author's viewpoint	5-point Likert scale (1=Not at all,5=very much)
	TEC2	Introduce WMS systems		
	TEC3	Introduce data analysis systems		
	TEC4	Introduce DSS		
	TEC5	Introduce adequate warehouse facilities	JR Carter et al., 1997	
Management skill upgrades	MSU1	Providing training to staff	JR Carter et al., 1997	5-point Likert scale (1=Not at
	MSU2	Establishing administrative management rules	Author's	

(Dependent)	MSU3	Assessing performance	viewpoint	all,5=very much)
	MSU4	Employing more skilled managers		
	MSU5	Consultations with a consulting company		
Supply chain redesign (Dependent)	RSC1	More carefully reselecting suppliers	JR Carter et al., 1997	5-point Likert scale (1=Not at all,5=very much)
	RSC2	More carefully reselecting carriers		
	RSC3	More carefully reselecting factory locations		
	RSC4	More carefully rearranging delivery schedules		
	RSC5	More carefully redesigning optimal ordering quantity	Author's viewpoint	
	RSC6	More carefully making outsourcing decisions		
	RSC7	Implementing early supply involvement		
	RSC8	Unifying packaging standards		
Knowing Business Culture well (Dependent)	KBC1	Knowing building communication channels between the enterprise and the government well	Author's viewpoint	5-point Likert scale (1=Not at all,5=very much)
	KBC2	Knowing public relations and crisis management well		
	KBC3	Knowing business practices well	JR Carter et al., 1997	
	KBC4	Knowing government procedure well	Author's viewpoint	

Chapter5. Results

Descriptive statistics, reliability analysis, factor analysis, correlation analysis and regression analysis were used to analyze the survey data.

The reliability analysis validated the Cronbach alpha coefficient of questionnaires. The Cronbach alpha coefficient was developed to test the variables. Details of the reliability analysis are shown in Table 5, Table 6 and Table 7.

In the descriptive statistics, a mean score rating was developed to represent the relative severity of each logistics barrier (Table 8 and Table 9) and describe efforts of firms' action to reduce logistics barriers (Table 10). Simultaneous 95% confidence intervals were constructed to test the significance of the severity of 43 logistics barriers grouped into 8 functional areas (Table 8 and Table9) and the degree of implementation of 22 firms' action to reduce logistics barriers grouped in 4 functional areas (Table 10).

Factor analysis was used to evaluate and shortlist the logistics barriers and the firms' actions with Varimax rotation as an extraction tool. Table 11 and Table 12 present a summary of the factor analysis results for logistics barriers. Table 13 presents a summary of the factor analysis results for firms' action to overcome logistics barriers.

Correlation is a term that refers to the strength of a relationship between two variables. In order to gain a dependable result, variables should be correlated within limits, but variables should not be correlated perfectly. The results of correlation analysis were acceptable correlation coefficients below 0.90. Details of the correlation analysis are shown in Table 14.

Multiple regression analysis was developed to describe the relationship between logistics barriers and firms' action to reduce logistics barriers. 22 firms' actions to reduce logistics barriers were grouped in 4 functional areas. These 4 functional areas were used as 4 dependent variables, while the logistics barriers were used as independent variables. Thus, 4 multiple regression equations were estimated. The purpose was to determine whether the actions are related to the severity of logistics barriers. It is reasonable to expect such a relation. Details of the regression analysis are shown in Table 15, Table 16, Table 17 and Table 18, respectively.

5.1 Reliability Analysis

The reliability analysis was developed to test the reproducibility. Niels (2013) indicated that reliability is used to evaluate a measuring instrument, which is an instrument to give nearly identical results in repeated measurements under identical conditions.

The reliability analysis validated the Cronbach alpha coefficient of questionnaires. The Cronbach alpha coefficient was developed to test the variables. The reliability test provided the Cronbach alpha which ranged from 0.76 to 0.89 and these exceeded the acceptable threshold of 0.60. Nunnally (1994) indicated that all Cronbach's alpha values are above the lower limit of 0.60 to ensure the internal consistency and validity of a construct.

Regarding the reliability analysis results on software logistics barriers, all Cronbach's alpha values are above 0.70. So we can ensure the internal consistency and validity of a construct. Specifically, PUR Cronbach's alpha value, ORD Cronbach's alpha value, INV Cronbach's alpha value and P&C Cronbach's alpha value are more than 0.80. And PAC Cronbach's alpha value is greater than 0.70.

Table 5

Reliability analysis results on software logistics barriers

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha	N of Items
PUR1	11.98	8.889	.609	.788	.822	5
PUR2	11.96	9.203	.625	.785		
PUR3	11.76	9.035	.602	.790		
PUR4	11.76	8.689	.643	.778		
PUR5	11.58	8.388	.604	.792		
ORD1	11.45	5.447	.633	.778	.819	5
ORD2	11.55	6.140	.614	.783		
ORD3	11.49	5.874	.614	.782		
ORD4	11.27	5.744	.614	.783		
ORD5	11.55	6.565	.605	.790		
INV1	16.30	11.675	.598	.696	.759	6
INV2	16.27	11.744	.672	.679		
INV3	16.18	14.164	.284	.777		
INV4	16.51	12.677	.540	.715		
INV5	16.30	11.990	.656	.685		
INV6	16.41	13.158	.321	.778		
PAC1	16.47	13.290	.366	.759	.755	6
PAC2	15.46	12.077	.656	.677		

PAC3	15.73	12.610	.541	.708		
PAC4	15.70	12.557	.638	.685		
PAC5	16.13	13.433	.449	.732		
PAC6	16.18	13.487	.374	.754		
P&C1	14.18	12.196	.749	.865	.892	5
P&C2	14.13	12.053	.765	.862		
P&C3	13.98	12.535	.726	.870		
P&C4	14.20	12.221	.738	.868		
P&C5	14.07	12.365	.700	.876		

Note: 1. Alpha if INV3 deleted coefficient above INV alpha coefficient, so deleted.

2. Alpha if INV6 deleted coefficient above INV alpha coefficient, so deleted.

3. Alpha if PAC1 deleted coefficient above PAC alpha coefficient, so deleted.

Details of the reliability analysis results on software logistics barriers are shown in Table 5. “Cronbach's alpha if INV3 deleted” coefficient and “Cronbach's alpha if INV6 deleted” coefficient were higher than INV factor’s Cronbach's alpha coefficient. Correlation coefficient INV3 and INV6 as a corrected item was reported as 0.284 and 0.321 which is a relatively low level. Thus, deleting both INV3 and INV6 can further increase the INV factor’s Cronbach's alpha coefficient from 0.759 to 0.811. “Cronbach's alpha if PAC1 deleted” coefficient was higher than PAC factor’s Cronbach's alpha coefficient. Correlation coefficient PAC1 as a corrected item was reported as 0.366 which is quite low. Thus, deleting PAC1 can further increase the PAC factor’s Cronbach's alpha coefficient from 0.755 to 0.759. After deleting INV3, INV6 and PAC1, all the Cronbach's alpha coefficients were acceptable.

Regarding the reliability analysis results on hardware logistics barriers, all Cronbach's alpha values are above 0.70. So we can ensure the internal consistency and validity of a construct. Specifically, TRA Cronbach's alpha value is 0.844. WAR Cronbach's alpha value is 0.831, and INF Cronbach's alpha value is 0.772.

Details of the reliability analysis results on hardware logistics barriers are shown in Table 6. “Cronbach's alpha if INF1 deleted” coefficient was higher than INF factor’s Cronbach's alpha coefficient. Thus, deleting INF1 can further increase the INF factor’s Cronbach's alpha coefficient from 0.772 to 0.782. But after deleting INF1, Cronbach's alpha if INF2 deleted coefficient increased from 0.722 to 0.804, which was higher than INF factor’s Cronbach's alpha coefficient (0.782). Thus, deleting INF 2 can further increase the INF factor’s Cronbach's alpha coefficient from 0.782 to 0.804. All the Cronbach's alpha coefficient has improved remarkably after deleting those 2 variables (INF 1 and INF 2).

Table 6

Reliability analysis results on hardware logistics barriers

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha	N of Items
TRA1	15.27	15.378	.604	.822	.844	6
TRA2	15.22	15.290	.620	.818		
TRA3	15.08	15.443	.612	.820		
TRA4	14.98	15.291	.624	.818		
TRA5	14.14	14.956	.618	.819		
TRA6	14.41	14.213	.660	.811		
WAR1	12.05	7.179	.678	.784	.831	5
WAR2	11.89	8.366	.611	.805		
WAR3	11.88	8.142	.621	.801		
WAR4	11.55	6.927	.655	.794		
WAR5	11.83	7.954	.612	.803		
INF1	13.38	9.921	.410	.782	.772	5
INF2	13.20	9.769	.568	.722		
INF3	12.80	9.108	.691	.680		
INF4	12.78	9.873	.563	.724		
INF5	12.78	9.826	.519	.739		

Note: 1. Alpha if INF1 deleted coefficient above INF alpha coefficient, so deleted.

2. Alpha if INF2 deleted coefficient above INF alpha coefficient, so deleted.

Regarding the reliability analysis results on firms' actions to reduce logistics barriers, all Cronbach's alpha values are above 0.70. So we can ensure the internal consistency and validity of a construct. Specifically, TEC Cronbach's alpha value is 0.868, and MSU Cronbach's alpha value is 0.772. RSC Cronbach's alpha value is 0.822, and KBC Cronbach's alpha value is 0.868.

Details of the reliability analysis results on firms' actions to reduce logistics barriers are shown in Table 7. "Cronbach's alpha if MSU5 deleted" coefficient was higher than MSU factor's Cronbach's alpha coefficient. Correlation coefficient MSU5 as corrected item was reported as 0.185 which is quite low. Thus, deleting MSU5 can further increase the MSU factor's Cronbach's alpha coefficient from 0.772 to 0.848. "Cronbach's alpha if RSC7 deleted" coefficient and "Cronbach's alpha if RSC8 deleted" coefficient were higher than RSC factor's Cronbach's alpha coefficient. Correlation coefficient RSC7 and

RSC8 as corrected item was reported as 0.312 and 0.315. Thus, deleting both RSC7 and RSC8 can further increase the RSC factor's Cronbach's alpha coefficient from 0.822 to 0.860. After deleting MSU5, RSC7 and RSC8, all the Cronbach's alpha coefficients have improved dramatically.

Table 7

Reliability analysis results on firms' actions to reduce logistics barriers

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha	N of Items
TEC1	14.38	9.545	.753	.824	.868	5
TEC2	14.11	10.130	.724	.833		
TEC3	14.05	9.343	.766	.821		
TEC4	14.09	10.630	.615	.858		
TEC5	14.12	10.262	.605	.862		
MSU1	14.55	7.320	.715	.666	.772	5
MSU2	14.51	7.732	.665	.687		
MSU3	14.80	8.084	.605	.709		
MSU4	14.75	8.378	.625	.706		
MSU5	15.05	10.061	.185	.848		
RSC1	25.33	17.325	.670	.785	.822	8
RSC2	25.37	16.770	.706	.779		
RSC3	25.41	17.457	.579	.797		
RSC4	25.35	17.301	.593	.795		
RSC5	25.25	17.906	.633	.792		
RSC6	25.34	17.579	.628	.791		
RSC7	25.30	19.426	.312	.833		
RSC8	25.48	18.803	.315	.838		
KBC1	11.93	5.168	.726	.835	.868	4
KBC2	11.95	5.604	.765	.812		
KBC3	11.87	6.242	.684	.845		
KBC4	11.78	6.235	.729	.830		

Note: 1. Alpha if MSU5 deleted coefficient above MSU alpha coefficient, so deleted.

2. Alpha if RSC7 deleted coefficient above RSC alpha coefficient, so deleted.

3. Alpha if RSC8 deleted coefficient above RSC alpha coefficient, so deleted.

5.2 Descriptive Statistics

Regarding the descriptive statistics results on software logistics barriers and hardware logistics barriers, a mean score rating was developed to represent the relative severity of each logistics barrier. Simultaneous 95% confidence intervals were constructed to test the significance of the severity of 43 logistics barriers grouped into 8 functional areas including purchasing (PUR), transportation services (TRA), order processing (ORD), warehousing services (WAR), inventory control (INV), packaging services (PAC), logistics information services (INF), and political and business culture (P&C) . The summary of descriptive statistics results on software logistics barriers is provided in Table 8. And the summary of descriptive statistics results on hardware logistics barriers is provided in Table 9.

For ease of interpretation, the average scores on each of 43 logistics barriers variables were categorized into quartiles of severity. Quartile Ⅰ (mean score 1.0-2.9) was classified as no barrier, Quartile Ⅱ (mean score 2.0-2.9) was classified as average, Quartile Ⅲ (mean score 3.0-3.9) was classified as very, and Quartile Ⅳ (mean score 4.0-4.9) was classified as extremely. The summary statistics are given in Table 8 and Table 9.

The descriptive statistics results on logistics barriers indicate that Chinese manufacturers have encountered considerable problems in their logistics process. 38 barriers were reported by the respondents as having an effect on their operations (mean rating >2.0). More specifically, 21 logistics barriers (48.83%) were considered very severe (mean rating >3.0) and 17 logistics barriers (39.53%) were considered as average (mean rating >2.0).

The logistics barriers perceived as very severe fall mainly in 5 functional areas: transportation services, inventory control, packaging services, logistics information services, and political and business culture. Moreover, almost all of logistics barriers variables were average in purchasing, order processing and warehousing services functional areas. Only the PUR 5 variable (lack of low-cost suppliers), ORD 4 variable (delayed order processing) and WAR 4 variable (lack of automatic warehouse equipment) were reported as very severe.

Problems seem less serious in the functional area of purchasing. Almost all item variables were less than or equal to 3.00, which was reported as average. But barriers in lack of low-cost suppliers was still significant for many firms (the mean rating score was 3.18), which was reported as very severe. Regarding purchasing, manufacturers commonly focus on suppliers' dependability and availability in the United States, but apparently manufacturers pay less attention to suppliers' dependability and availability

in China. When Chinese manufacturers are heavily involved in international competition, price wars were often viewed as the main way to gain a competitive advantage. Thus, Chinese manufacturers pay more attention to procurement cost.

Table 8

Descriptive statistics results on software logistics barriers

			95% Confidence Interval		
			Lower	Upper	Perceived severity
PUR1	N	128	128	128	
	Mean	2.78	2.63	2.95	average
PUR2	N	128	128	128	
	Mean	2.80	2.65	2.95	average
PUR3	N	128	128	128	
	Mean	3.00	2.85	3.16	average
PUR4	N	128	128	128	
	Mean	3.00	2.83	3.17	average
PUR5	N	128	128	128	
	Mean	3.18	2.99	3.35	very
ORD1	N	128	128	128	
	Mean	2.88	2.72	3.03	average
ORD2	N	128	128	128	
	Mean	2.78	2.66	2.91	average
ORD3	N	128	128	128	
	Mean	2.84	2.70	2.97	average
ORD4	N	128	128	128	
	Mean	3.05	2.91	3.20	very
ORD5	N	128	128	128	
	Mean	2.78	2.67	2.89	average
INV1	N	128	128	128	
	Mean	3.30	3.09	3.47	very
INV2	N	128	128	128	
	Mean	3.32	3.13	3.48	very
INV4	N	128	128	128	
	Mean	3.09	2.91	3.23	very
INV5	N	128	128	128	
	Mean	3.30	3.13	3.45	very

PAC2	N	128	128	128	
	Mean	3.67	3.50	3.85	very
PAC3	N	128	128	128	
	Mean	3.41	3.23	3.58	very
PAC4	N	128	128	128	
	Mean	3.43	3.27	3.60	very
PAC5	N	128	128	128	
	Mean	3.01	2.83	3.17	very
PAC6	N	128	128	128	
	Mean	2.95	2.75	3.14	average
P&C1	N	128	128	128	
	Mean	3.46	3.28	3.62	very
P&C2	N	128	128	128	
	Mean	3.51	3.32	3.69	very
P&C3	N	128	128	128	
	Mean	3.66	3.47	3.83	very
P&C4	N	128	128	128	
	Mean	3.45	3.26	3.61	very
P&C5	N	128	128	128	
	Mean	3.57	3.38	3.74	very
Valid N	N	128	128	128	

Regarding order processing areas, almost all item variables were less than or equal to 3.00, which was reported as less serious. But the average of “delayed order processing” was 3.05. According to descriptive statistics results, we found some of manufacturers lack flexibility in order processing.

Most of Chinese manufacturers have encountered considerable barriers in inventory control area. Lack of WMS, high inventory carrying cost, lack of ability to identify shortages ahead of time and lack of inventory control methods were reported as very severe (mean rating scores were more than 3.00). Many small-sized and medium-sized firms lack funds and technical advantages to introduce WMS, and lack shared understanding of best inventory control practices. Thus, these logistics barriers lead to high inventory carrying cost, low flexibility and low dependability.

Unrecyclable packages, high cost and lack of packaging management skills are the main barriers in the packaging services area. They were reported as very severe, and their mean rating scores were more than 3.00. Many Chinese manufacturers are still in traditional manual packing. Compared with automated packing, manual packing is

prone to improper packing, insecure packing, high cost, lack of package information and uncontrollability. Reverse logistics and green logistics are still in early stages. Thus, it is difficult to put recyclable packaging into practice.

Not only multinational corporations but also Chinese manufacturers have encountered considerable barriers in political and business culture. If manufacturers want to strive to make them stand out in its particular field, they must be proficient at business practices and deal with government regulations professionally. Because of corruption and rent-seeking behavior, skillfully managing relationships with governments commonly bring higher profits. All of those variables were reported as very severe and mean rating scores were more than 3.00 in political and business culture.

Barriers seem less serious in the functional area of transportation services. Most of those variables were less than 3.00. However, it is important to realize that high highway tolls and low loading/unloading efficiency are still significant. Katsuhiko HAYASHI (2010) described that compared to Japan; China lacks standardized transport equipment such as palettes and folding containers which result in inefficiency material handling. Moreover, the quality of transportation infrastructure was poor countrywide. But because we selected manufacturers from major cities in China, lack of transportation infrastructure was reported as average.

Warehousing services barriers were reported as less serious in the descriptive statistics results (almost all item variables were less than 3.00). But lack of automatic warehouse equipment was identified in our survey. The mean rating score was 3.25, which was reported as very severe. Many small-sized and medium-sized firms lack funds and technical advantages to introduce automatic warehouse equipment in China, which will influence the efficiency of warehousing services.

Barriers in logistics information services were reported as very severe, and its mean rating scores were more than 3.00. When Chinese manufacturers are heavily involved in international competition, survival is the most important thing, especially for many small-sized and medium-sized firms. Thus, the Chinese manufacturers focus more on short-term gains rather than long-term benefits. They focus more on purchasing, distribution networks and inventory control than information services, reverse logistics and green logistics.

Table 9

Descriptive statistics results on hardware logistics barriers

			95% Confidence Interval		
			Lower	Upper	Perceived severity
TRA1	N	128	128	128	
	Mean	2.55	2.38	2.73	average
TRA2	N	128	128	128	
	Mean	2.60	2.44	2.79	average
TRA3	N	128	128	128	
	Mean	2.74	2.57	2.91	average
TRA4	N	128	128	128	
	Mean	2.84	2.66	3.01	average
TRA5	N	128	128	128	
	Mean	3.68	3.49	3.86	very
TRA6	N	128	128	128	
	Mean	3.41	3.20	3.61	very
WAR1	N	128	128	128	
	Mean	2.75	2.59	2.92	average
WAR2	N	128	128	128	
	Mean	2.91	2.77	3.05	average
WAR3	N	128	128	128	
	Mean	2.92	2.79	3.05	average
WAR4	N	128	128	128	
	Mean	3.25	3.07	3.43	very
WAR5	N	128	128	128	
	Mean	2.97	2.81	3.13	average
INF3	N	128	128	128	
	Mean	3.44	3.25	3.61	very
INF4	N	128	128	128	
	Mean	3.45	3.29	3.62	very
INF5	N	128	128	128	
	Mean	3.45	3.27	3.63	very
Valid N	N	128	128	128	

Regarding the descriptive statistics results on firms' actions to reduce logistics barriers, a mean score rating was developed to describe the efforts of firms' action to reduce

logistics barriers (Table 10). Simultaneous 95% confidence intervals were constructed to test the degree of implementation of 22 firms' actions to reduce logistics barriers. 4 firms' action variables were technology system upgrades (TEC), management skill upgrades (MSU), redesigning supply chains (RSC), and knowing business culture well (KBC). The summary of descriptive statistics results on firms' actions to reduce logistics barriers is provided in Table 10.

A five-point Likert scale was employed to measure the degree of firms' actions variables in the 4 dependent variables. A five-point Likert scale ranging from "not at all" to "very much" was used to measure respondents' intention to counteract the barriers. For ease of interpretation, the average scores on each of the 22 firms' action to reduce logistics barriers were categorized into quartiles of severity. Quartile Ⅰ (mean score 1.0-1.9) was classified as under consideration, and Quartile Ⅱ (mean score 2.0-2.9) was classified as in the planning process. Quartile Ⅲ (mean score 3.0-3.9) was classified as partially implemented, and Quartile Ⅳ (mean score 4.0-4.9) was classified as fully implemented. The summary statistics are given in Table 10.

The descriptive statistics results on firms' actions to reduce logistics barriers indicate that Chinese manufacturers have recognized existing logistics barriers and tried to reduce these logistics barriers in firms' actions. More specifically, all the listed actions were either partially implemented (mean rating >3.0) or fully implemented (mean rating score>3.9). In other words, respondents indicated that they had taken some kind of counter-action to overcome the barriers. In addition, no action was reported in the planning process in the study.

Firm actions in technology system upgrades were reported as partially implemented and mean rating scores were more than 3.00. Many manufacturers considered that technology system upgrades are a better way to improve order processing levels, warehousing services levels and logistics information levels.

Most manufacturers pay more attention to management skill upgrades. Almost all of the variables were most than 3.00. However, firm actions in establishing administrative management rules were reported as fully implemented, and the mean rating score was 3.90. Training staff can improve staffs' specialized knowledge, technical know-how, and cultural understanding in our survey. In addition, establishing administrative rules and assessing performance can make an effective and dependable organization.

Firm actions in redesigning supply chain were reported as partially implemented and mean rating scores were more than 3.00. Redesigning supply chains is a good way to optimize supply chains, which reduces the risk and cost, and improves the efficiency of the distribution network. However, implementing early supply involvement and unifying packaging standards are controversial in redesigning supply chains' functional area. Some respondents supported that it is difficult to put implementing early supply

involvement into practice in early stages. And some respondents indicated that unifying packaging standards is largely outside a firm's influence, which is more within a government's control.

Table 10

Descriptive statistics results on firms' actions to reduce logistics barriers

			95% Confidence Interval		
			Lower	Upper	The degree of implementation
TEC1	N	128	128	128	
	Mean	3.30	3.13	3.47	partially implemented
TEC2	N	128	128	128	
	Mean	3.58	3.41	3.73	partially implemented
TEC3	N	128	128	128	
	Mean	3.63	3.46	3.80	partially implemented
TEC4	N	128	128	128	
	Mean	3.60	3.45	3.74	partially implemented
TEC5	N	128	128	128	
	Mean	3.57	3.40	3.74	partially implemented
MSU1	N	128	128	128	
	Mean	3.86	3.68	4.04	partially implemented
MSU2	N	128	128	128	
	Mean	3.91	3.73	4.08	fully implemented
MSU3	N	128	128	128	
	Mean	3.62	3.45	3.77	partially implemented
MSU4	N	128	128	128	
	Mean	3.66	3.52	3.82	partially implemented
RSC1	N	128	128	128	
	Mean	3.65	3.50	3.79	partially implemented
RSC2	N	128	128	128	
	Mean	3.61	3.46	3.76	partially implemented
RSC3	N	128	128	128	
	Mean	3.56	3.41	3.71	partially implemented
RSC4	N	128	128	128	
	Mean	3.63	3.46	3.78	partially implemented
RSC5	N	128	128	128	

	Mean	3.73	3.59	3.86	partially implemented
RSC6	N	128	128	128	
	Mean	3.64	3.50	3.77	partially implemented
KBC1	N	128	128	128	
	Mean	3.91	3.74	4.09	fully implemented
KBC2	N	128	128	128	
	Mean	3.89	3.73	4.05	partially implemented
KBC3	N	128	128	128	
	Mean	3.98	3.82	4.13	fully implemented
KBC4	N	128	128	128	
	Mean	4.06	3.92	4.20	fully implemented
Valid N	N	128	128	128	

Most manufacturers focus on knowing business culture well to reduce logistics barriers. Because of corruption and rent-seeking behavior, skillfully managing relationships with governments commonly brings higher profits. Mastering building communication channels with governments, business practices, and government procedure were reported as fully implemented. Knowing public relations and crisis management well was identified as partially implemented.

5.3 Factor Analysis

Factor analysis was used to evaluate and shortlist the logistics barriers and the firms' action to reduce logistics barriers in the Chinese manufacturing sectors. Table 11 and Table 12 present a summary of the factor analysis results for logistics barriers (Table 11-software logistics barriers & Table 12-hardware logistics barriers). Table 13 presents a summary of the factor analysis results for firms' actions to reduce logistics barriers.

Those tables provide factor loadings resulting from a factor analysis using a Varimax rotation of all the questions of the three groups that comprise hardware barriers, software barriers and firms' counter-actions. The software logistics barriers contained 5 factors with Eigenvalues above 1.0. These 5 factors explain 63.491% of the inherent variation in software logistics barriers.

Factor 1 is the political and business culture factor comprising 5 items in Table 11. This factor accounted for 15.882% of total variance. Based on factor loading, complicated business practices and government procedures were reported as major barriers in Chinese manufacturing sector. The same results were developed in descriptive statistics results.

Table 11

Factor analysis results on software logistics barriers

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	
	Culture	Order	Purchasing	Inventory	Packaging	Communalities
P&C1	.810	.070	.174	.142	.044	.714
P&C2	.808	.102	.207	.209	-.072	.755
P&C4	.779	.274	.122	.122	.127	.728
P&C5	.748	.174	.002	.096	.309	.695
P&C3	.739	.057	.205	.283	.181	.704
ORD2	.153	.749	.101	.190	.018	.632
ORD5	.129	.722	.044	-.025	.315	.640
ORD1	.093	.697	.258	.333	.040	.673
ORD3	.174	.665	.278	.122	.142	.585
ORD4	.104	.594	.266	.084	.397	.600
PUR3	.102	.116	.732	.050	.284	.643
PUR2	.205	.316	.705	.152	.024	.663
PUR1	.144	.263	.700	.098	.089	.597
PUR4	.112	.068	.678	.390	.098	.639
PUR5	.232	.095	.541	.312	.390	.605
INV4	.097	.161	.151	.750	.110	.632
INV5	.243	.143	.141	.714	.183	.643
INV1	.310	.166	.174	.624	.276	.620
INV2	.288	.157	.334	.578	.152	.577
PAC4	.101	.117	.202	.313	.706	.661
PAC2	.271	.089	.019	.446	.689	.756
PAC6	.238	.155	.185	-.108	.589	.474
PAC5	-.160	.214	.156	.229	.515	.414
PAC3	.384	.341	.091	.296	.481	.590
Eigenvalues	3.812	2.990	2.925	2.867	2.644	
% of Variance	15.882	12.460	12.188	11.945	11.017	
Cumulative %	15.882	28.342	40.530	52.475	63.491	

Note: 1. Extraction Method: Principal Component Analysis.

2. Rotation Method: Varimax with Kaiser Normalization.
3. Rotation converged in 7 iterations.
4. Based on reliability analysis results, deleted PAC1, INV6 and INV3.

Factor 2 is the order processing factor comprising 5 items in Table 11. This factor accounted for 12.460% of total variance. Based on factor loading, lack of communication infrastructure was reported as a major barrier in the Chinese manufacturing sector. Lack of communication infrastructure was another major barrier followed by delayed order processing.

Factor 3 is purchasing factor comprising 5 items in Table 11. This factor accounted for 12.188% of total variance. Based on factor loading, lack of responsiveness to needs was reported as a major barrier in the Chinese manufacturing sector. Compared with descriptive statistics results, lack of responsiveness to needs was another major barrier after lack of low-cost suppliers.

Factor 4 is the inventory control factor comprising 4 items in Table 11. This factor accounted for 11.945% of total variance. Based on factor loading, unable to identify shortages ahead of time was reported as a major barrier in the Chinese manufacturing sector. The same results were developed in descriptive statistics results.

Factor 5 is the packaging services factor comprising 5 items in Table 11. This factor accounted for 11.017% of total variance. Based on factor loading, lack of packaging management skills was reported as a major barrier in the Chinese manufacturing sector. The same results were developed in descriptive statistics results.

Again, factor analysis with principal component analysis and Varimax rotation was employed to identify hardware logistics barriers as shown in Table 12. Variables were extracted when the factor loading was greater than 0.5. The hardware logistics barriers contained 3 factors with Eigenvalues above 1.0. These 3 factors explain 63.446% of the inherent variation in hardware logistics barriers.

Factor 1 is the transportation services factor comprising 6 items in Table 12. This factor accounted for 22.880% of total variance. Based on factor loading, lack of alternative transport modes was reported as a major barrier in Chinese manufacturing sector. Compared with descriptive statistics results, lack of alternative transport modes was another major barrier after lack of loading and unloading efficiency and high highway tolls.

Factor 2 is the warehousing services factor comprising 5 items in Table 12. This factor accounted for 21.888% of total variance. Based on factor loading, lack of appropriate warehouse locations was reported as a major barrier in the Chinese manufacturing sector. Compared with descriptive statistics results, lack of appropriate warehouse locations was another major barrier after lack of automatic warehouse equipment.

Table 12

Factor analysis results on hardware logistics barriers

	Factor 1	Factor 2	Factor 3	
	Transportation	Warehousing	Information	Communalities
TRA2	.814	.042	-.029	.665
TRA3	.758	.235	-.051	.632
TRA4	.679	.123	.317	.576
TRA1	.656	.345	.122	.564
TRA5	.655	.101	.368	.575
TRA6	.642	.258	.395	.634
WAR1	.243	.792	.069	.691
WAR2	.177	.781	-.045	.644
WAR5	.114	.700	.300	.593
WAR4	.128	.700	.363	.638
WAR3	.152	.698	.216	.557
INF4	.130	.149	.853	.767
INF3	.056	.180	.792	.662
INF5	.267	.195	.758	.684
Eigenvalues	3.203	3.064	2.615	
% of Variance	22.880	21.888	18.678	
Cumulative %	22.880	44.768	63.446	

Note: 1. Extraction Method: Principal Component Analysis.

2. Rotation Method: Varimax with Kaiser Normalization.

3. Rotation converged in 5 iterations

4. Based on reliability analysis results, deleted INF1 and INF2.

Factor 3 is the logistics information services factor comprising 3 items in Table 12. This factor accounted for 18.678% of total variance. Based on factor loading, lack of DSS (decision support system) was reported as a major barrier in the Chinese manufacturing sector. The same results were developed in descriptive statistics results.

Finally, factor analysis with principal component analysis and Varimax rotation was employed to identify firms' actions to reduce logistics barriers as shown in Table 13. Variables were extracted when the factor loading was greater than 0.5. The firms' actions contained 4 factors with Eigenvalues above 1.0. These 4 factors explain 67.147% of the inherent variation in firms' actions to reduce logistics barriers.

Table 13

Factor analysis results on firms' actions to reduce logistics barriers

	Factor 1	Factor 2	Factor 3	Factor 4	
	Supply chain	Technology	Knowing culture	Management	Communalities
RSC6	.795	-.036	.076	.089	.647
RSC2	.747	.245	.162	.193	.682
RSC4	.740	.047	.197	.111	.601
RSC5	.695	.166	.154	.224	.585
RSC1	.649	.248	.313	.157	.605
RSC3	.634	.262	.248	.092	.540
TEC1	.207	.803	.172	.182	.750
TEC3	.141	.784	.282	.182	.748
TEC2	.105	.752	.150	.350	.722
TEC5	.105	.713	.071	.187	.559
TEC4	.158	.698	.317	-.065	.617
KBC2	.183	.297	.760	.269	.771
KBC3	.319	.169	.748	.143	.711
KBC1	.187	.245	.742	.272	.719
KBC4	.395	.247	.677	.167	.704
MSU3	.109	.101	.105	.831	.723
MSU4	.144	.173	.135	.736	.611
MSU1	.228	.289	.352	.702	.752
MSU2	.337	.214	.281	.689	.714
Eigenvalues	3.678	3.448	2.869	2.763	
% of Variance	19.356	18.149	15.098	14.544	
Cumulative %	19.356	37.505	52.603	67.147	

Note: 1. Extraction Method: Principal Component Analysis.

2. Rotation Method: Varimax with Kaiser Normalization.

3. Rotation converged in 5 iterations

4. Based on reliability analysis results, deleted MSU5, RSC7 and RSC8.

Factor 1 is the supply chain redesign factor comprising 6 items in Table 13. This factor accounted for 19.356% of total variance. Based on factor loading, making outsourcing decisions was reported as a major solution in firms' actions to reduce logistics barriers.

Factor 2 is the technology system upgrade factor comprising 5 items in Table 13. This factor accounted for 18.149% of total variance. Based on factor loading, introducing EDI systems was reported as a major solution in firms' actions to reduce logistics barriers.

Factor 3 is the realizing business culture factor comprising 4 items in Table 13. This factor accounted for 15.098% of total variance. Based on factor loading, realizing public relations and crisis management were reported as a major solution in firms' actions to reduce logistics barriers. Compared with descriptive statistics results, realizing public relations and crisis management were other major solutions after mastering building communication channels with the government, realizing business practices, and understanding government procedure.

Factor 4 is the management skill upgrades factor comprising 4 items in Table 13. This factor accounted for 14.544% of total variance. Based on factor loading, assessing performance was reported as a major solution in firms' actions to reduce logistics barriers. Compared with descriptive statistics results, assessing performance was another major solution after establishing administrative management rules.

5.4 Correlation Analysis

This thesis used a correlation analysis to test the relationship between variables. Correlation is a term that refers to the strength of a relationship between two variables. A high correlation means that two or more variables have a strong relationship with each other, while the low correlation means that two or more variables have a weak relationship with each other. Moreover, a high correlation coefficient indicates that the dependent variable will usually change when the independent variable changes.

In order to gain a dependable result, variables should be correlated within limits, but variables should not be correlated perfectly. The results of correlation analysis are acceptable when correlation coefficient is below 0.90. Details of the correlation analysis are shown in Table 14.

Table 14

Correlations analysis results

	Mean	Std. Deviation	PUR	ORD	INV	PAC	P&C	TRA	WAR	INF	TEC	MSU	RSC	KBC
PUR	2.952	.727	1											
ORD	2.866	.597	.563**	1										
INV	3.250	.797	.587**	.501**	1									
PAC	3.294	.729	.546**	.558**	.602**	1								
P&C	3.528	.864	.462**	.422**	.536**	.478**	1							
TRA	2.970	.765	.554**	.504**	.439**	.477**	.440**	1						
WAR	2.959	.680	.392**	.521**	.575**	.488**	.393**	.489**	1					
INF	3.448	.861	.374**	.527**	.421**	.592**	.579**	.453**	.455**	1				
TEC	3.538	.777	.053	.231**	-.009	-.084	.149	.186*	.193*	.215*	1			
MSU	3.762	.793	.127	.099	.065	-.052	.104	.136	.007	.003	.513**	1		
RSC	3.635	.663	.166	.179*	-.058	.134	.221*	.164	.181*	.232**	.448**	.508**	1	
KBC	3.961	.786	.187*	.153	.005	-.022	.335**	.202*	.168	.168	.584**	.589**	.605**	1

Note: 1. Correlation is significant at the 0.01 level (2-tailed).

2. Correlation is significant at the 0.05 level (2-tailed).

5.5 Regression Analysis

Multiple regression analysis was developed to describe the relationship between logistics barriers and firms' action to reduce logistics barriers. The 22 firms' action to reduce logistics barriers were grouped in 4 functional areas. These 4 functional areas

were used as 4 dependent variables, while the logistics barriers were grouped as independent variables. Thus, 4 multiple regression equations were estimated. Again, the regression analysis was performed to find out how logistics barriers in China affect the degree of four firms' countermeasures. It is reasonable to expect such a relation. Details of the regression analysis are shown in Table 15, Table 16, Table 17 and Table 18 respectively.

Firstly, using technology system upgrades as dependent variables and the logistics barriers as independent variables, a multiple regression equation was established. The purpose was to determine whether technology system upgrades are related to the severity of the barriers. The regression analysis results on technology system upgrades are shown in Table 15.

Table 15

Regression analysis results on technology system upgrades

	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
(Constant)	2.64	0.37		7.21	0.000		
Purchasing	-0.07	0.12	-0.07	-0.64	0.527	0.49	2.06
Transportation	0.11	0.10	0.11	1.03	0.307	0.57	1.76
Order	0.31	0.14	0.25	2.23	0.027**	0.53	1.89
Warehousing	0.26	0.12	0.24	2.23	0.028**	0.56	1.79
Inventory	-0.19	0.12	-0.20	-1.67	0.099*	0.45	2.24
Packaging	-0.43	0.12	-0.41	-3.54	0.001***	0.48	2.07
Information	0.20	0.10	0.23	2.05	0.043**	0.53	1.87
Politics/culture	0.13	0.09	0.15	1.44	0.152	0.58	1.71
R^2				0.26			
Adjusted R^2				0.20			
F				4.92***			
Sig.				0.00			

Note: 1. *: p<0.10, **: p<0.05, ***: p<0.01.

The significance of the F-value at the 0.01 level indicates that manufacturers do attempt to reduce logistics barriers encountered. An R^2 of 0.26 indicates that the model explains the presumed relationship between the logistics barriers and technology

system upgrades. We can see that changes in the logistics barriers account for 26% of the variation in technology system upgrades.

Although, packaging barriers (t=-3.54, p<0.01) are statistically significant, the magnitude of the coefficient was in the negative (-) direction. Because many Chinese manufacturers still use traditional manual packing, packaging services barriers will not directly influence at technology system upgrades.

In all, the independent variables, order processing, warehousing services, and information services were statistically significant.

Using management skill upgrades as the dependent variables and the logistics barriers as the independent variables, a multiple regression equation was established. The regression analysis results on management skill upgrades are shown in Table 16.

Table 16

Regression analysis results on management skill upgrades

	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
(Constant)	3.42	0.33		10.37	0.000		
Purchasing	0.09	0.11	0.10	0.80	0.426	0.49	2.03
Transportation	0.23	0.10	0.27	2.37	0.020**	0.58	1.71
Order	0.15	0.13	0.14	1.15	0.253	0.52	1.94
Warehousing	-0.04	0.11	-0.04	-0.33	0.740	0.54	1.84
Inventory	-0.02	0.11	-0.03	-0.22	0.830	0.42	2.39
Packaging	-0.21	0.12	-0.25	-1.84	0.069*	0.43	2.32
Information	-0.15	0.09	-0.20	-1.58	0.116	0.49	2.02
Politics/culture	0.14	0.09	0.18	1.54	0.126	0.55	1.83
R^2				0.14			
Adjusted R^2				0.08			
F				2.31			
Sig.				0.02**			

Note: 1. *: p<0.10, **: p<0.05, ***: p<0.01.

Among the independent variables, only transportation barriers (t=2.37, p<0.01) were significant and the equation itself was significant (R^2=0.14, p<0.05). Packaging services were significant in the 10 percent level (t=-1.84, p<0.1), but the direction was

negative (-). We can see that changes in the logistics barriers account for 14% of the variation in management skill upgrades. In other words, management skill upgrades tend to be directed at logistics barriers in the transportation services areas.

Using supply chain redesign as the dependent variable and the logistics barriers as independent variables, a multiple regression equation was established. The regression analysis results on management skill upgrades are shown in Table 17.

The significance of F-value at the 0.01 level indicates that manufacturers do attempt to reduce logistics barriers encountered. An R^2 of 0.20 indicates that the model explains the presumed relationship between the logistics barriers and redesigning supply chains. We can see that changes in the logistics barriers account for 20% of the variation in redesigning supply chains.

Among the independent variables, warehousing ($t=3.04$, $p<0.01$) and inventory control ($t=-4.24$, $p<0.01$) were statistically significant, even though the inventory control shows a negative sign. In summation, warehousing barriers clearly exert a positive impact on supply chain redesign in China.

Table 17

Regression analysis results on redesigning supply chains

	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
(Constant)	3.07	0.27		11.20	0.000		
Purchasing	0.13	0.09	0.17	1.38	0.170	0.49	2.03
Transportation	-0.01	0.08	-0.01	-0.10	0.920	0.58	1.71
Order	-0.04	0.11	-0.04	-0.32	0.753	0.51	1.98
Warehousing	0.28	0.09	0.35	3.04	0.003***	0.54	1.85
Inventory	-0.38	0.09	-0.54	-4.24	0.000***	0.44	2.29
Packaging	0.04	0.10	0.06	0.46	0.645	0.43	2.30
Information	0.07	0.08	0.11	0.90	0.368	0.49	2.04
Politics/culture	0.11	0.07	0.17	1.51	0.135	0.55	1.81
R^2				0.20			
Adjusted R^2				0.15			
F				3.56***			
Sig.				0.00			

Note: 1. *: p<0.10, **: p<0.05, ***: p<0.01.

Traditionally, supply chain redesign has been directed at logistics barriers in inventory control. But the actions of supply chain redesign focus on purchasing, transportation, order processing and warehousing services in this questionnaire. And the respondents have great differences in the safety stock level and inventory control management level, which were deleted according to reliability analysis results. So the regression analysis results indicated that supply chain redesign has not been directed at logistics barriers in the inventory control functional areas.

Using knowing business culture well as dependent variables and the logistics barriers as independent variables, a multiple regression equation was established. The regression analysis results on knowing business culture well are shown in Table 18.

Table 18

Regression analysis results on knowing business culture well

	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
(Constant)	3.05	0.32		9.50	0.000		
Purchasing	0.24	0.11	0.25	2.31	0.023**	0.50	2.00
Transportation	0.07	0.09	0.08	0.79	0.429	0.58	1.71
Order	0.05	0.12	0.04	0.40	0.688	0.53	1.89
Warehousing	0.33	0.11	0.31	3.05	0.003***	0.54	1.86
Inventory	-0.42	0.10	-0.47	-4.08	0.000***	0.43	2.32
Packaging	-0.31	0.11	-0.32	-2.93	0.004***	0.46	2.16
Information	-0.05	0.09	-0.06	-0.61	0.545	0.51	1.96
Politics/culture	0.43	0.08	0.51	5.16	0.000***	0.57	1.74
R2				0.36			
Adjusted R2				0.31			
F				7.87			
Sig.				0.00***			

Note: 1. *: p<0.10, **: p<0.05, ***: p<0.01.

The significance of F-value at the 0.01 level indicates that manufacturers do attempt to reduce logistics barriers encountered. An R^2 of 0.36 indicates that the model explains the presumed relationship between the logistics barriers and knowing business culture

well. We can see that changes in the logistics barriers account for 36% of the variation in knowing business culture well.

Among the independent variables, purchasing ($t=2.31$, $p<0.05$), warehousing ($t=3.05$, $p<0.01$) and political and business culture ($t=5.16$, $p<0.01$) have a positive effect on “knowing business culture well”. However, inventory control ($t=-4.08$, $p<0.01$) and packaging barriers ($t=-2.93$, $p<0.01$) have a negative sign and are significant at the 1 percent level.

Chapter6. Conclusion

6.1 Conclusion

The main objective of the thesis was to identify the relationship between logistics barriers and firms' countermeasures in China.

This thesis suggests that logistics barriers are the major problems in the Chinese manufacturing sector. In particular, the poor performance of transportation services, inventory control, packaging services, and logistics information services are major impediments to developing an efficient logistics system to support the manufacturers operations. High cost, undependability, low responsiveness, low automation level, low information services level, complicated business practices and lack of shared understanding of the best logistics practices are the primary problems encountered.

Another conclusion to be drawn from our thesis is that manufacturers do attempt to reduce logistics barriers encountered. 22 firms' actions to reduce logistics barriers grouped in 4 functional areas including technology system upgrades (TEC), management skill upgrades (MSU), redesigning supply chain (RSC), and knowing business culture well (KBC). All the firms' actions were implemented to reduce logistics barriers.

The third conclusion to be drawn from our thesis is that not only multinational corporations but also Chinese manufacturers have encountered considerable barriers in political and business culture. If manufacturers want to strive to make them stand out in their particular fields, they must be proficient at business practices and deal with government regulations professionally. Because of corruption and rent-seeking behavior, skillfully managing relationships with governments commonly brings higher profits.

The fourth conclusion to be draw from our thesis is that Chinese manufacturers focus more on short-term gains than long-term benefits. When Chinese manufacturers are heavily involved in international competition, price wars are often viewed as the main way to get the most customers. Due to the lack of technical advantage and insufficient fund conditions, survival is the most important thing for many small-sized and medium-sized firms. Thus, they focus more on purchasing, distribution networks, order processing and warehousing services than inventory control, information services, packaging services, reverse logistics and green logistics.

In consideration that both the Chinese manufacturing industry and logistics industry are in early stages and most Chinese manufacturers do attempt to reduce logistics barriers encountered, the Chinese manufacturing industry will overcome the logistics barriers and gain a competitive advantage in the near future.

6.2 Limitations and Suggestions for Future Research

Although the results can be regarded as valuable information for manufacturers in China, the study has many limitations that affect the reliability of those results.

Firstly, in consideration of 3PL services (third-party logistics services), reverse logistics and green logistics are still in early stages in China, and many related services are unavailable in Chinese manufacturing sectors. Therefore, these functional areas were not designed as logistics barriers in this thesis. As times progress and the economy advances, the Chinese logistics industry will be more comprehensive and more effective. Future research could focus on 3PL services barriers, reverse logistics barriers and green logistics barriers.

The second limitation is related to independent variables. Due to lack of work experience, firms' actions to reduce logistics barriers were based more on theory. Future research could develop more practical actions to reduce logistics barriers.

Because of time and fund limitations, the sample of manufacturers who participated in this survey was selected from cities in key regions of China. This can raise an issue on the generalization of the research results. Along with economic advances and industrial system perfection, future research could survey countrywide.

This thesis focuses on Chinese manufacturers. However, not only Chinese manufacturers, but also multinational corporations have encountered considerable logistics barriers in Chinese manufacturing sectors. Thus, future research could develop to discuss the logistics barriers for multinational corporations in China.

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Appendix 1

Abstract:

As time progresses and the Chinese economy advances, the Chinese manufacturers play a key role in the global supply chain and make great contributions to global economic development. At the same time, China is called the world's factory and its economics of scale constantly expand. But China still has a host of logistics barriers in the manufacturing sector. Emerged logistics barriers make manufacturers far more complicated and less controllable than another part of business management. In many cases, existing or potential barriers result in longer order cycle times, higher logistics costs, and more customer dissatisfactions. Thus, logistics barriers apparently make manufacturers difficult to gain a competitive advantage.

The purpose of this thesis is to describe logistics barriers and a firm's actions to reduce logistics barriers. Moreover, we intend to examine whether the actions are related to the severity of the barriers in the Chinese manufacturing sectors. It is reasonable to expect such a relationship.

Data was collected by a questionnaire interview. A five-point Likert scale was employed to measure the eight categories of degree of logistics barriers variables and the four categories of firms' actions variables in the target firms. Questionnaires were sent to over 300 professionals in Chinese manufacturing. The survey questionnaire with several logistics activity related variables, was designed and distributed to manufacturing companies between January and May 2014. The target manufacturing companies were identified from the list of manufacturers in each province within 9 industry sectors.

The logistics barriers were fixed as independent variables. This thesis divides logistics barriers into 2 categories: software logistics barriers and hardware logistics barriers. Software logistics barriers contain purchasing barriers, order processing barriers, inventory control barriers, packaging services barriers, and political and business culture barriers. Hardware logistics barriers include transportation services barriers, warehousing services barriers and logistics information services barriers.

A firm's action to reduce logistics barriers were fixed as dependent variables. We divide a firm's action to reduce logistics barrier into 4 categories: technology system upgrades, management skill upgrades, supply chain redesign, and knowing business culture well.

Descriptive statistics, reliability analysis, factor analysis, correlation analysis and regression analysis were used to analyze the survey data.

Keywords: Manufacturing, logistics barriers, logistics costs, SCM, China.

Appendix 2

QUESTIONNAIRE

Dear Sir/Madam,

I am Yuanxin Zhang, male, a graduate student of Pukyong National University in South Korea. For my Master's thesis, I am going to assess the logistics barriers to manufactures in China.

As you are in the management team or a team leader of such a subsidiary, I would like to invite you to participate in this research study by completing the attached questionnaire.

The questionnaire is brief and will only take about 5 minutes of your time. It will be greatly appreciated if you could complete the questionnaire and return it as soon as possible.

I am looking forward to receiving your answers.

All information you provide will be kept strictly confidential and will not be used for anything other than academic research purposes. And information that you provide will not be open to the public. If you have any questions or concerns about the questionnaire, please contact to me.

Sincerely,

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A. **General questions.**

1. How long is your **working age** in your entire life? ( ) years.

2. What is your **position** in your company? ( )
   A. Functional-level staff B. Functional-level manager
   C. Business-level manager D. Corporate-level manager

3. What is your **final Educational degree**? ( )
   A. Junior high school diploma B. Senior high school diploma
   C. Associate degree D. Bachelor
   E. Master F. Doctor

4. What is your **company size**? About ( ) staff.

5. Your company was established in ( ) year.

6. What is the business category of your company? ( )
   A. Light Industry Company; B. Machine Building Company;
   C. Electronics Company; D. Automotive Company;
   E. Ship – building company; F. Chemical Industry Company;
   G. Pharmaceutical Company; H. Logistics Industry Company;
   I. Construction Industry Company; J. Others;

B. The following questions are about the **logistics barriers** of manufactures in China. Please indicate the extent to which the following statements describe your situation.

Purchasing	Not at all very much
suppliers' lack of quality dependability	1 ----- 2 ----- 3 ----- 4 ----- 5
suppliers' lack of delivery dependability	1 ----- 2 ----- 3 ----- 4 ----- 5
Suppliers' lack of responsiveness to needs	1 ----- 2 ----- 3 ----- 4 ----- 5
Suppliers' lack of after-service dependability	1 ----- 2 ----- 3 ----- 4 ----- 5
Lack of low-cost suppliers	1 ----- 2 ----- 3 ----- 4 ----- 5

Transportation services	Not at all very much
Lack of transportation infrastructure	1 ----- 2 ----- 3 ----- 4 ----- 5
Lack of alternative transport modes	1 ----- 2 ----- 3 ----- 4 ----- 5
Lack of alternative carriers	1 ----- 2 ----- 3 ----- 4 ----- 5
Lack of intermodal services	1 ----- 2 ----- 3 ----- 4 ----- 5
High highway tolls	1 ----- 2 ----- 3 ----- 4 ----- 5
Lack of loading/unloading efficiency	1 ----- 2 ----- 3 ----- 4 ----- 5

Order processing	Not at all very much
Lack of available suppliers' information	1 ----- 2 ----- 3 ----- 4 ----- 5
Lack of communication infrastructure	1 ----- 2 ----- 3 ----- 4 ----- 5
Lack of order processing skills	1 ----- 2 ----- 3 ----- 4 ----- 5
Delayed order processing	1 ----- 2 ----- 3 ----- 4 ----- 5
Suppliers' lack of order filling capacity	1 ----- 2 ----- 3 ----- 4 ----- 5

Warehousing services	Not at all very much
Lack of appropriate warehouse locations	1 ----- 2 ----- 3 ----- 4 ----- 5
Lack of storage spaces	1 ----- 2 ----- 3 ----- 4 ----- 5
Lack of ABC inventory classification	1 ----- 2 ----- 3 ----- 4 ----- 5
Lack of automatic warehouse equipment	1 ----- 2 ----- 3 ----- 4 ----- 5
High level of damage cost and shrinkage cost in the warehouse	1 ----- 2 ----- 3 ----- 4 ----- 5

Inventory control	Not at all very much
Lack of WMS	1 ----- 2 ----- 3 ----- 4 ----- 5
High level of inventory carrying cost	1 ----- 2 ----- 3 ----- 4 ----- 5
High level of safety stock	1 ----- 2 ----- 3 ----- 4 ----- 5
Inability to identify shortages ahead of time	1 ----- 2 ----- 3 ----- 4 ----- 5
Lack of inventory control methods	1 ----- 2 ----- 3 ----- 4 ----- 5
Lack of skilled inventory controls staff	1 ----- 2 ----- 3 ----- 4 ----- 5

Packaging services	Not at all very much
Lack of unified packaging standard	1 ----- 2 ----- 3 ----- 4 ----- 5
Lack of recyclable packages	1 ----- 2 ----- 3 ----- 4 ----- 5
High cost of packages	1 ----- 2 ----- 3 ----- 4 ----- 5
Lack of packaging management skills	1 ----- 2 ----- 3 ----- 4 ----- 5
Lack of package information	1 ----- 2 ----- 3 ----- 4 ----- 5
Low utility rate of unit package	1 ----- 2 ----- 3 ----- 4 ----- 5

Logistics information services	Not at all very much
Lack of cargo tracing services	1 ----- 2 ----- 3 ----- 4 ----- 5
Lack of EDI systems	1 ----- 2 ----- 3 ----- 4 ----- 5
Lack of data analysis systems	1 ----- 2 ----- 3 ----- 4 ----- 5
Lack of DSS (decision support system)	1 ----- 2 ----- 3 ----- 4 ----- 5
lack of ES (expert system)	1 ----- 2 ----- 3 ----- 4 ----- 5

Political and Business Culture	Not at all very much
Complicated business practices	1 ----- 2 ----- 3 ----- 4 ----- 5
Complicated government procedure	1 ----- 2 ----- 3 ----- 4 ----- 5
Complicated communication channels between the enterprise and the government	1 ----- 2 ----- 3 ----- 4 ----- 5
High fines in logistics activities	1 ----- 2 ----- 3 ----- 4 ----- 5
Lack of tax preferences	1 ----- 2 ----- 3 ----- 4 ----- 5

C. The following questions are about **a firm's action to reduce logistics barriers**. Please indicate the extent to which the following statements describe your situation.

Technology system upgrades	Not at all very much
Introduce EDI systems	1 ----- 2 ----- 3 ----- 4 ----- 5
Introduce WMS	1 ----- 2 ----- 3 ----- 4 ----- 5
Introduce data analysis systems	1 ----- 2 ----- 3 ----- 4 ----- 5
Introduce DSS	1 ----- 2 ----- 3 ----- 4 ----- 5
Introduce adequate warehouse facilities	1 ----- 2 ----- 3 ----- 4 ----- 5

Management skill upgrades	Not at all very much
Providing training to staff	1 ----- 2 ----- 3 ----- 4 ----- 5
Establishing administrative management rules	1 ----- 2 ----- 3 ----- 4 ----- 5
Assessing performance	1 ----- 2 ----- 3 ----- 4 ----- 5
Employing more skilled managers	1 ----- 2 ----- 3 ----- 4 ----- 5
Consultations with a consulting company	1 ----- 2 ----- 3 ----- 4 ----- 5

Supply chain redesign	Not at all very much
More carefully reselecting suppliers	1 ----- 2 ----- 3 ----- 4 ----- 5
More carefully reselecting carriers	1 ----- 2 ----- 3 ----- 4 ----- 5
More carefully reselecting factory locations	1 ----- 2 ----- 3 ----- 4 ----- 5
More carefully rearranging delivery schedule	1 ----- 2 ----- 3 ----- 4 ----- 5
More carefully redesigning optimal ordering quantity	1 ----- 2 ----- 3 ----- 4 ----- 5
More carefully making outsourcing decisions	1 ----- 2 ----- 3 ----- 4 ----- 5
Implementing early supply involvement	1 ----- 2 ----- 3 ----- 4 ----- 5
Unifying packaging standards	1 ----- 2 ----- 3 ----- 4 ----- 5

Knowing Business Culture well	Not at all very much
Knowing building communication channels	1 ----- 2 ----- 3 ----- 4 ----- 5

between the enterprise and the government well	
Knowing public relations and crisis management well	1 ----- 2 ----- 3 ----- 4 ----- 5
Knowing business practices well	1 ----- 2 ----- 3 ----- 4 ----- 5
Knowing government procedure well	1 ----- 2 ----- 3 ----- 4 ----- 5

D. If you think anther barriers may influence logistics development or another firm action may reduce logistics barriers in China, please write in the box below.

THANK YOU VERY MUCH FOR PARTICIPATING IN THE STUDY!