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考試科目： 文獻評論

系所名稱： 航運管理學系博士班

1.答案以橫式由左至右書寫。2.請依題號順序作答。

請先閱讀 "Coastal port reform in China" 一文，再針對以下問題提出你的觀點。

- 1.請說明大陸國際商港管理型態變革的背景。(25%)
- 2.請歸納說明大陸國際商港管理型態變革的類型，以及每一種型態的特色。(40%)
- 3.大陸國際商港管理體制的變革效益，是否也適用於台灣的國際商港？(35%)

## Coastal port reform in China

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This paper reviews reforms that have been happening to the China coastal port industry. It covers the economic background, motivations and progress of the reforms, and discusses issues associated with relevant planning events, such as the National Layout Plan for Coastal Ports. It is concluded that the reforms are necessary for the industry to raise funds for infrastructure expansion and to enhance the industry efficiency, and that China has adopted appropriate steps to change the industry governance and to pass relevant plans in the reform process.

### 1. Introduction

There have been significant changes in China's port industry, which include, but are not limited to, the port infrastructure, governance and ownership. As far as infrastructure is concerned, China's port system has been expanded considerably, with the handling capacity being increased to cope with the constant growth in freight volumes. At the same time, previous port authorities have been transformed into two types of organizations: port administrations and corporations, with the former playing a key role in regulation and planning of the port industry, and with the latter being incorporated under the Corporation Act of the People's Republic of China [1] and being responsible for port operations. In order to expand the capacity and to improve the operational efficiency of ports, the industry ownership has started being diversified, with joint ventures in various forms between the state-owned port corporations and other domestic organizations as well as foreign organizations being incorporated to run port facilities. In 2006, the Ministry of Communications of the People's Republic of China promulgated the National Layout Plan for Coastal Ports [2].

This paper reviews these events. It starts with the economic background of these reforms. Then, the paper analyses the motivations and objectives of reforming China's port governance and ownership, the practice of carrying out the reforms, and planning that are associated with the port industry. Finally, the paper draws relevant conclusions.

### 2. Economic background

In the last ten plus years, China was experiencing significant economic growth (figure 1). Although its growth was slowing down slightly due to the 1997 Asian Financial Crisis, the economy has been developing at a strong growth rate of above 10% since 2003.

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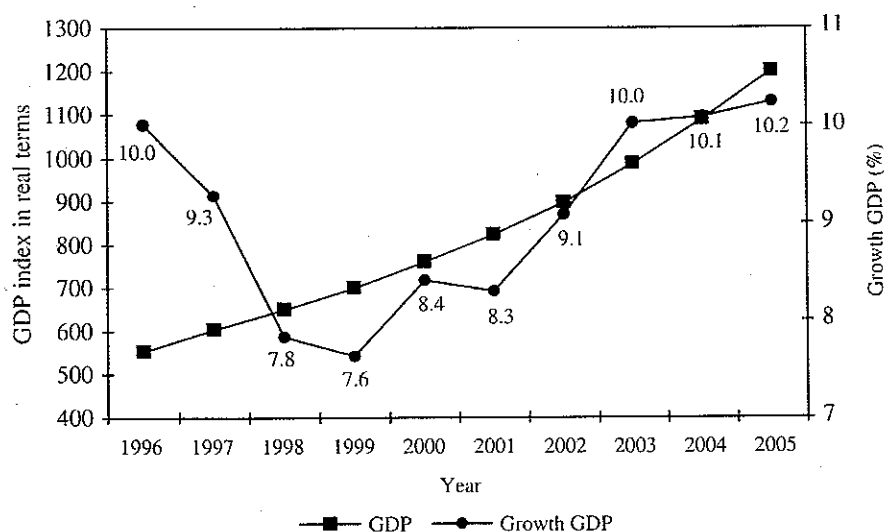


Figure 1. Economic development in China.

Source: [3].

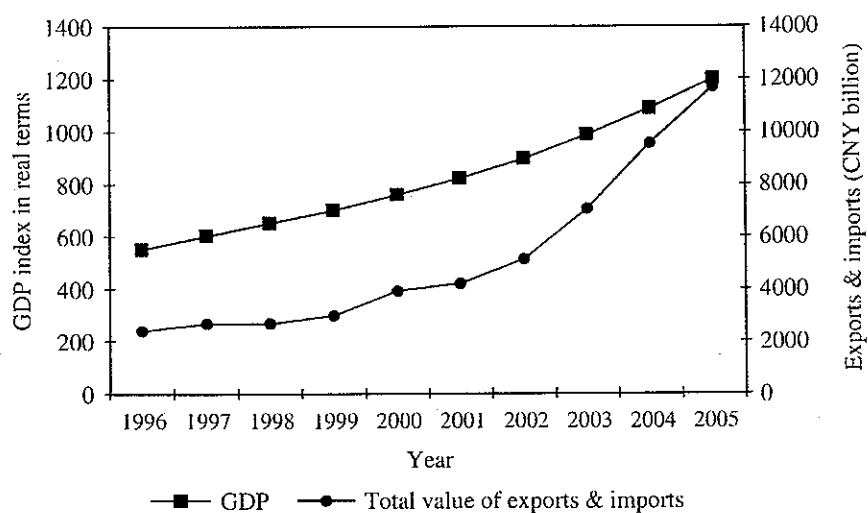


Figure 2. GDP and the total values of exports and imports in China.

Source: [3].

During the same period, China's international trade also grew significantly at an average rate of 19.1% per annum (in nominal terms), as shown in figure 2. It is worth noticing in figure 2 that the growths in gross domestic product (GDP) and exports and imports have a very close association for each other, with the elasticities of exports and imports with respect to GDP being about 2 in recent years (figure 3). Another perspective to look at the relationship between China's economic growth and trade is freight volumes handled by major coastal ports, which are more closely related to the demand for port facilities (figure 4). The elasticity of the freight with respect to GDP has been about 2 in recent years, as shown in figure 5.

The high elasticity has been due to a fact that the booming economy of China, especially since joining the World Trade Organization in 2000, has created significant demand for raw materials (e.g. crude oil, iron ore and coal) and other production input, of which significant portions have been sourced from overseas as

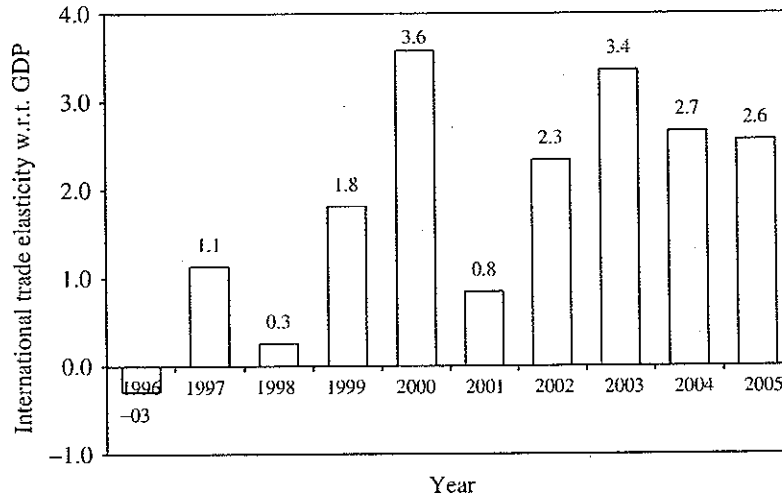


Figure 3. Elasticity of international trade with respect to GDP in China.  
Source: [3].

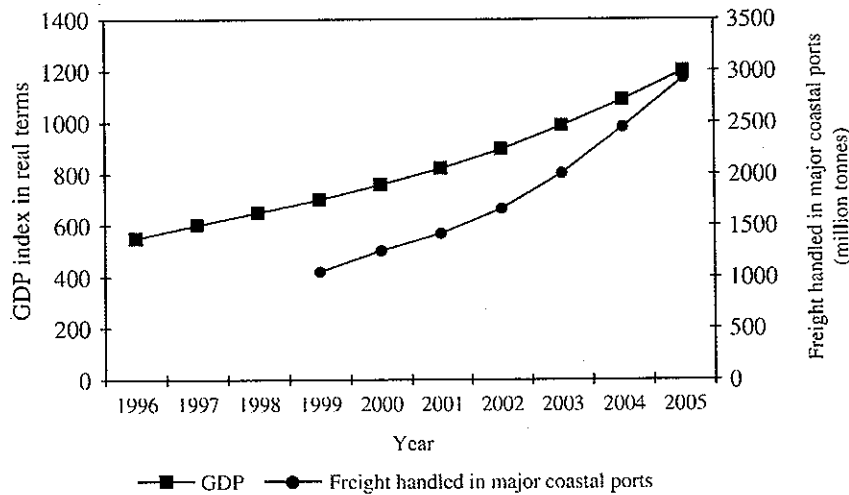


Figure 4. GDP and freight volumes handled by major coastal ports in China.  
Source: [3].

inbound freight [4]. Figure 6 shows the six main categories of inbound freight through China's major coastal ports. Metal ores, crude oil and coal are the top three inbound bulk commodities. The category of 'Others' is mainly general cargo, and has had not only larger tonnages than bulk goods but also has had faster growth rates. The huge volumes of coal as outbound freight through major coastal ports (figure 7) are mainly headed for domestic destinations, being transported by rail from Shanxi Province to Qinghuangdao Port and then shipped to other coastal ports in southern and eastern China and inland waterway ports [5], such as those along the Yangtze River.

On the other hand, China has been becoming a major manufacturing base of more and more products for the world market. This has created a large demand for outbound shipping transport, both as bulk cargo and as general cargo in containers as shown by the category of 'Others' in figure 7.

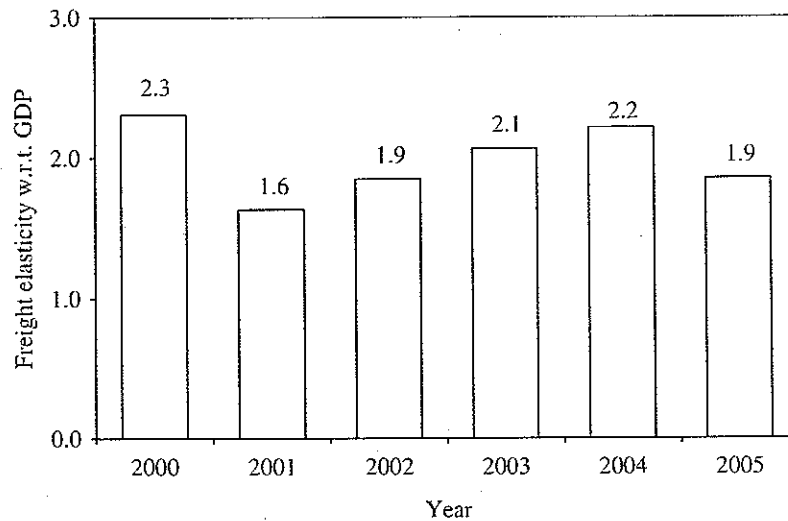


Figure 5. Elasticity of freight handled in major coastal ports in China.  
Source: [3].

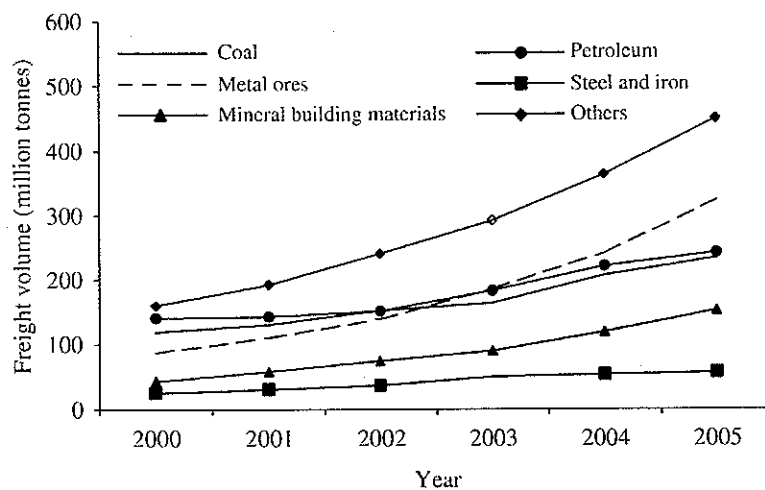


Figure 6. Top six inbound freight categories handled in China's coastal ports.  
Source: [3].

In 2005 China had a total freight throughput in ports of 4.854 billion tonnes, including 3.009 billion tonnes through coastal ports. In the same period, 11 ports achieved a freight throughput of more than 100 million tonnes, with Shanghai Port having a throughput of 443 million tonnes, Ningbo Port 269 million tonnes, Guangzhou Port 250 millions and Tianjin Port 241 million tonnes [6].

The growth of container volumes through China's ports has been significant. As shown in figure 8, the total container throughput in China's ports has been increased from 8.0 million TEU in 1996 to 93.0 million TEU in 2006 with an average growth rate of 27.8% per year. The total container movements through the top ten container ports follows a similar growth pattern, with their shares in all ports having been in a range of 82% to 84% since 2000 when China joined the World Trade Organization, except for 92% in year 2002. Shanghai Port and

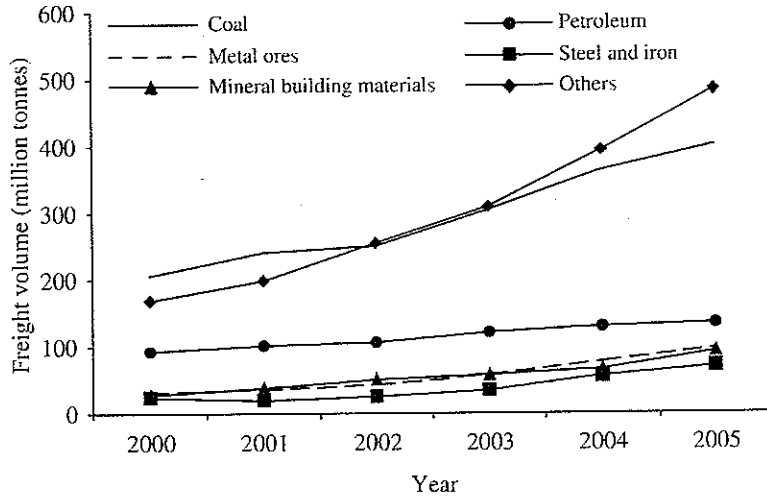


Figure 7. Top six outbound freight categories handled in China's coastal ports. Source: [3].

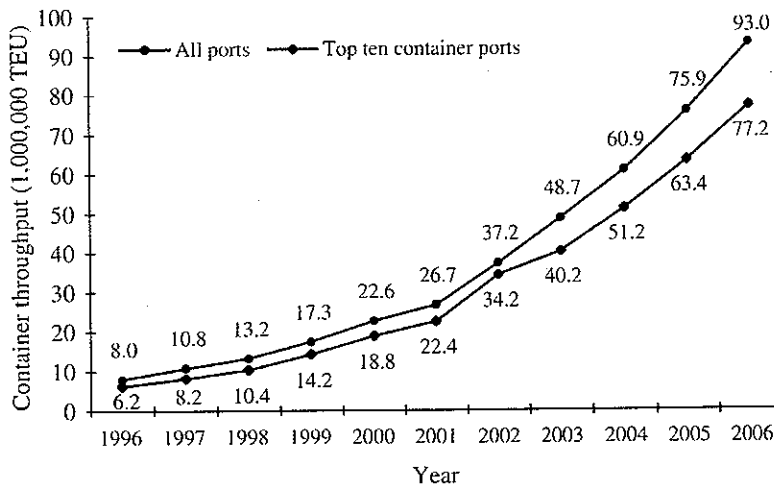
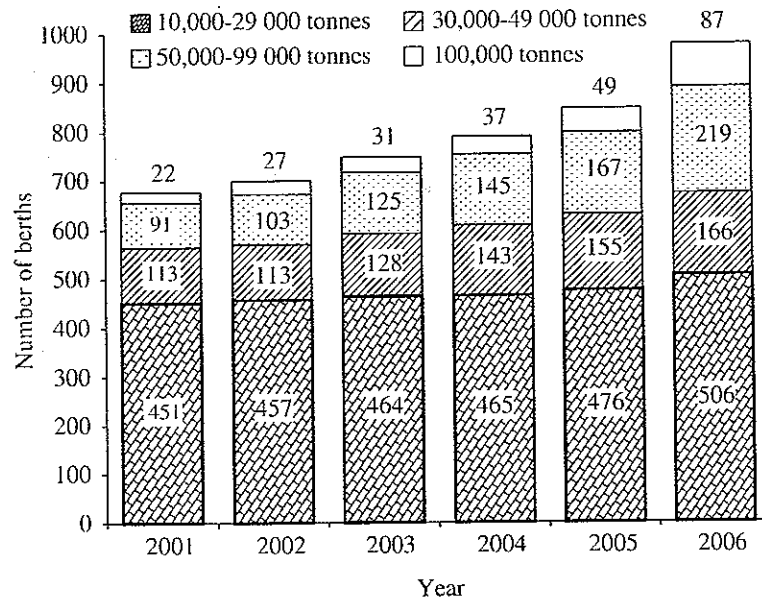


Figure 8. Container throughput in China's ports. Source: [7].

Shenzhen Port were ranked as the third and fourth largest container ports in the world in year 2006, with the former handling 21.72 million TEU and the latter 18.50 million TEU [7].

An important factor in contributing the current achievement in the port industry in China is the expansion of port capacity. By the end of year 2006, China had in total 35453 berths, including 1203 10 000-tonne-class berths. In coastal ports, it had 4511 public berths, including 978 10 000-tonne-class berths [8], of which the growth pattern and breakdown since 2001 are shown in figure 9.

To summarize, China has experienced a booming economy that has had a close relationship with the rapid development of the port industry. The importance of the development can be seen from both its ever-increasing freight volumes and massive port expansion programmes.



**Figure 9. Breakdown of 10 000-tonne-class berths in China's coastal ports.**  
Sources: [8, 9, 10].

### 3. Reform of the governance system of the port industry

To a large extent, the aforementioned achievement in China's port development has resulted from its economic reform and specific policies and the corresponding instruments for reforming the port industry. The overall objectives of the reforms have included modernization of the industry, attraction of investment from various sources to fund its infrastructure expansion, and introduction of advanced technology and management to enhance its efficiency [11]. In the last 20 plus years, China carried out many reforms to the industry, and the corresponding governance system has been through three development stages: centralization prior to 1984, semi-decentralization after 1987 and decentralization after 2002.

#### 3.1. Centralization

Before 1984, the Ministry of Communications directly controlled the 38 major ports in China, consisting of 13 coastal ports and 25 ports along the Yangtze River [12]. This system originated from China's then planned economy, in which the central government, through the corresponding ministries, controlled large state-owned business organizations and local governments managed small state-owned ones [13]. Under this regime, the Ministry determined all aspects of business in the ports and local governments did not have much input into the port industry in their regions.

A significant feature of the system is the financial arrangements between the ports and the Ministry. In each year, individual ports carried out their operations according to corresponding plans, covering annual financial targets and budgets, endorsed by the Ministry, and all of their operation revenues went to the Ministry irrespective of whether or not they actually achieved corresponding financial targets. The Ministry, through a separate financial arrangement, centrally allocated funding for the innovation and development of the ports, and whether or not the funding needed by individual ports could be fulfilled was not linked to their commercial performance. As a result, it was likely that the ports did not proactively enhance their

operational efficiency and look for the business development opportunities that were relevant to them.

### 3.2. *Semi-decentralization*

After 1987, 37 of the 38 major ports were transferred to a semi-decentralization or dual-administration system, being jointly controlled by the Ministry of Communications and the local governments. The only exception was Qinhuangdao Port that is of its national significance as the largest coal transport port and was still under direct control of the Ministry. Under this new regime, individual port organizations carried out functions of port regulation, planning and operations, which were in fact local port monopolies [12]. In terms of sharing of responsibility, the local government mainly played a role in managing human resources, such as appointing members of the executive team, while the Ministry was in charge operation planning, procurement, infrastructure/equipment enhancement and development, finance and others [14, 15].

The most important feature of the system was probably a new financial arrangement between the ports and the Ministry [14], of which the objective was to nurture a self-sufficient funding resource for each of the ports. Under the new regime, individual ports could retain certain proportions of the profits as the port production development funds if they made profit, and use the funds for the port development and innovation projects that had been approved by the Ministry. This system directly linked the operational performance of individual ports to the availability of funding for their development and innovation projects. It encouraged the ports proactively to enhance their efficiency. On the other hand, it only improved the financial relationship between the ports and the Ministry in a sense that individual ports had certain amount of autonomy of sourcing development funds, and did not allow them to choose projects at their discretion.

### 3.3. *Decentralization*

China started radically reforming its port industry late in 2001. Since joining the World Trade Organization in 2000, China had been experiencing fast growth of economy and international trade, which in term required an efficient port industry. However, the then governance system of the port industry hardly supported the booming economy unless it is completely reformed.

A key component of the reform is the decentralization of the port industry. China has taken a trial-and-error approach to this and gradually started with a couple of ports to gain relevant experience since 1984 [16]. A large scale of decentralization was symbolized by the fact that all 37 ports under the dual-administration were transferred to the corresponding local governments by March 2002, following a decree from the State Council of the People's Republic of China [17] and that Qinhuangdao Port, which was previously directly controlled by the Ministry of Communications, was handed over to the Hebei Provincial Government [11, 15].

As a part of the reform, the previous port organizations were split into two parts: administrations and corporations. In general, each port city established a port administration at the municipal level to govern all ports within its jurisdiction boundary. For example, Dalian Municipal Port Administration and Shanghai Municipal Port Administration are responsible for Dalian Port and Shanghai Port, respectively. The only exception is Qinhuangdao Port, which is administered by Hebei Provincial Port and Shipping Administration. The municipal port



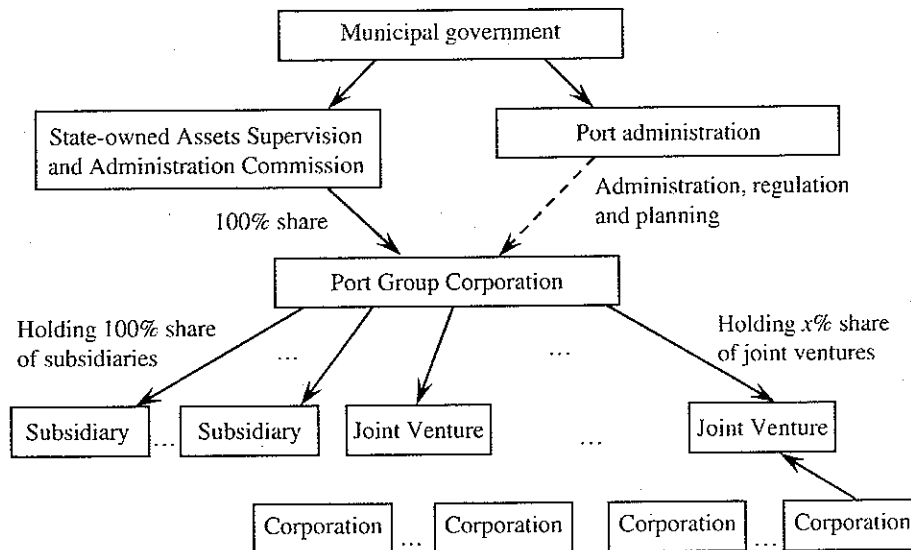


Figure 10. A generic model of port governance in China.

administration acts as a governmental agency, typically having the following functions [18, 19, 20]:

- administration, such as granting licences to commercial organizations operating in the port industry;
- regulation, with respect to industry standards, market rules, pricing rules/guidelines, the quality of port construction projects and the safety of operations;
- planning;
- development, provision and maintenance of public infrastructure, such as channels, breakwaters, anchorages and navigation marks [21]; and
- port security.

The other part of the decentralization was the establishment of port corporations. In general, port corporations inherited all operational staff, assets (e.g. wharfs, cranes, warehouses and stockyards), credits and debts from the former port organizations, and were incorporated under the Corporation Act of the People's Republic of China 1999 [1]. They operate as commercial organizations, having strategic objectives that are specific to themselves and the local situations, paying corporate taxes to the tax offices and not being any more subject to annual financial targets set by the Ministry of Communication.

After the decentralization in 2002, there exist three models of the governance of the port corporations. The first one, as shown in figure 10, covers the situations in most port cities. After having received all operational staff and assets of the former port organization, the corresponding municipal State-owned Assets Supervision and Administration Commission owns 100% of the port corporation, which is called the port group corporation. The corporation is incorporated under the Corporation Act and the Commission represents the corresponding municipal government as its sole shareholder. Under the group corporation there are subsidiaries, of which the shares are held either solely by the corporation itself or jointly by the corporation and its business partners. For instance, Dalian Port Group Corporation in northern China

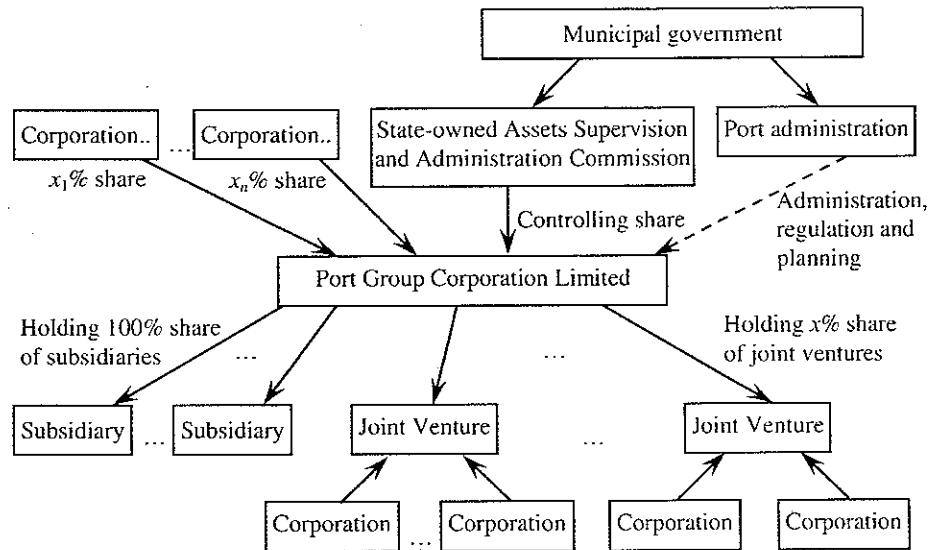


Figure 11. The Shanghai model of port governance.

has 26 subsidiaries and five of them are directly involved in cargo handling: a general cargo terminal company, an oil cargo terminal company, a bulk grain terminal company, a bulk mineral terminal company and a container terminal corporation limited. The first four subsidiaries are 100% owned by Dalian Port Group Corporation. Like most container terminals in China's ports, the container terminal corporation is a joint venture, with Dalian Port Group Corporation holding 89.5% shares, COSCO Pacific Ltd 8% share, P. G. Logistics Group Co. Ltd 1% share, Shanghai Port Container Co., Ltd 1% share and China Ocean Shipping Agency (Dalian) 0.5% share.

The second is the Shanghai Model, as shown in figure 11. Shanghai International Port (Group) Co., Ltd was initially established in 2003 by reforming the former Shanghai Port Authority. By then it was solely owned by the Shanghai Municipal State-owned Assets Supervision and Administration Commission and was fitted for the first model. In 2005, the governance of the Corporation evolved, becoming a joint venture of the Commission (50% share), China Merchants Holdings (International) Company Limited (30% share), Shanghai Tongsheng Investment (Group) Co., Ltd (19% share) and other two institutional shareholders (0.5% share respectively). The significance of the evolution is that the main port corporate body, Shanghai International Port (Group) Co., Ltd is not completely owned by the Commission any more. Apart from the evolution of the ownership of the main corporation body, the Shanghai Model is similar to the first model with respect to subsidiaries. It has several cargo-handling subsidiaries and most of them are container operators. All of the container subsidiaries are joint ventures either with domestic corporations, of which most are state-owned corporations, or with foreign corporations such as Hutchison and Maersk. These joint ventures are either under Shanghai International (Group) Co., Ltd as direct subsidiaries, or under a direct subsidiary of the Corporation.

The last one is the Shenzhen Model (figure 12), which is significantly different from the two aforementioned models due to some historical reasons. Shenzhen was a small town near Hong Kong in Guangdong Province. Before early 1980s, it did not have decent port infrastructure and no any large merchant ship ever called at

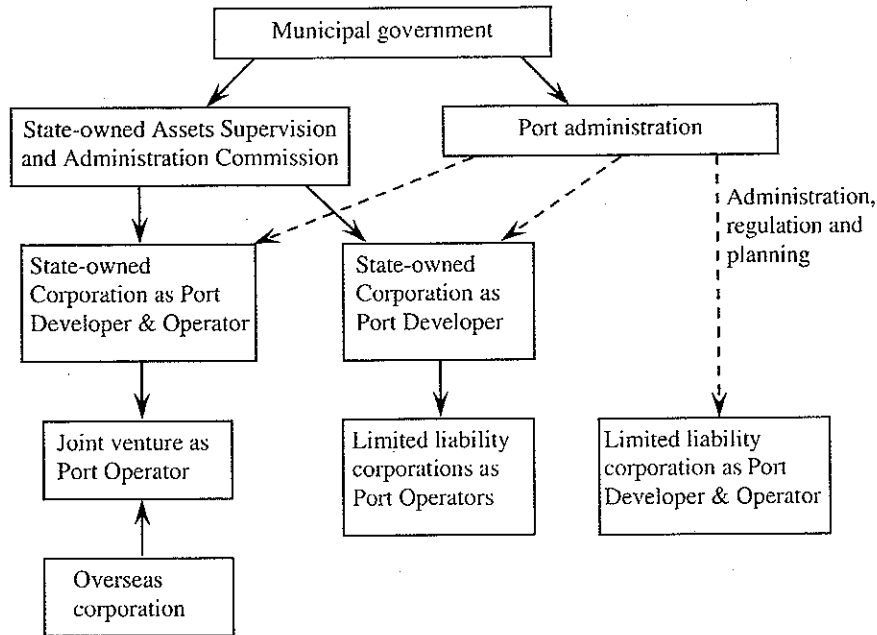


Figure 12. The Shenzhen model of port governance.

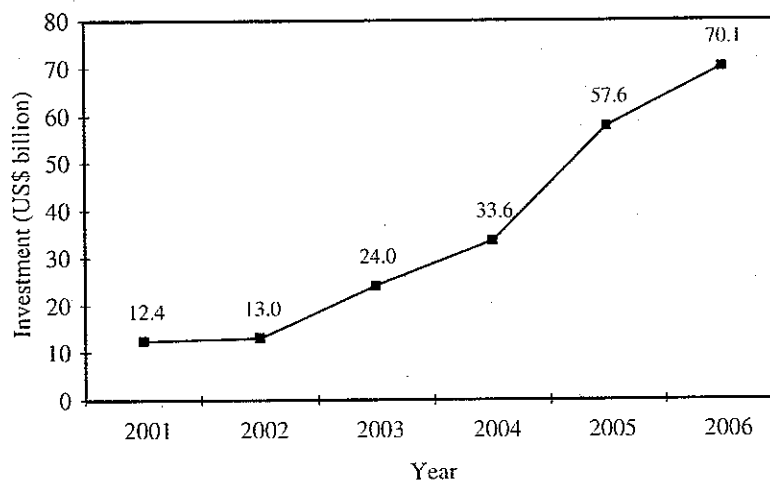
its port facilities. In the course of developing the Shenzhen Special Economic Zone, many port facilities were built and put into operations in a period between early 1980s and early 1990s. During this period, although major ports in other regions of China were still under financial control of the Ministry of Communication, Shenzhen was given a high level of sovereignty, having commercial organizations or consortiums to build and/or then operate its six port precincts. As a result, Shenzhen does not have a single port corporation, as in other port cities in China, which dominates the local port industry. Instead, it has at least three sub-models of running port business.

The first is that a state-owned corporation initially develop and operate port facilities and then form a joint venture with corporations from overseas. Yantian Port Precinct belongs to this sub-model. Shenzhen Yantian Port Group Co., Ltd originally built this precinct as container terminals and teamed with Hutchison Whampoa Limited in 1994 to establish a joint venture, Yantian International Container Terminal Co., Ltd, to run container-handling business.

The second sub-model covers Shekou Port Precinct, Chigang Port Precinct and Mawan Port Precinct. They were developed by individual commercial organizations and then other commercial organizations run the business of handling various cargoes in the precincts.

The last one is that individual corporations develop and operate port facilities. Xiatong Port Precinct and Shayuyong Port Precinct belong to this sub-model. For example, Xiatong Port Precinct was jointly developed and operated by three oil and gas corporations, and the cargo through the precinct is oil and gas.

To summarize, Shenzhen is special in a sense that commercial organizations rather than the Ministry of Communication were involved in the port industry right at the beginning of its existence, and that many port corporations, which are not subsidiaries of a dominant port group corporation like those in other port cities



**Figure 13.** Investment in coastal ports in China's coastal ports.

Sources: [8, 9, 10].

in China, run the port business. This situation is likely to lead to more competition and potentially to result in a more efficient port industry [16].

#### 3.4. *Diversification of industry ownership*

In order to build an efficient port industry to meet constantly increasing demand, China needs significant amounts of investment in port capacity expansion and in operations over a number of years. The amounts of investment in capacity expansion of its coastal ports between 2001 and 2006 are shown in figure 13. In addition to the funding from the government, these massive sizes of capital investment need to be sourced from other avenues, including the private sector, the public and overseas corporations.

In fact, China has taken a gradual and careful step to introduce non-state-owned ownership to the port industry at various stages of reforms. In order to attract foreign investments, in 1985 China promulgated the Interim Regulations of the State Council of the People's Republic of China on Preferential Treatment to Sino-Foreign Joint Venture on Harbour and Wharf Construction [16] and since then many corporations from overseas and their Chinese counterparts have established joint ventures in the port industry. By 2001 China has had 25 container terminals in the hand of Sino-foreign joint ventures [16]. The following are some examples of such joint ventures:

- In 2005, China Merchants Holdings (International) Company Limited in Hong Kong invested CNY5.6 billion (equivalent to about US\$705 million) to hold 30% share of Shanghai International Port (Group) Co., Ltd [22].
- Dubai Ports World and Yantai Port (Group) Corporation formed a joint venture, DP World Yantai Co., Ltd, to provide container-handling services [23].
- In 1994, Hutchison Whampoa Limited in Hong Kong and Shenzhen Yantian Port Group Co., Ltd established their joint venture of container handling, Yantian International Container Terminal Co., Ltd [24].
- In 2000, P&O and Qingdao Port (Group) Corporation founded a joint venture, Qingdao Qianwan Container Terminal Co., Ltd, to provide

container-handling services. In 2003, other two business partners joined the joint venture and P&O became the second largest shareholder having 29% share of the corporation valued at US\$887 million [25].

Other development in diversifying the ownership of the port industry has been to attract investment from the public. Some port corporations have been approved by relevant governmental agencies to raise funds on stock exchanges in China, which has broadened the spectrum of the industry ownership and made the public on the list of their shareholders. The following are some examples:

- In 1995, Beihai Municipal Port Co., Ltd was floated on the Shenzhen Stock Exchange.
- Jinzhou Port Co., Ltd floated its A (in Chinese currency) and B (in foreign currencies) shares on the Shanghai Stock Exchange in 1998 and 1999, respectively.
- Shanghai Port Container Co., Ltd, which is a joint venture between Shanghai International Port (Group) Co., Ltd and other four Chinese corporations, was floated on the Shanghai Stock Exchange in 2000. The raised funds have been used to build a container terminal in Waigaoqiao, which is run as Shanghai Port Container Co., Ltd, Waigaoqiao Terminal Branch [26].
- In June 2006, Shanghai International Port (Group) Co., Ltd made a decision to have the Corporation as a whole to be floated on the Shanghai Stock Exchange.

In summary, China has diversified the ownership of its port industry by having a large range of shareholders and made the situation, in which the industry is only state-owned, be history. The diversified ownership has certainly widened the avenue for the industry to access the investment required for its infrastructure expansion programmes.

### 3.5. *National and regional port development plans after the decentralization*

As an integral part of reforming the port industry, after the decentralization the Ministry of Communications and relevant provincial bureaus of communications are still in charge of port regulation and planning matters that are of national and provincial significance, respectively. This arrangement of governance is partly due to the following emerging issues.

The decentralization in 2002 helps to encourage local governments to develop the port industry within their own jurisdiction boundaries. They have proposed and implemented some projects that are more oriented to the local economies but may not be the best from a regional or national perspective. This may lead to some facilities being duplicated within neighbouring cities and being under-utilized.

A problem associated with the duplication is the use of coastlines. On the one hand, China in general has very limited coastline resource, especially coastlines with deep water, which is critical to constructing port facilities. On other hand, some cities have not exploited the potential of their coastlines, building small wharfs along deep-water coastlines because of financial constraints.

A port is a point on a regional transport network. Whether or not it can be consistent with the regional distribution of various economic activities of its hinterlands, depends on not only itself but also neighbouring ports and the transport systems connecting them together. It has become critical to take a regionally holistic view towards the development of port facilities in a city.

Historically, the above issues have not been difficult to deal with when those major ports were under the direct control of the Ministry of Communications. After the decentralization, the Ministry has tried on an *ad hoc* basis to co-ordinate port development initiatives to achieve a better outcome for the region. However, the Ministry needs a systematic and consistent approach to such issues in the long term, and promulgated in 2006 the National Layout Plan for Coastal Ports [2] as a national guideline for developing the coastal ports.

On the one hand, this national plan is required by the Port Act of the People's Republic of China 2004 [21]. On the other hand, the Ministry of Communications uses this plan as the bases to check the consistency of individual port master plans and/or projects, which are developed and proposed by individual ports, with corresponding national and/or regional strategies for the port development. A master plan or project, which fails to comply with the national development direction, is likely to be disapproved by the Ministry. Provincial port layout plans with a similar spirit to the national plan have been or are being developed by relevant provincial bureaus of communications.

#### 4. Discussion and conclusion

China is not alone in terms of reforming the port industry. Port reforms in various forms have also happened to other countries/regions [27–30]. To a large extent, all these reforms have adopted some commercial principles that are used in the private sector: commercialization, corporatization and privatization, and ended up with one of the Baird [31] port administration models, as shown in table 1.

Commercialization is for the government port authority to adopt some mindsets of the private sector. With this strategy, the government retains the ownership and control of the ports, but operational and management practices are changed to mimic those of the private sector, with an objective of improving the industry efficiency and productivity [32].

According to Everett [32], corporatization is for the government port authority to become more commercially oriented. In this process, the government retains the ownership, acting as a landlord and regulator, and a commercial management structure is introduced, with the port operations being transferred to the private sector.

A fundamental change to the publicly owned port authority is privatization, which transfers public assets to the private sector. This can completely sell an entire port land, as in some practice in the UK [31] or part of port services or operations. It can also lease or contract out of the whole or part of a port.

Table 1. Port governance models in other countries/regions.

Model	Port function		
	Land ownership	Regulation	Cargo handling
1. Pure public sector	Public	Public	Public
2. Public sector/private sector	Public	Public	Private
3. Private sector/public sector	Private	Public	Private
4. Pure private sector	Private	Private	Private

Source: [31].

Table 2. Features of China's port industry after the decentralization in 2002.

Port function	Organization	
Ownership	Public port infrastructure	Municipal port administrations
	Cargo handling facilities	Port corporations
Regulation	National port regulations	Ministry of Communications
	Provincial port regulations	Provincial bureaus of communications
	Municipal port regulations	Municipal port administrations
Planning	National/regional port layout plans	State Council and Ministry of Communications
	Local port layout plans	Local governments
	Port master plans	Municipal port administrations
Operation	Cargo handling	Port corporations

Against the above classification of port reform processes, the port industry in China has been corporatized, with involvement of a wide range of shareholders: state-owned organizations, domestic private organizations, and the general public and overseas organizations, of which the characteristics are summarized in table 2. It can be seen that the governance systems of the industry after the decentralization in 2002 are similar to the Baird second model with some deviations. Individual port corporations carry out operations of cargo handling in all ports in China, while corresponding municipal port administrations are in charge of regulation, planning and other governmental procedures, which can be largely characterized by the Baird second model. One deviation is that the cargo handling facilities such as wharfs and warehouses are not owned by municipal port administrations, and that they belong to corresponding port corporations, which can have a wide range of shareholders. The other difference is that the operations of cargo handling are carried out by port corporations, which are not wholly owned by the private sector. These port corporations have an ownership that are shared by state-owned organizations as well as non-state-owned organizations and individuals.

In general, the reform has paved the way for the local governments in port cities in China to proactively to enhance the competitiveness of their port industry, and offered them more administrative and financial sovereignty. The reform has also carefully allowed participation of diversified shareholders in the industry, which broadens funding sources for port infrastructure expansion and technology innovation programmes. More importantly, the reform has also made port development goals pursued by local governments be consistent with national or regional development objectives through national and provincial port layout plans, which are controlled by the Ministry of Communications and corresponding provincial bureaus of communications, respectively.

Consequently, volumes of freight handed in individual ports have in general been able to keep pace with the fast growth of China's economy, providing ever increasing capacities to handle gigantic quantities of raw materials required for fueling the economy and finished products supplied to both the domestic and international markets. For example, as shown in figure 8, container throughput in China's ports has been dramatically increased after the decentralization in 2002. It took four years between 1996 and 2000, when China joined the World Trade Organization, for the contain throughput to be increased from 8.0 million TEU

Table 3. Comparison of top container ports in China mainland and the world.

Year	Shanghai			Shenzhen			Singapore			Hong Kong		
	Rank	TEU	TEU growth (%)	Rank	TEU	TEU growth (%)	Rank	TEU	TEU growth (%)	Rank	TEU	TEU growth (%)
2000	6	5613	33.1	11	3994	33.7	2	17040	6.9	1	18100	11.7
2001	5	6334	12.9	8	5076	27.1	2	15520	-8.9	1	17800	-1.7
2002	4	8612	36.0	6	7614	50.0	2	16800	8.2	1	19144	7.6
2003	3	11370	32.0	4	10650	39.9	2	18100	7.7	1	20450	6.8
2004	3	14557	28.0	4	13650	28.2	2	20600	13.8	1	21984	7.5
2005	3	18084	24.2	4	16197	18.7	1	23190	12.6	2	22602	2.8
2006	3	21718	20.1	4	18468	14.0	1	24800	6.9	2	23234	2.8

Source: [7].



to about 22.6 million TEU; two years between 2000 and 2002, when China decentralized its port industry, for the container throughput to be increased from 22.6 million to 37.2 million TEU; and four years between 2002 and 2006 for the container throughput to be astonishingly increased from 37.2 million TEU to 93.0 million TEU. The average growth during the three periods has slightly diminished over years, with the corresponding average annual rate being 29.6% per annum, 28.3% per annum and 25.7% per annum. However, the absolute growth has increased, with an average increase of 3.7 million TEU per annum between 1996 and 2000, an average increase of 7.3 million TEU per annum between 2000 and 2002, and an average increase of 14.0 million TEU per annum between 2002 and 2006.

From an individual port's perspective, the development is equally impressive. Table 3 shows the growth of container throughputs of the top two container ports in China mainland and in the world. It can be seen that after the reform in 2002, Shanghai Port and Shenzhen Port became the third and fourth largest container ports in the world. Although their ranking has not been changed since, the corresponding growth rates have been maintained at two-digit numbers, while the two largest container ports, Singapore and Hong Kong, have had an annual growth of either low two-digit or one-digit values. With this development pace being maintained, it is likely that Shanghai Port replaces Hong Kong to become the second largest container port in the world in 2007 [7].

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