

ORIGINAL RESEARCH:

Logistics development at Dalian port to revitalize Northeast China

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Abstract

The development of logistics in Dalian port is analyzed from the perspective of its impact on revitalizing Northeast China, using both quantitative and qualitative methods. The logistics development targets, achievements and the main problems of Dalian port in the revitalizing period so far, are discussed. The discussion focuses on the investment, port areas, transportation development, logistics information systems, development of logistics enterprise, and the development problems of Dalian port since the implementation of the revitalization plan in 2003. The analysis includes an examination of the growth rate over time and reflects on the possible causes of the observed fluctuation in data. The study makes suggestions for the future development of Dalian port based on an objective assessment of the achievements so far and the problems that existed in the port city at the beginning of the revitalization period.

Keywords: Dalian port, Logistics development, Northeast China, Revitalization plans.

Introduction

Dalian port gradually became the leading hub port for Northeast China after it was founded in 1899, and since 1984 has been a significant node for connecting the domestic and foreign markets and resources in Northeast China. Northeast China, including Liaoning, Jilin and Heilongjiang provinces and the eastern part of Inner Mongolia, provide the economic input for Dalian port. Almost 95%, 67% and 70% of the material and goods from Heilongjiang, Jilin Province and eastern Inner Mongolia, respectively, are transported by sea via Dalian port (Yang, 2010). The main cargo transported via Dalian port includes petroleum (47.4% of gross throughput), grains and crops (16.1%), and general merchandise (16%). The annual throughput of metallic and nonmetallic ore, iron and steel, coal, and chemical fertilizer has reached 2.5 million tons.

As a very convenient gateway to the Asia Pacific region, Dalian port is an ideal port for transportation of cargo to the Far East, Southeast Asia, North America and Europe. The only 'free trade zone' and free trade area in Northeast China are also located in this port. As Sun (2005) stated, with its unique regional advantages and natural deep water conditions, Dalian port is enabled to undertake 70% of the import-export goods and 90% of the container transportation of Northeast China.

The cargo throughput of Dalian Port in 1997 was only 70 million tons, but it reached 171 million tons in 2005 (Chen, 2007) and 249 million tons in 2008. In 2007, there were nearly 300 ports in more than 160 countries that were linked to Dalian port (Ao and Song, 2007). By 2011, 84 of the world's top 500 enterprises had invested in 179 projects in Dalian. By the end of 2011, Dalian port possessed 38 port-based enterprises and 225 berths, including sixty-one 10,000-ton berths. The total length of the berths is 30 kilometers with an annual throughput of 155 million tons and a maximum berthing capacity of 300,000 tons. In 2011, the throughput reached 267 million tons (The People's Government of Liaoning Province, China, 2012). In addition, Dalian port is taking over 90% of the container transportation of the region. Because of the important status of Dalian port in international logistics in East Asia, doing research on its recent development is necessary.

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Methodology

This study includes a review of data and information regarding the development of logistics in Dalian as well as an analysis of its role and impact on the economic revitalization of Northeast China. Most of the data used in the study is secondary data collected from the yearbooks published by the Statistical Bureaus of Liaoning Province, Dalian City, Shanghai City, Guangdong Province and Shenzhen City. Besides, data has been collected from China Ports Yearbook published by China Ports Magazine Company.

The collected data cover the period from 2003 to 2012, with the year 2003 being at the start of the revitalization policies in Northeast China. The China State Council (CSC) and National Development and Reform Commission (NDRC) have adopted 'Revitalizing Northeast China' as a national strategy since 2003. In 2005, a 'Plan of Revitalizing Northeast China' (PRNC) was promulgated by CSC which stressed speeding up the establishment of Dalian International Shipping Center. The construction of port facilities was strengthened to further increase foreign investment in Dalian port. The policy of support focused on large ports, container terminals, and industries adjacent to Dalian port. In 2007, CSC ratified the PRNC as the most important official plan for development in the region.

The main purpose of the development plan was to accelerate the revitalization in Northeast China and promote the regional economy. Based on the plan, Northeast China has faced new development opportunities and challenges. This study is focusing on the accomplishments as well as challenges and issues faced in the course of implementing this development plan. The collected data were charted to show the level of progress through the years 2003 to 2012, and further analyzed to determine the probable causes and reasons.

Analytical methods were used for discussion of the data in various logistics dimensions whereby descriptive data are fed into the analytical model based on the logistics development plan in Dalian port following the implementation of PRNC. The discussion benefits from the observations and results of the four field research sessions conducted by the researcher at Dalian port in the period between 2010 and 2012. The study not only focuses on the absolute number but also the growth rate in order to examine the development situation of Dalian port.

Findings and Results

The gross fixed assets investment from 2003 to 2012 in Dalian Port adds up to 82.84 billion RMB (Figure 1). With financial support, Dalian port has developed at an unprecedented rate in the last 10 years; the establishment of an international shipping center in the area of 'one island and three bays' has already started. The investments focus on the establishment of Dayaowan Container Terminal (DCT). Figure 1 demonstrates three development phases that are recognized by the trend of the fixed assets investment in the last 10 years: the early phase from 2003 to 2005, the stable phase from 2006 to 2008, and the adjustment phase from 2009 to 2012.

In the early phase the investments to the fixed assets of Dalian port were increasing continually. The large investment was the key support of the infrastructure construction of the port, highway and railway terminal. In 2003 and 2004, the main development items for Dalian port were the construction of the ore terminal and oil wharf in Nianyu Bay, both with 300 thousand-ton berths. The new port facilities increased the throughput capacity of berths to 33 million tons. The land reclamation project in Dalian Free Trade Zone (DFTZ) was also completed. The investment in 2004 and 2005 effectively prompted the establishment of

Dayaowan port and the highway network project in Dalian. The construction of the Railway Ferry Terminal of Yan-Da Ferry Railway, which is from Dalian Port to Yantai Port (in Shandong Province), was launched in 2004. The main development items in 2005 included 41 shipping projects and the 2 berth constructions. The railway ferry terminal of Yan-Da Railway was completed in this year. The Dalian highway network project, including Tuyang highway, Dayaowan highway, and the connecting line between Shenyang-Dalian highway and Dandong-Dalian highway, was launched in 2005, with a total length of 85 kilometers.

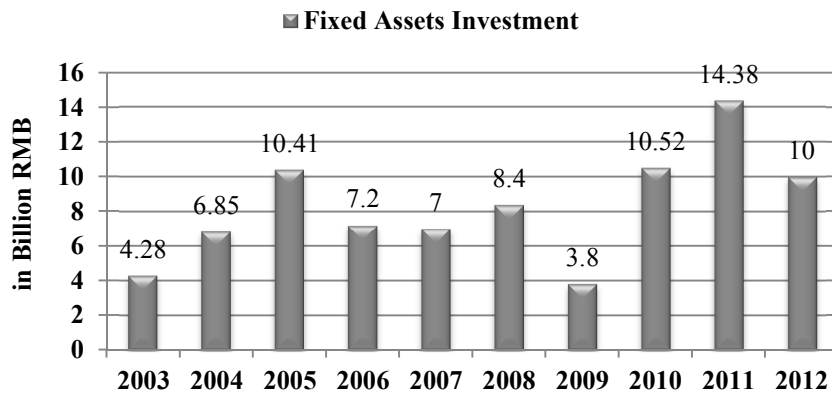


Figure 1: Investment in Dalian port, 2003-2012. (Source: made by author based on data from Statistical Communique of Dalian National Economic and Social Development 2003-2011)

The trend of the investments to the fixed assets of Dalian from 2006 to 2008 was stable. Though the investments during those three years were less than that of the previous three years, the projects of the logistics infrastructures in Dalian port were progressing smoothly. In 2006, 48 shipping projects began to be constructed in Dalian as well as 23 new berths with a throughput capacity of 50 million tons per year. The main part of the Dalian highway network was completed in this year. In 2007, 12 new berths with a throughput capacity of 14 million tons per year were brought into service. Dalian port signed an agreement of strategic cooperation with Yingkou and Jinzhou Port in 2008. The integration of port resources made a breakthrough in Liaoning province. Twelve new berths with a throughput capacity of 13.29 million tons per year were brought into service.

Influenced by the Lehman Shock, the fluctuation of the investment in 2009-2012 was wide in range. Though the economic situation was very critical, Dalian port still kept developing in those years. The investment was affected by frequent explosion accidents in the affiliated oil wharfs and factories of China National Petroleum Company (CNPC) Dalian branch in Nianyuwan bay and Dalian city in 2010 and 2011. Moreover, the damage of the breakwater of a P-Xylene (PX) Plant, a chemical plant, led to a parade and demonstration by citizens of Dalian in August, 2011. The accident also caused anxiety about the hidden dangers of the PX plant.

In 2009, the projects of the No. 22 oil wharf at Nianyuwan port and the main part of the roads to relieve port congestion at Changxing Island and Dayaowan port were completed. Some new port projects in Dayaowan Port Area, including 4 berths of the container terminal, a new 300 thousand-ton oil wharf and specialized ore terminal and the projects of new port areas in Zhuanghe and Lushun, were all accepted and put into service simultaneously. As a result, the throughput capacity for the whole Dalian port increased by 30 million tons per year.

The investment for Dalian port shook off the shadow of the Lehman Shock in 2010. In 2011, the investment for fixed assets of Dalian port kept increasing and new infrastructure projects were launched. By the end of the year, 16 inland depots were built in Dalian and 25 BCTs, with at least 60 runs per week, were opened to service. The shipment of Sea-Railway intermodal in Dalian Port in the year reached 380,000 TEU, which implied an increase of 5% compared with that in 2011.

Development of the logistics system in Dalian: Dalian port has been transformed into a ‘third generation port’ which focuses on intermodal transportation, and a centre for distribution of resources. The cooperation and integration between Dalian Port and other port groups of Jinzhou, Yingkou and Dandong formed a new group of ports which are centered on Dalian port. The development of the logistics network in Dalian Port has formed strong support for the revitalization in Northeast China (Figure 2). According to data at the end of 2011, Dalian Port owned 196 berths, 78 of which were 10-thousand-ton class berths. The port facilities follow advanced standards and play a crucial role in the transportation of domestic and foreign resources. There are six shipping centers in Dalian port. There are some specialized port areas in the ‘one peninsula and three bays’ area, which focus on the construction of Dayaowa Port Area, Dalian Bay Port Area, Nianyu Bay Port Area, Ore Port Zone, and Beiliang Port Zone, etc. Specialized deep water port areas have been set up for containers, petroleum and liquid chemicals, ironstone, break-bulk, commercial automobiles, groceries, passenger, Ro/Ro vessels, and international mail ship.



Figure 2: Logistics Network of Dalian Port. (Source: made by author based on the Report on the Development of Dalian Logistics Industry 2010)

The main port areas in Dalian include Bei Liang Grain Transshipment Center Port, located at the southwest bank of Dagushan Peninsula, with an annual transshipment capacity of 12 million tons; Nianyu Bay Port Area, located at the southeast bank of Dagushan Peninsula and comprised of 2 crude oil docks and 5 product oil docks, with an annual handling capacity of 50.71 million tons; Dayaowan Port Area, which is the largest container transportation and transshipment base in Northeast and North China, located at the north bank of Dagushan Peninsula, with an annual throughput of 2 million TEUs; and Dagushan Ore Transshipment Center, located at the south bank of Dagushan Peninsula. The dock is the largest unloading berth available in China with the most advanced facilities, and can anchor all bulk ore vessels from all over

the world. Dalian Bay General Groceries Functional Zone, located at Dalian Bay Port Area, has an annual throughput capacity of 14 million tons. The passenger and Ro/Ro Cargo port areas are focused on international cruise service transforming into international shipping and business service centers as well as a port information service center. The Lushun-Yantai-Dalian Train Ferry Terminal is located at the Yangtouwua port area of Lushun and is an important hub ferry terminal of the train and truck transportation between Northeast China and North China.

Maritime Transportation: Dalian port has developed cooperative relations with more than 300 ports in over 160 countries and has opened 80 oceanic container lines. The gross throughput of Dalian port went up 24.02 tons during the years 2003 to 2012 (Figure 3), 12.53 tons of which were handled in the 11th ‘Five-Year Plan’ period. The investment of fixed assets has strengthened the capacity of maritime transportation of Dalian port.

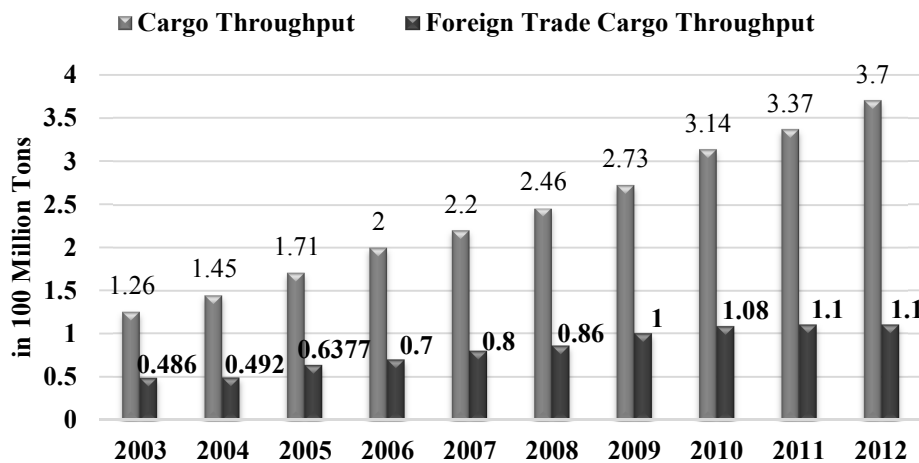


Figure 3: Cargo throughput and foreign trade throughput of Dalian port, 2003-2012. (Source: made by author based on Statistical Communique of Dalian National Economic and Social Development 2003-2012)

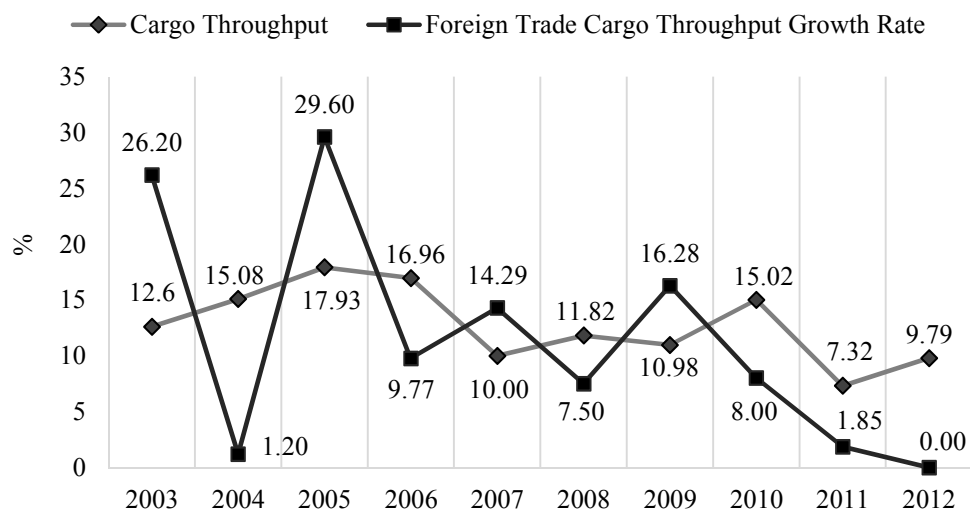


Figure 4: Growth rate of cargo throughput and foreign trade throughput in Dalian port, 2003-2012. (Source: made by author based on Statistical Communique of Dalian National Economic and Social Development 2003-2012)

Both the throughput growth of cargo and foreign cargo of Dalian port were affected directly by the Lehman Shock in 2008, and although the rates increased in 2010 and 2011, they were both affected again by the frequent explosions in CNPC Dalian branch in 2010 and 2011. Obviously, the safety of the hub port has been a serious problem for its future cargo transportation.

The total container throughput of Dalian port has gone up to 42.4202 million TEU, 21.387 million of which were handled in the 11th 'Five-Year Plan' period; the container throughput kept increasing from 2003 to 2012. Affected by the Lehman Shock, the growth rate was only 1.1% in 2009. But Dalian port shook off the negative influence rapidly in 2010. The local government put out a policy for offering subsidies to the shipping companies, railway transportation and the owners of the cargo in order to attract container vessels to berth alongside Dalian port. The policy maintained the growth of the container throughput from 2010 to 2012. By the end of 2010, Dalian Port owned 273 shipping vessels and the gross shipping capacity reached 6.5 million tons. The gross shipping cargo in Dalian Port from 2003 to 2011 reached 62.335 million tons, 39.93 million tons of which were in the '11th Five-Year Plan' period. The gross freight transport cargo by shipping in Dalian port increased from 2003 to 2011 reaching 30.95 million tons/Km, 20.49 million tons/Km of which were in the '11th Five-Year Plan' period.

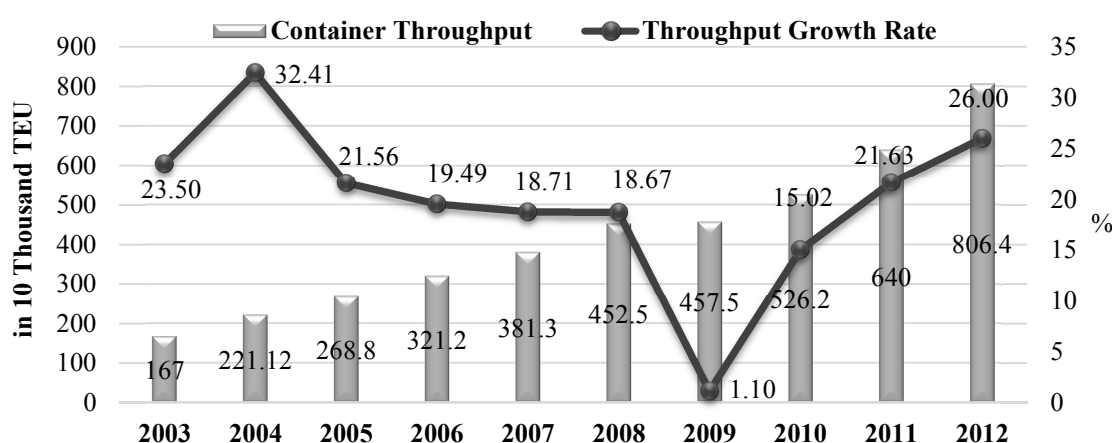


Figure 5: Containers throughput of Dalian port, 2003-2012. (Source: made by author based on Statistical Communique of Dalian National Economic and Social Development 2003-2012)

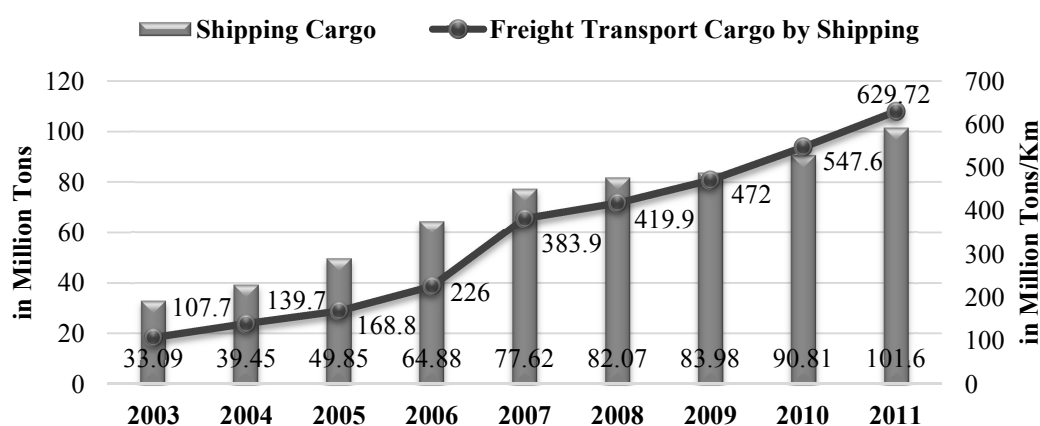


Figure 6: Shipping cargo and freight transport cargo by shipping at Dalian port, 2003-2011. (Source: made by author based on Dalian Statistics Year book, 2003-2012)

The cargo transport growth rates sharply increased in 2007 (Figure 7) because some infrastructure projects in Dalian Port were completed and put into service in this year. Under the influence of the Lehman Shock, the growth of both indices in 2009 was less than other years. The indices kept increasing after the shock because of the policy of subsidies.

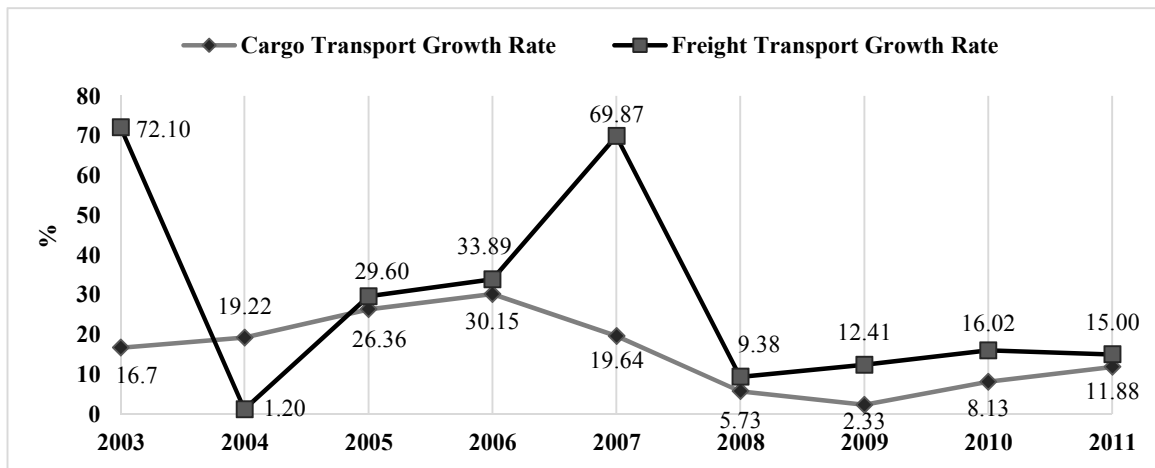


Figure 7: Growth rates of shipping cargo and freight transport cargo by shipping at Dalian port, 2003-2011. (Source: made by author based on Dalian Statistics Year book, 2003-2012)

Air Shipping: The cargo and mail throughput in Dalian International Airport (DIA) from 2003 to 2012 reached to 1279.6 thousand tons, 662.9 thousand tons of which were in the ‘11th Five-Year Plan’ period (Figure 8). The fluctuation of growth from 2003 mainly focused on the construction project of DIA and the Lehman Shock.

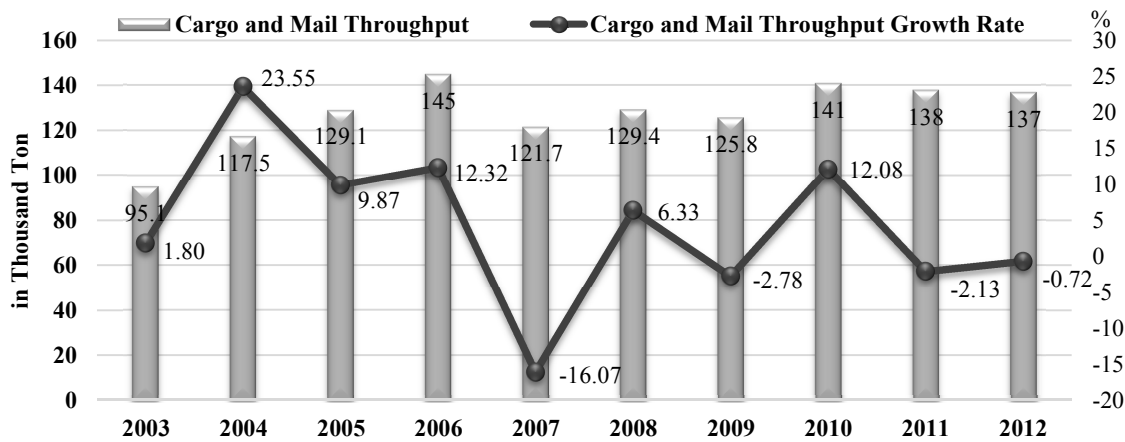


Figure 8: Cargo and Mail Throughput of Dalian International Airport, 2003-2012. (Source: made by author based on Statistical Communique of Dalian National Economic and Social Development 2003-2012)

The flights of DIA kept increasing from 2003 to 2012 (Figure 9). The growth trend indicates a rapid growth of flights in DIA in the first two years of the revitalization because the implementation of the plan brought more business opportunities to Dalian port. The growth from 2005 to 2009 was slow but steady. The Lehman Shock also affected the flights via DIA. The growth rate of flights was decreasing sharply in 2010 and 2011 because of the frequent explosion accidents by CNPC Dalian branch and the hidden danger of the PX Plant. Confidence over the safety in Dalian was recovered in 2012.

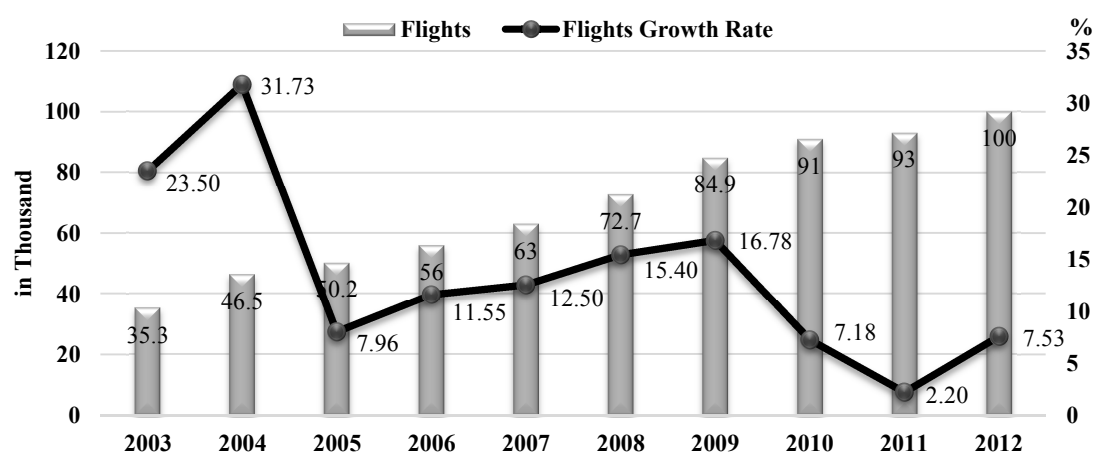


Figure 9: Flights of Dalian International Airport, 2003-2012. (Source: made by author based on Statistical Communique of Dalian National Economic and Social Development 2003-2012)

Affected by the Lehman Shock, the international lines kept decreasing in 2009 and 2010 (Figure 10). However, driven by the policies of expanding domestic demand by the China Central Government, the domestic lines still increased after the Lehman Shock. The international lines increased in 2011 because of the recovery of the global economy but decreased in 2012 due to the weakening relationship between China and Japan; China stopped some air lines to Japan in this year.

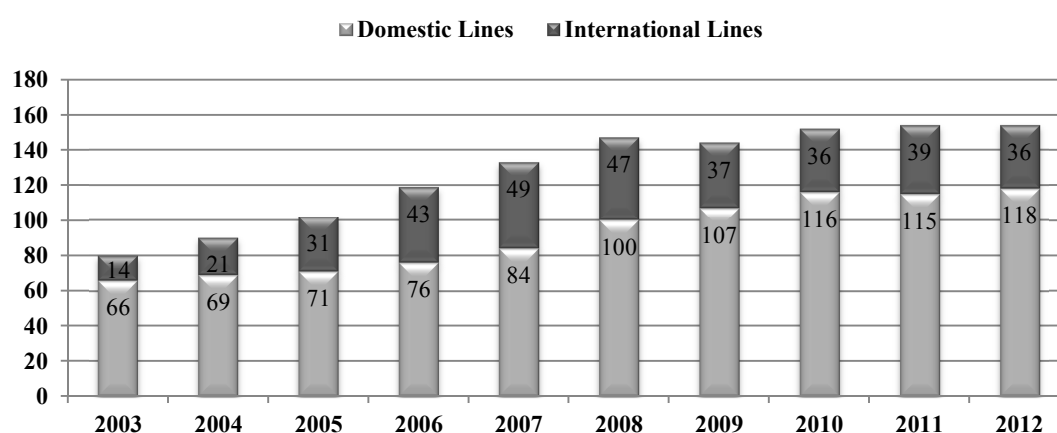


Figure 10: Domestic & International Lines of Dalian International Airport, 2003-2012. (Source: made by author based on Dalian Statistics Year book 2004-2011 and Statistical Communique of Dalian National Economic and Social Development 2003-2012)

Highway Transportation: There are 512 town-class roads in Dalian City, with a total length of 6,000 Km. Gross cargo transferred by highway in Dalian from 2003 to 2010 reached 1709.41 thousand tons, 984.51 thousand tons of which were in the 11th 'Five-Year Plan' period (Figure 11). The gross freight transport cargo by highway in Dalian from 2003 to 2011 reached 117.64 million tons/Km, 71.54 million/Km of which was in the 11th 'Five-Year Plan' period. The trend of the cargo transported by highway indicates it kept increasing steadily from 2003 to 2008 (Figure 12), but decreased in 2009 due to the Lehman Shock and the increase in the cost of highway transportation. The transportation by highway in Dalian City went up slowly due to the high charge of using the highways. The trend of the freight cargo transported by highway indicates that it kept increasing from 2003 to 2011, and it had a sharp increase in 2009 because Dalian port signed an agreement of strategic cooperation with Yingkou and Jinzhou ports in 2008.

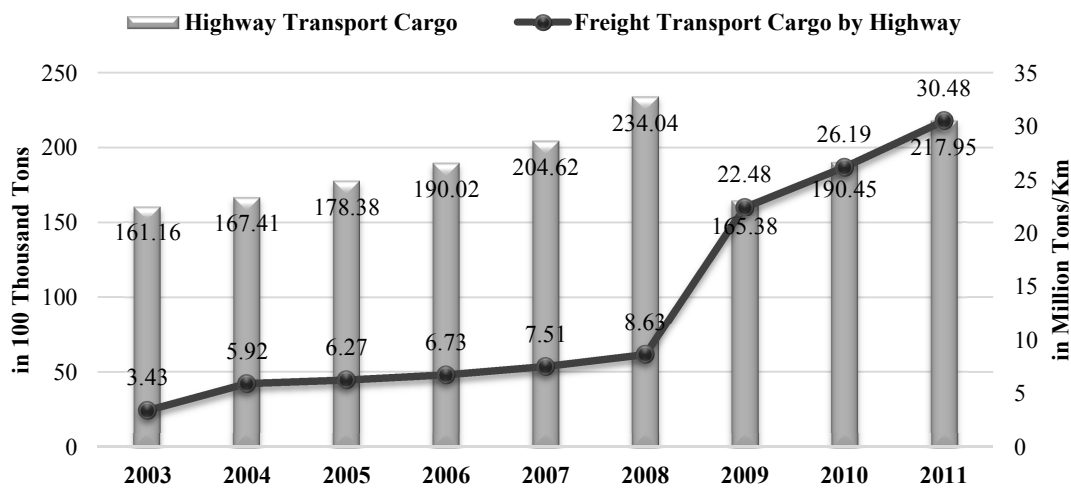


Figure 11: Highway Transport Cargo and Freight Transport Cargo of Dalian Port, 2003-2011.
(Source: made by author based on Dalian Statistics Year book, 2004-2011)

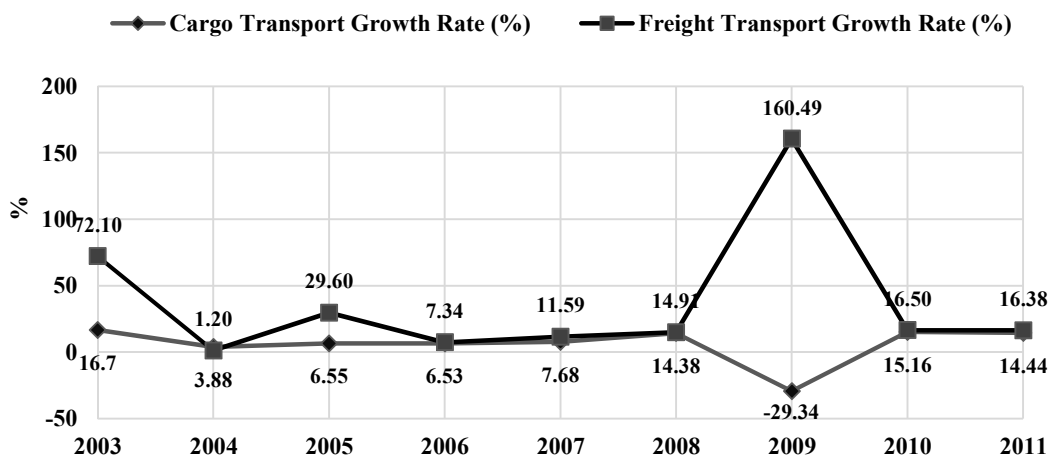


Figure 12: Growth Rate of Highway Transport Cargo and Freight Transport Cargo of Dalian Port, 2003-2011.
(Source: made by author based on Dalian Statistics Year book, 2004-2011)

Railway Transportation: By the end of 2010, there were 55 train stations in Dalian City and 17 operating railways; the length of the railways in Dalian area reached 1,385 Km. The gross cargo transferred by railway in Dalian from 2003 to 2011 reached 219.4 thousand tons, 116.9 thousand tons of which were in the 11th ‘Five-Year Plan’ period. The gross freight transport cargo by railway in Dalian from 2003 to 2011 reached 159.83 million tons/Km, 90.96 million tons/Km of which were in the 11th ‘Five-Year Plan’ period (Figure 13).

The freight transport by railway was increasing in most of the revitalization period except in 2009 due to the influence of the Lehman Shock. Though the frequent explosion accidents by CNPC Dalian branch and the hidden danger of the PX Plant affected the growth of railway cargo transportation in 2011, the general trend indicates that freight transport by railway has become a crucial transportation method in Dalian port.

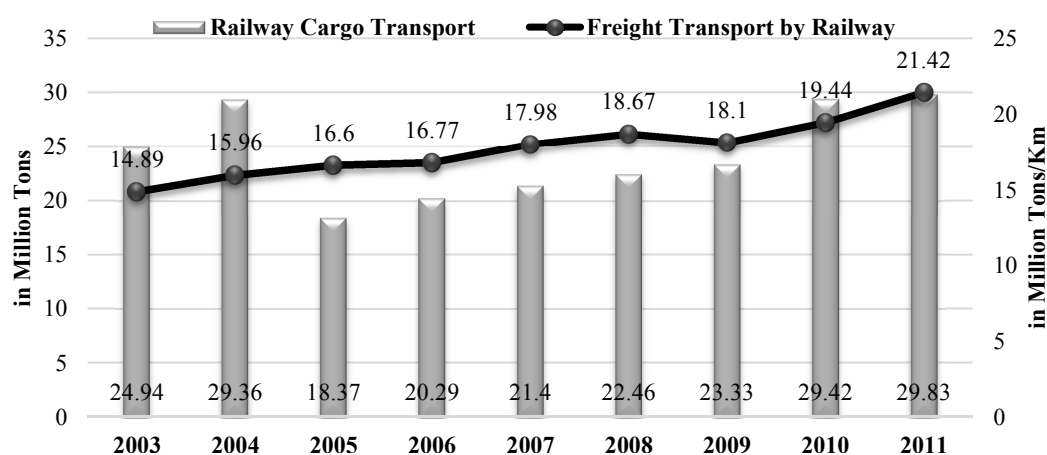


Figure 13: Railway Transport Cargo and Freight Transport Cargo of Dalian Port, 2003-2011. (Source: made by author based on Dalian Statistics Year book, 2004-2012)

The index shows a decrease in 2005 (Figure 14) because the output of products such as coal, crude oil, iron and grain, mainly transported by railway, decreased in this year throughout China. The energy and grain base in Northeast China also suffered from the impact. The cargo transported by railway kept increasing from 2005 to 2010. The sharp increase in 2010 was caused by the increased cost of highway transportation in 2009.

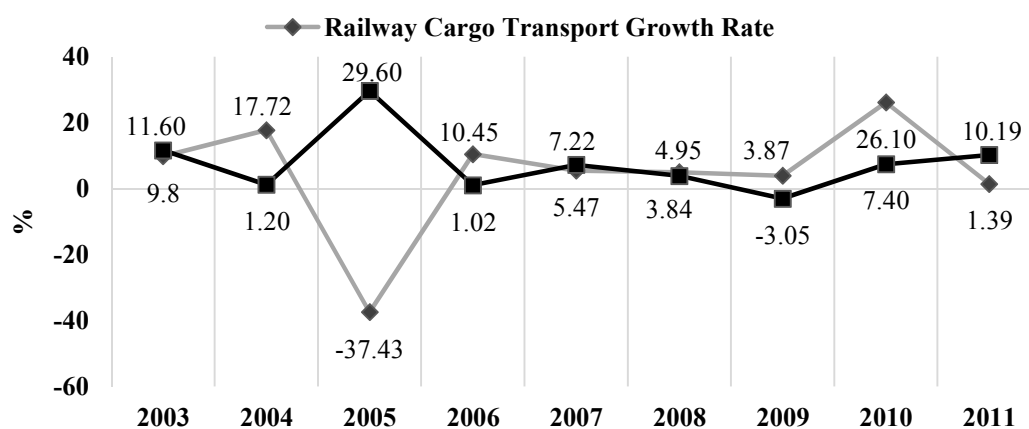


Figure 14: Growth Rate Railway Transport Cargo and Freight Transport Cargo of Dalian Port, 2003-2011. (Source: made by author based on Dalian Statistics Year book, 2004-2012)

Intermodal Transportation: Intermodal transportation is the core of logistics development in Dalian port, as combined transportation is prospering worldwide. To establish a modern transportation system, Dalian port invested in the Circle Lines of Bohai Sea and some inland depots (also called dry port) in the hinterland of Northeast China with the cooperation of the railway department in the 11th ‘Five-Year Plan’ period. Northeast China and the Bohai Economy Zone are connected as a whole by these projects, and so a new logistics network has been set up in North China. The intermodal transportation system consists of shipping, railway, and train ferry, and increases the container throughput and transshipment of Dalian Port, whose containers transported by intermodal transportation reached 100 million in the 11th ‘Five-Year Plan’ period. The costs of logistics have decreased and transportation in the region has become more efficient.

Warehouses: Warehouses provide support for logistics and play a pivotal role in the development of port cities. As an important part of logistics in Dalian port, warehouses have developed substantially in the 11th ‘Five-Year Plan’ period. The warehouses in Dalian port are classified into 8 types, for storing grain, mechanical, electrical, and chemical industry, refrigeration, ore and textile. The main functions of the warehouses include transfer, storage, distribution and bonded storage.

According to data, by the end of 2010, there were 277 warehouse and storage enterprises in Dalian port, and the area of all the warehouses was 9.112 million m² with a storage capacity of 9.76 million tons. The throughput of the warehouses in 2009 was 44.2 million tons and the revenue reached 2.58 billion RMB. Many warehouse enterprises which focus on storage have been upgraded to become comprehensive logistics services enterprises.

Development of the Logistics Information System: Information-based logistics is one of the marked characteristics and an inevitable trend for the development of modern logistics in the electronic business era. An efficient logistics information system for Dalian port was set up in 2009; the system includes the Intermodal Transportation Service System of Northeast China, Liaoning Electronic Port System, Dalian Harbor IT Service Center, Express Port Community Interface (EPCI), Automatic Identification System (AIS), Electronic Declaration and Control System, Express Quarantine Service System, and Dynamic Tracing System for Railway and Shipping. More than 120 kinds of electronic messages were applied to the system by the end of 2010. The systems are used by logistics departments, customs, trade and finance systems and electronic government. The systems serve as information platforms for port supervisors, shipping companies and forwarder enterprises in all process of port logistics. The information systems have strengthened the port management and streamlined the customs clearance. They have also has improved the quality of port service. The information about port, shipping, railway and supervision of Dalian Port now can be shared with other logistics cities in Northeast China.

Some logistics enterprises in Dalian Port also developed information-based logistics systems in order to promote their business efficiency. ‘Digital System for Dalian Port’ developed by PDA obtained financial support from the Chinese National Development and Reform Commission and passed the national acceptance check. The ‘Freight Management System’ developed by China Shipping Logistics Company is an information system that focuses on the logistics business in Dalian port. At the same time, COSCO developed a comprehensive warehouse management system. According to data, there are more than 3,500 logistics enterprises in Dalian Port (Table 1), more than 200 of which are large and medium enterprises.

Table 1: Classification of Logistics Enterprises in Dalian Port

Classification	Number of Enterprises	Share of Total (%)
Logistics	1,561	44.6
Forward Shipping	710	20.3
Highway Transportation	700	20
Warehouse	264	7.6
Shipping	117	3.3
Express	57	1.6
Port	56	1.6
Information Development	35	1
Total	3,500	100

Source: Created by the author based on the Report on the Development of Dalian Logistics Industry 2010

Some logistics enterprises in Dalian port have started using information technologies such as Global Positioning System (GPS), Geographic Information System (GIS) and Radio Frequency Identification (RFID) to make the logistics business more efficient.

Foreign and Joint Enterprises: Foreign logistics enterprises are important to the logistics development in Dalian port. In the '11th Five-Year Plan' period, some prestigious international logistics enterprises have entered Dalian port (Table 2). Furthermore, some Chinese enterprises established joint logistics ventures with international logistics enterprises (Table 3). There were 115 foreign logistics enterprises and 53 joint logistics enterprises from Hong Kong, Taiwan and Macau in Dalian port by the end of year 2010. The strategies, management styles, logistics technologies and enterprise culture of these companies brought new business conceptions to the development of logistics enterprises in Dalian Port.

Table 2: Main foreign logistics enterprises in Dalian port

Enterprise	Nationality
Maersk Line Shipping Container Co., Ltd., Dalian Branch	Denmark
Nippon Yusen Kaisha (China), Dalian Branch	Japan
Hanjin Shipping (China), Dalian Branch	Korean
Orient Overseas Container Line Logistics, Ltd. (China), Dalian Branch	Hong Kong
Dalian Sankyu International Logistics Co., Ltd.	Japan
Dalian Kintetsu Logistics Co., Ltd.	Japan
CMA-CGM China, Dalian Branch	France
TNT Dalian Branch	Netherlands

Source: Created by the author based on the Report on the Development of Dalian Logistics Industry 2010

Private logistics enterprises account for 90% of total logistics enterprises in Dalian port. A great many private logistics enterprises have emerged in recent years as powerful groups of the industry. Many of them have been restructured into Third Party Logistics (TPL) enterprises. Some of them have applied the solutions of logistics not only into the supply chain management and the optimization of customers, but also the whole logistics business processes.

Table 3: Main joint logistics enterprises in Dalian port

Enterprise	Nationality of investors
Nittsu Sinotrans Logistic Dalian, Ltd.	Japan
Dalian Alps Teda Logistics Co., Ltd.	Japan
Dalian YIDU-JIFA Cold Logistics Co., Ltd.	United States
Dalian Jilong Logistics Co., Ltd.	Sweden
Dalian Rieck Henco Int'l Transportation Co., Ltd.	Germany & Hong Kong
Dalian Schnellecke Logistics Co., Ltd.	Germany
Dalian Singamas International Container Co., Ltd.	United States

Source: Created by the author based on the Report on the Development of Dalian Logistics Industry 2010

Discussion

Dalian plays an important role in the economic development in Liaoning province, where the port is located. From 29 ports along the coastal economic zone in Liaoning Province, 14 are located in Dalian area, and

Dalian owns 48% of total ports in the province (Li, 2010). In the 11th ‘Five-Year Plan’ period (2006-2010), 36.92 billion Yuan (RMB) was invested in the fixed assets of Dalian port. The throughput of the cargo imported and exported via Dalian port in the period reached 1.25 billion tons. The revenue of logistics in Dalian port grew vigorously in the same period such that in 2010, the gross revenue of Dalian logistics reached 1,450 billion RMB; the added value of Dalian logistics was 47.29 billion RMB, which accounted for 9.5% of the annual GDP in Dalian. Overall, the rapid development of logistics in Dalian port has promoted the economy of the region. These achievements strongly support the revitalization of Northeast China.

However, there are still problems in development of Dalian port. Though logistics in Dalian port has developed steadily in the last 10 years, there are serious issues in its future development, such as logistics structure imbalance. There is a lack of the sense of service in both logistics enterprises and local governmental agencies. Obstructions in fair competition and win-win cooperation are problems that need to be solved. Also there are problems in tax policies, transportation management, administrative efficiency and the human resource management of logistics. Problems of arbitrary and unreasonable charges, tax policies, land policies and transportation that affect the development of enterprises have not been solved for a long time. Also, the socialization of logistics is not in accordance with the economic development in Dalian port. In addition, logistics technologies have not been applied extensively in the development of logistics in the region; compared with the international advanced shipping market, Dalian port still lags far behind.

High annual GDP has been the development target in all China. In 2005, Dalian planned for a 13% growth target in the average annual GDP in the ‘11th Five-Year Plan’ period, much higher than the national target of an average annual 7.5% growth in GDP in the same period. Dalian port introduced petrochemical programs in order to accomplish the target, but problems with the security management system of CNPC Dalian branch caused many explosion accidents and created serious problems (Table 4). The resources of the port are over developed in Dalian area due to the construction project’s benefit for the growth of GDP.

Table 4: CNPC Dalian Branch Petrochemical Accidents (2010-2011)

Date	Accident	Cause of the Accident	Impact
2010.7.16	An explosion in the crude oil pipeline destroyed a 100 thousand crude oil tank of CNPC Dalian International Storage Company at Dalian New Port.	Too much oxygen in the pipeline caused by ZC-PCD with strong oxidizer, which was being injected into pipelines after the crude oil unloaded.	Polluted seawater over 430 square km ² . Most of the coastal sea life was polluted by the oil.
2010.10.24	Residue crude oil at the bottom of the destroyed tank (on 7.16) caught fire when it was torn down.	Residue crude oil	Air Pollution
2011.7.16	A 10 million class atmospheric-vacuum distillation unit of CNPC Petrochemical Dalian branch caught fire.	Leakage of the three-distillation heat exchanger.	Air Pollution
2011.8.29	No. 875 diesel tank of CNPC Petrochemical Dalian branch storing 800 ton diesel caught fire.	A static fire of the pipeline between the two diesel tanks that took place during the operation	Air Pollution
2011.11.22	No. 31 and 32 crude oil tanks of CNPC Petrochemical Dalian branch, storing 100 thousand tons crude oil, caught fire.	The seal curtains of the tanks were struck by lightning.	Air Pollution

Source: created by the author based on data from http://news.xinhuanet.com/fortune/2011-11/24/c_111192315.htm

Petrochemical industries should not be developed near the living areas. Dalian area is rich in coastal resources for establishing ports. The current petrochemical and chemical plants should be relocated to safe areas, and CNPC should strengthen the security management of crude oil storage and observe a safe distance between the oil plants and living areas as a key factor for establishing new petrochemical plants. From the standpoint of sustainable development, the resources of the bays and coastal areas in Dalian area can be divided to three types: coastal areas that may be developed for logistics and economic development in the next 50 years; coastal areas that may be reserved for at least 50 years in order to leave potential areas for future generations with advanced concepts and technologies; and coastal areas that may be protected from any development for ecological equilibrium and environmental protection in the area.

A main problem of logistics in Dalian port is that transport corridors between the port areas and urban traffic system are not developed well and the resources of traffic in Dalian are not integrated well, which make the network run with low efficiency. An insufficient demand for TPL may be the primary reason that the logistics has developed slowly in the whole Northeast China. This is because the latent demands of logistics in the region have not been transformed into market demands. The heavily socialized system of logistics has not kept abreast with economic development in the region. Therefore, the supply capacity of specialized logistics is not enough for the development of international trade. A considerable number of small scale logistics enterprises exist in Dalian Port, while the presence of too many small logistics enterprises is not conducive to the development of logistics.

One major difficulty in establishing a regional international and market-based logistics system is the weakness of the administrative system at all levels of government. Compared with the Chinese Southeast coastal area, the reform in Northeast China is relatively backward. To promote the development of logistics integration and establish an open and effective logistics system, government interferences need to be minimized, relying instead on both the market and enterprises. The development of logistics in the region needs guidance and coordination from the market; governmental services and policies cannot meet the development needs of contemporary global logistics.

To help solve these problems, there is a need to enhance the education and training of human resources in international logistics on both logistics management and logistics engineering in order to offer qualified personnel to both governmental departments and enterprises. At present, the amount and structure of logistics human resources in Dalian port does not fit with the needs of transformation and upgrading of the logistics in the port. Though many logistics graduates are engaged in logistics in Dalian port in recent years, qualified personnel for logistics development is still insufficient. Highly qualified people are needed in Dalian to help design the logistics network, optimize the logistics process and deal with the shipping business.

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