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REPORT OF THE PORT AND
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Research Perspectives for Improving the Productivity and the Sustainability of Port Management

Koji TAKAHASHI*

Synopsis

In 2011, the National Diet of Japan passed a law to implement the policy of International Container Strategy Ports, which would be applied to public-built private-management system and private company financing methods to container terminals at the main ports operated by Port Management Bodies which are local governments. It would also establish the port management corporation at each port in order to improve the productivity of container terminals throughout Japan. Port management corporations have already been established at several ports such as “Kobe-Osaka International Port Corporation” and “Yokohama-Kawasaki International Port Corporation”.

The purpose of establishing port management corporations for container terminals is to amend the rigid port management system by local governments, and to be prepared to provide a quick response to global economic changes and the wills of cargo owners and shipping companies. Current port management corporations, however, are facing various problems of management.

On the other hand, under the current economic environment, port management needs to make new capital investment to cope with the issues such as the tightening of carbon dioxide (CO_2) emissions regulations, and the improvement of an industrial safety and health environment for port workers.

Therefore, in this report, the author would like to first analyze the issues that current port management face, and then propose solutions for them, followed by proffering effective methods and scenarios to implement the solutions. At the end, a process will be proposed, as research perspectives for improving the productivity and sustainability of port management.

This report is based on the author’s research in seven fields of geography, engineering, finance, administrative law, business administration, risk management and politics. This report is the first systematic research on port management system as well as a groundbreaking one in the research history of port management.

Key Words: Port Management, Management Corporation, Productivity, Sustainability

* Senior Director for International Affairs and Research
3-1-1 Nagase, Yokosuka, Kanagawa 239-0826, Japan
National Research and Development Agency, National Institute of Maritime, Port and Aviation Technology, Port and Airport Research Institute
Phone：+81-46-844-5062 Fax：+81-46-844-0575 e-mail: takahashi-ko@pari.go.jp

港湾空港技術研究所報告
第 55 巻第 4 号（2016.12）

港湾運営の生産性および持続可能性の向上のための研究視点

高橋　浩二*

要　　旨

日本政府は、2011 年、日本全体のコンテナターミナルの生産性を向上するため、港湾管理者たる地方公共団体が管理する主要港のコンテナターミナルに公設民営および民間運営会社による港湾運営方式を導入し、港湾運営会社を設立する方針を出した。この方針を受けて、阪神港、横浜川崎港等ではすでに港湾運営会社が設立されている。

コンテナターミナルの港湾運営会社の設立の目的は、港湾管理者たる地方公共団体による港湾運営体制に代わり、世界的な経済変化や荷主・船社の意向に素早く対応できる港湾運営体制を整えることである。

一方、港湾運営は、二酸化炭素排出規制の強化や、労働安全環境の改善等に対応しなければならない経済環境に置かれている。

このため、筆者は、本報告で、まず、現行の港湾運営制度を、地勢学、工学、財政学、行政法学、経営学、危機管理学、政治学の 7 つの観点から分析し、課題を明らかにした。最後に、これらの効果的な解決策および港湾運営の生産性および持続可能性の向上のための研究視点を示した。

なお、筆者は、港湾運営に関し、上記の7つの分野における最新の研究を取り入れ、国内外のジャーナルや学会に多くの査読審査付き研究論文（主筆13編）を発表してきた。本報告はこれらの研究成果を体系的網羅的に取り纏めたものであり、同時に期せずして港湾運営方式を体系的網羅的に研究した研究成果となった。

筆者は国外の多くの港湾経営者や研究者等から研究成果を英文で公表するよう強い要望を受けたため、本報告を英文で執筆した。

キーワード：港湾運営、運営会社、生産性、持続可能性

＊ 国際主幹　兼　特別研究主幹
〒239-0826　横須賀市長瀬3-1-1　国立研究開発法人　海上・港湾・航空技術研究所　港湾空港技術研究所
電話：046-844-5062　　Fax：046-844-0575　　e-mail: takahashi-ko@pari.go.jp

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Contents

1. Introduction

To get this report started, the author presents an overview of the current state of stakeholders concerned with port management in Japan. Stakeholders of Japan are very complicated as well as more numerous than those of the world as shown at **Table 1.1**.

The Port and Harbor Law of Japan gives the authority and responsibility of Port management to the "Port Management Body". According to this law, the Japanese "Port Management Body" is classified into "Prefecture", "Municipality", "Port Authority" and "Administrative Association" which consists of two or more local governments.

Table 1.2 and **Figure 1.1** show the calcification, numbers and locations of ports in Japan. As shown at **Table 1.3**, there have been established 166 port management bodies in Japan. The breakdown of them is as follows: 39 are prefectures, 120 are Municipalities, 1 is Port Authority and 6 are Administrative Association. As all of them are local governments, no port management bodies have ever been independent from the local government systems. Although "Port Authority" has the same name as ones in U.S.A., Canada and EU, Japan's is significantly different from others. Unless it is necessary to discern them exactly in this report, the author describes "Port Management Body" as "Local Government".

Figure 1.2 shows that there are many stakeholders in terminal operations. A terminal operator contracts port transport companies to handle container cargo. Terminal operators are composed of three business groups historically which are affiliated with a shipping company, a warehousing company and a port transport company. When port workers are short, these companies may contract with sub providers as an original prime provider.

Port workers have organized an industrial labor union. They are employees of port transport companies, warehousing companies, port truck companies and so on. As port workers are employees of these private companies, Japanese employment form is different from that of U.S.A. and other foreign countries. The industrial labor union does not dispatch port workers to container terminals, which is different from the labor unions in USA such as International Longshore and Warehouse Union: ILWU and International Longshoremen's Association: ILA.

Table 1.1 Stakeholders of Port Management

Source: The author created this table based on author's research.

U.S.A.	**Japan**
Port Authority Terminal Operator Labor Union	National Government Port Management Body Port Authority Local Government Administrative Association Port Management Cooperation Terminal Operator Port Corporation Port Transport Business Prime Provider Shipping company Warehousing company Pure-play company Sub Provider Pure-play company Labor Union
EU	
Port Authority Terminal Operator Labor Union	
U.K.	
Terminal Operator Labor Union	

Table 1.2 Classifications and Numbers of Ports

Source: "List of Port Management Bodies" of MLIT (2016)

Classification		
International Strategic Ports	Extremely Significant Role for International Trade	5
Major International Ports	Significant Role for International Trade	18
Major Ports	Significant Role for Mainly Domestic Trade	102
Local Ports	Role for local area's trade	808
Article 56 Ports	Designated Water Ares	61
Total		994

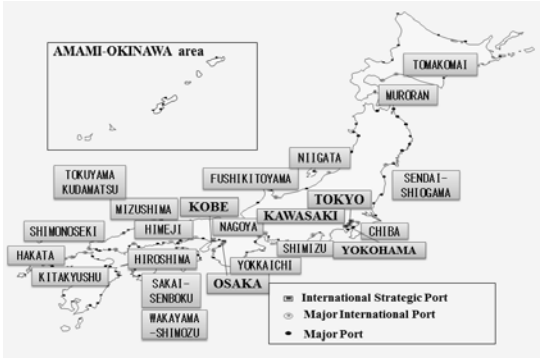

Figure 1.1 Locations of Ports in Japan

Table 1.3 Type of Ports and Port Management bodies

Note: (*) shows numbers of “Ports of Refuge”. Total includes number of “Ports of Refuge”.

Port Management Bodies governing several types of ports are classified into the high rank division.

Source: “List of Port Management Bodies” of MLIT (2016)

		Port Management Body			
Division	Total	Prefecture	Municipality	Port Authority	Administrative Association
Int’l Strategic Ports	5	1	4	0	0
Major Int’l Ports	18	11	4	0	3
Major Ports	45	25	16	1	3
Local Ports	98	2	96	0	0
Total (*)	166 (29)	39 (23)	120 (6)	1 (0)	6 (0)

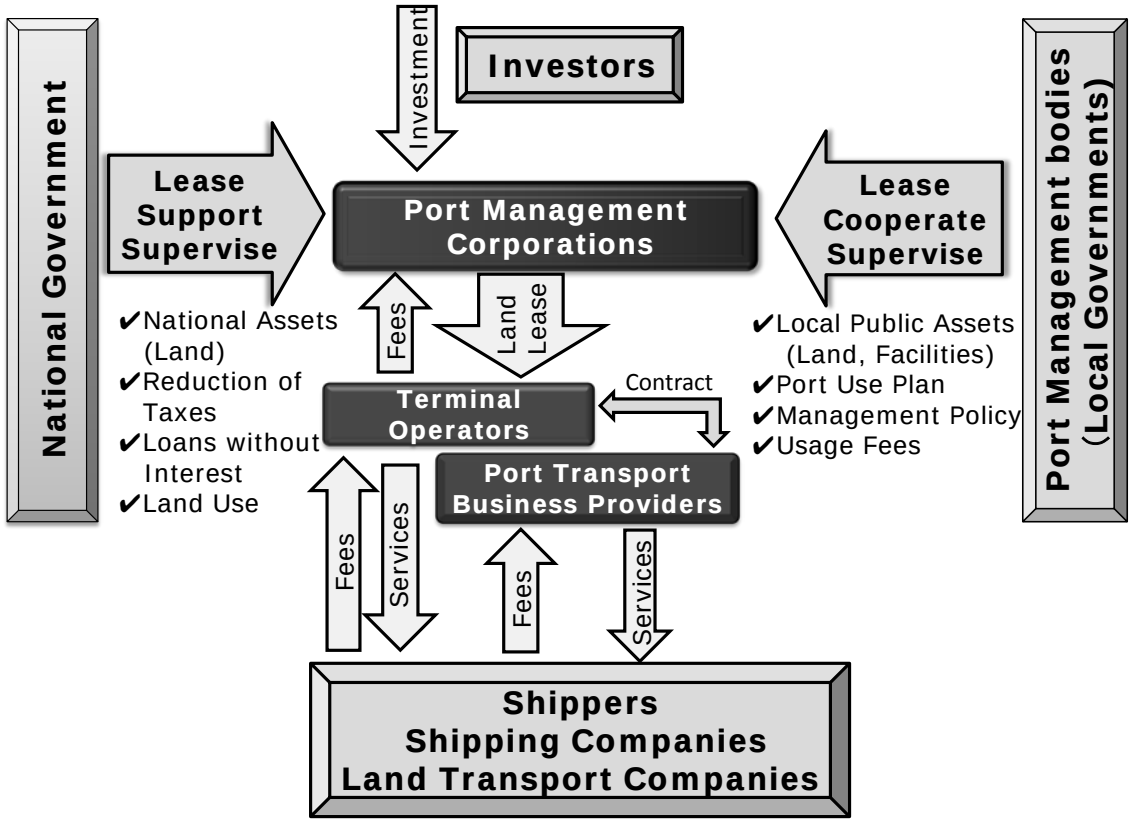

Figure 1.2 Correlation Diagrams of Concerned Parties of Port Management

Source: The author created this figure based on Acts of Japan.

The local government has to plan, construct and manage its ports by the law. If the local government needs the national government's support and the national government determines that it is necessary to intensively support based on the national strategic policy, the local government can receive subsidies for construction of port facilities such as deep-sea breakwaters, deep-sea quays and so on.

It does not mean that the national government has never done anything, but its participation in port management is limited to providing subsidies for construction of various port facilities and to examining whether the port plan is suitable for the national strategic policy.

Insofar as container terminals, port management by the local government is not productive. Therefore, many policies for improving the productivity of container terminals have been carried out in Japan such as spinning off profitable business, privatization, and concession which is the so-called 'scheme of separating infrastructure ownership and management'.

Major local governments established "Public/Private Port Corporations" to construct and manage container terminals instead of doing it themselves. However, Port corporations were limited to constructing container terminals and leasing them to terminal operators individually. This situation caused a result to be unproductive. The first reason was that these corporations had to construct deep-sea container terminals with their own resources, but they could not get sufficient income in spite of immense construction costs. The second reason was that these port corporations and local governments had the overlapping role in a port to lease terminals to terminal operators. As a result, some port corporations such as Kobe Port Corporation fell into absolute insolvency.

With the purpose of improving this situation, a system wherein one port management corporation manages all container terminals in the same port has been established based on a scheme of separating infrastructure ownership and management (the so-called "public-built private-management system") by the leadership of the national government. In the background where local governments had agreed to the establishment of port management corporations, there were circumstances where local governments were plagued by the absolute insolvency of port corporations and had expected port management corporations to repay the debt owed to the local/national government and commercial banks with their operating profits.

What kinds of advantages are these port management corporation systems expected to have?

The port management corporations borrow the real estate and port facilities constructed by the national/local government cheaply and lend them at a reasonable price to terminal operators. In other words, this corporation is the real estate lease business to run with a profit margin by subletting lands and port facilities. As the only one port management corporation managing all container terminals in one port, this corporation is expected to improve the productivity not only by concentrating investment on the latest container terminal but also by cleaning up surplus container terminals. This corporation may promote reorganization of container terminals in Japan. In the future, through the integration of port management corporations, one corporation will become able to manage the productivity of all container terminals in International Strategic Ports, Major International Ports and Major Ports.

On the other hand, a new policy was necessary for the National Government to participate in port management and to realize the scheme of separating infrastructure ownership and management by the leadership of the national government. In 2011, the National Diet of Japan passed a law to implement the policy of International Container Strategy Ports.

As thus far described, Port management corporations have been established as private stock companies for earning a great deal of money as well as realizing the policy of International Container Strategy Ports by playing a role in managing container terminals. However, now, they face the various managing issues as mentioned in this report, which make their initial objectives difficult to achieve.

However, there have not been many exhaustive analyses focusing on the issues and scenarios that provide specific solutions for them. Therefore, the author has been undertaking comprehensive analyses on port management, and its various research that has been presented as the following series of the author's past research on port management.

Takahashi et al. (2013e, 2013f) stated the need to integrate facilities for container terminals by reducing surplus facilities, in accordance with Japan's geographic characteristics from the perspective of physical geography, in order to improve the productivity of container terminals in Japan. Takahashi et al. (2013b, 2014d) and Kasugai et al. (2013) argued that the fiscal conditions of local governments, as port management bodies had been deteriorating due to an increase in the capital costs and administrative and maintenance expenses of the ports to be reduced and integrated. Takahashi et al. (2013c, 2015b) pointed out that a rise in the capital costs and administrative and maintenance expenses should be compensated by injecting local taxes. Takahashi et al. (2013d) also verified the current port management system operated by local governments with the objective of Japan's legal system, and pointed out the situation of a global port operation being constrained by the Local Autonomy Act of Japan. Furthermore, Takahashi et al. (2013a, 2013g, 2014a) insisted that an integrated operation of container terminals throughout Japan is necessary, in order to build the sustainability in port management, which is resistant to large-scale natural disasters expected to occur in the future. According to Takahashi et al. (2014b, 2014c), what is inevitable to implement solutions for the issues is not leaving it to the initiative of local governments but the powerful leadership of the national government.

On the other hand, in the current economic environment, port management needs to make new capital investment to cope with the issues such as the tightening of CO_2 emissions regulations, a lower birth rate with longer longevity, and the improvement of an industrial safety and health environment for port workers.

For this reason, the author conducted intensive surveys on cargo owners, shipping companies, port transport business providers, the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) and port management bodies, in order to specify the factors that were hurdles to resolving the issues and to clarify the current economic environment of port management. Based on the analyses, finally, Takahashi (2015a) proposed the management strategy for port management corporations.

This report shows detailed solutions in **Chapter 9**, as well as conclusions of the author's past research mentioned in **Chapter 2** to **Chapter 8**, to the issues on the current port management system of Japan.

This report aims to specify the issues that stakeholders face, social economic problems to be dealt with, strong points and challenges of the port management corporations, new objectives and solutions that the national government advocates, the necessity of third parties, several scenarios in which the founding purposes of the port management corporations are realized, and the process of integration of the port management corporations into one corporation in Japan as their business strategies. The author verifies them in **Chapter 8** and **Chapter 9**.

Finally, the author shows conclusion and summary of this report in **Chapter 10**.

Note: Productivity and Sustainability

'International competitiveness' is non-existent concept in this report and is frequently used wrongly instead of 'productivity' or 'sustainability' in Japan. The author uses productivity and sustainability in this report according to the definitions by Business Dictionary (2016).

2. Analysis on Geographical Characteristics

2.1 Overview and Issues

Shipping companies consider two types of factors when setting up trunk shipping routes for international container transportation. The first is geographical factors, such as geographical positions on a global scale, sea area conditions to set up shipping routes, economic sizes of port hinterlands, and international affairs. The second is factors related to means of transportation, such as scales and functions of container ships and container terminals. Fujita・Krugman・Venables (1999) showed why ports and other transportation hubs become sites for cities. By focusing on the "economic activity density" and "vertical depth" of the port hinterland, which are the least studied among geographic characteristics so far, an analysis of the geographical characteristics of ports throughout the world clarified that three types of ports exist in terms of port placement:

a. "Continental hub port type," which has dense economic activity and is large in vertical depth;

b. "Marine hub port type," which has low density economic activity and is small in vertical depth; and

c. "Japanese-type," which has dense economic activity and is small in vertical depth.

The analysis also clarified that, to prevent further decreases in the shares of economic activity in other countries, Japanese-type ports are required to implement a balanced minimization policy that does not depend on improved indexes of overseas transshipment ratios but on the integration of port facilities.

2.2 Current Status of the Placement of Container Ports throughout the World

Visual checks of aerial views in Google Maps confirmed that mooring facilities exist that are dedicated to containers in more than 435 ports in 125 countries around the world. **Figure 2.1** shows the locations of top 100 ports confirmed as holding container facilities.

Figure 2.2 indicates, by country, the number of ports with mooring facilities dedicated to containers, particularly in the 15 countries with a relatively larger number of ports. China has the largest number of ports, followed by Japan, U.S.A., Germany, and Spain. Considering that China is at the top and U.S.A. is in third place, the number of ports that these countries possess is reasonable, because of their huge land areas and trading volumes. Germany has a large number of inland-river ports along the Rhine water system, but only four ports in direct contact with the open sea at which large container ships can call. Spain has mooring facilities for containers at many ports on the Canary Islands, resulting in a relatively large number of ports. Relative to these countries, the number of ports in Japan is extraordinarily large given its land area.

Figure.2.1 Locations of Ports Holding Mooring Facilities, Dedicated to Containers
Note: Top 100 Ports Handling Container Cargo Volume

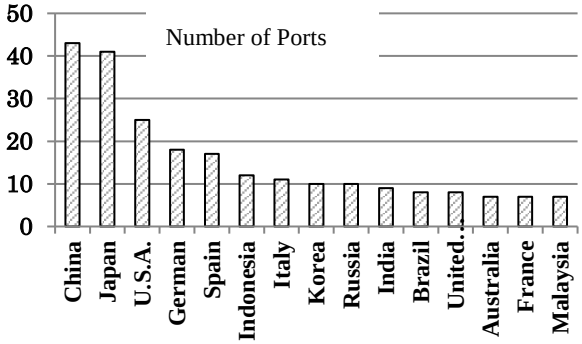

Figure 2.2 Number of Ports by Country Holding Mooring Facilities Dedicated for Containers

Figure2.3 shows, for each region of the world, the status of ports holding mooring facilities dedicated to containers. In this summary, inland-river ports limiting the calling of large container ships are separately counted. Overall, East Asia and Europe have the largest number of container handling ports. As of 2010, the East Asian regions including China had the

largest proportion of the approximately 100 ports that handled 1 million TEU (Twenty Foot Equivalent Unit) or more per year, followed by European regions, North American regions including the Atlantic and Pacific regions, and Southeast Asian regions. Likewise, the East Asian region including China, Japan, South Korea, and Taiwan has the largest share of the approximately 20 ports in the world that handle 5 million TEU, followed by Southeast Asia and the Atlantic coast region of Europe. A review of America shows that large-scale container ports exist on both the Pacific side and the Atlantic Ocean side. The Middle East region's large-scale port is in Dubai.

As previously mentioned, East Asia, the Atlantic coast region of Europe, and North America are aggressively engaged in economic activities; thus, against this background, that large-scale container ports are thriving is fully understandable. However, large-scale container ports have emerged in Southeast Asia and the Middle East because they handle not only import and export cargo generated from their hinterlands but also many transshipment cargo.

Moreover, in relation to those container ports, noticing that relatively large-scale container ports are economically viable is important even in areas in which no large islands and economic activity islands exist and in which the generation of cargo cannot be expected because of their sluggish economies. Therefore, the ports are running smoothly only through transshipments between container ship routes.

In addition, many inland river ports are seen handling containers along the Rhine water system, the Chan Jiang River water system, the Danube River, the Amazon, the Rio de la Plata, the Congo River, and others. These inland river ports, at which large-scale container ships call, contribute to the formation of their hinterlands and are reasonably regarded as complementing and replacing land transportation.

2.3 Classification by Economy Density

Figure 2.4 shows the nominal values of GDP per inhabitable land area in the 15 top countries with more than U.S. $1 trillion in GDP for fiscal year 2012. In Japan, GDP per inhabitable land area was prominently high among these countries.

Furthermore, **Figure 2.5** shows the value gained by dividing the national land area by the shoreline. This dimension as a distance is viewed as representing the depth of the country for the shoreline. However, the length of the shoreline is known to vary depending on the measurement scale used, which is a classical fractal problem. Although stating that the absolute values directly represent the values of the depth of national lands is difficult, using the indexes for a relative comparison of countries or regions may be possible. For example, according to **Figure 2.5**, the national land area per shoreline of Japan is 1/100th that of Brazil, the largest, and 1/50th that of China, the second largest. Converting these values into relative relationships of ports and their hinterlands shows that the hinterlands of the ports in Japan are extremely narrow and have almost no depth compared with ports located on continents.

As previously described, compared with lands of other countries, Japan's land is high in the density of economic activity but spatially narrow considering the extension of its shoreline; therefore, Japan's land is viewed as having quite a unique geographical and spatial structure. As a result, Japan has established many ports as its basis of local economic activity.

2.4 Classification by Sea Distance between ports

Figure 2.6, **Figure 2.7**, and **Figure 2.8** show the number of container ports for every 500 km of distance within a total distance of 5,000 km in the three regions of the Atlantic coast of Western Europe, Southeast Asia, and East Asia. These figures are regarded as showing the patterns of distance distributions in which the targeted major ports have their own centeredness.

Distribution patterns by distance range of major ports in Europe shown in **Figure 2.6** and of those in Southeast Asia shown in **Figure 2.7** are relatively uniform and no significant difference exists among them. Almost no geographical distance advantage exists for container ports among the major ports in Europe; therefore, their current relationships are deemed likely to be maintained.

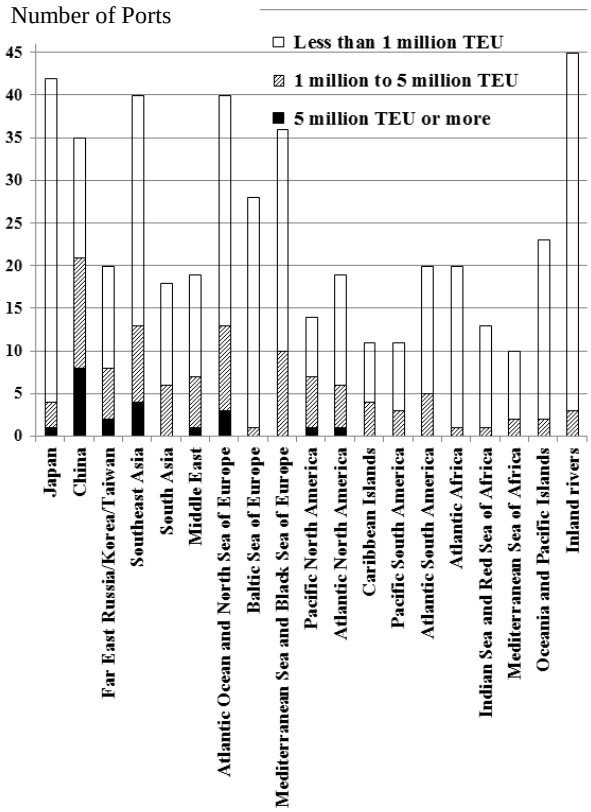

Figure 2.3 Number of Ports by Region Holding Mooring Facilities Dedicated to Containers

Source: Containerization International Yearbook 2012.

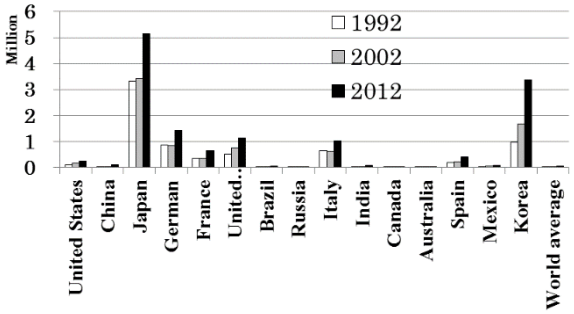

Figure 2.4 GDP per Inhabitable Land Area (Nominal Value)

Source: World Economic Outlook Database 2013, IMF
THE WORLD FACT BOOK, CIA
State of the World's Forest 2009.FAO

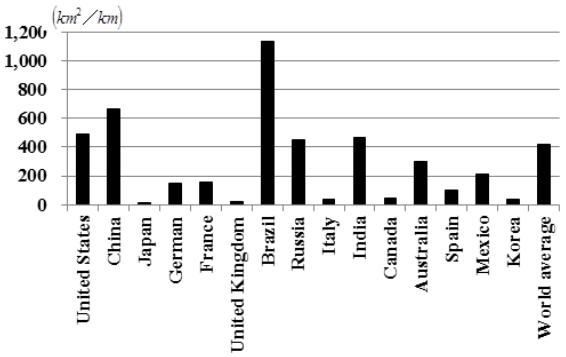

Figure 2.5 National Land Area per Shoreline

Source: THE WORLD FACT BOOK, CIA

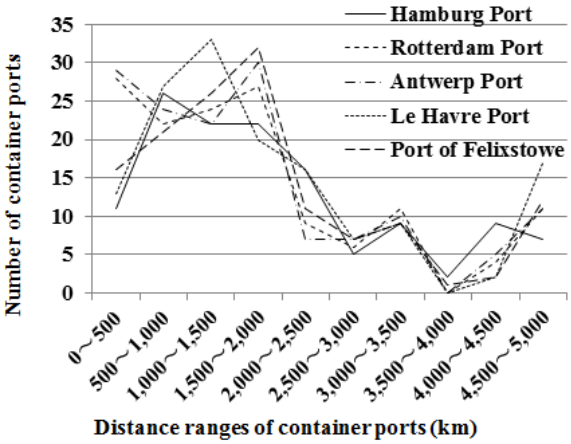

Figure 2.6 Distances to Container Handling Port from Major Ports (Atlantic Coast of Western Europe)

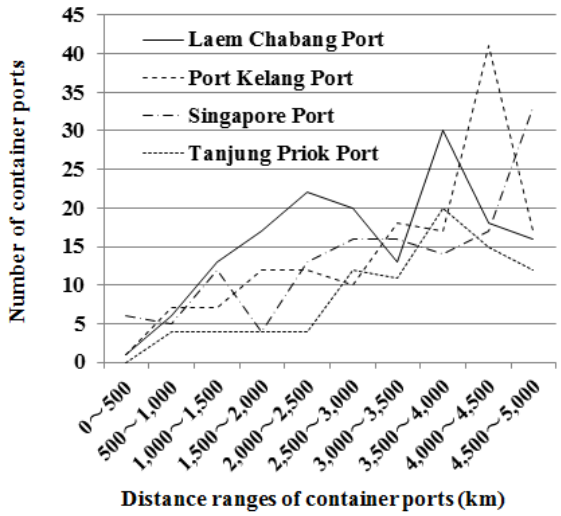

Figure 2.7 Distances to Container Handling Port from Major Ports (Southeast Asia)

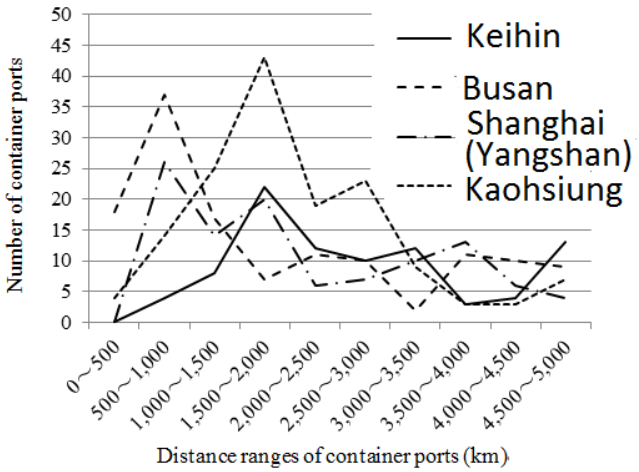

Figure 2.8 Distances to Container Handling Port from Major Ports (East Asia)

Regarding Southeast Asia in **Figure 2.7**, the Singapore Port is far advanced in terms of expansion of scale, followed by other ports. These four ports are far from one another relative to those in Europe. Nevertheless, these ports have no difference in geographical advantage because few ports exist in the vicinity of Southeast Asia, and many ports in the region are larger in scale and, therefore, distributed across long distances rather than at short distances. Regarding future competition among ports, a good possibility exists that the ports in this region that compete with those in East Asia, Europe, North America, and other regions are located at long distances in an attempt to acquire positions of hub ports in the global network by collapsing the existing pattern.

Figure 2.8 shows the major ports in East Asia, which are very different from one another in terms of geographic advantage—quite different from ports in Europe and Southeast Asia. A comparison of Busan Port in Korea and Keihin Port (Tokyo, Kawasaki and Yokohama) in Japan shows that quite a number of ports are within a 1,000-km distance to Busan Port in the eastern part of China and Japan, and this port is clearly in a position to more easily collect cargo through short-distance feeder transport. In addition, the port also faces Tsushima Straits, which converges shipping routes. Clearly, Busan Port is in a more advantageous position for cargo collection for marine transportation than Keihin Port in Japan, which is located at the far-east end of the East Asian region. Kaohsiung Port covers a distance of 1,500 to 2,000 km, whereas Keihin Port covers a distance of 0 to 5,000 km but offers no geographical advantage for this specific distance covered.

An analysis of the patterns of the distances among these ports showed that the strategic international container policy that aims to attract overseas transshipment cargo from, for example, Busan Port to Japanese ports is contrary to Japan's geographic characteristics. Thus, this analysis indicates that not much of an effect is expect from the strategic international container policy.

2.5 Classification of International Container Ports

Table 2.1 shows the result of the classification of ports around the world based on geographic characteristics. Broadly, the number of continental hub ports is the largest. Many of them have wide-area, low-density hinterlands that are structured to collect the cargo generated in those vast hinterland areas. The ports in Japan have the extreme opposite characteristics of such continental ports. Although Japan's ports have very narrow hinterland areas, the economic activity is extremely dense and many container handling ports are placed there. The hinterlands of the ports in Europe are classified into an intermediate position between these two extremes.

Regarding the classification of the world's leading international container ports by whether they depend primarily on land transportation or marine transportation to collect cargo, the representative ports depending on land transportation are those along the Atlantic coast, such as Amsterdam and Antwerp in the EU, almost all major ports in U.S.A. including Long Beach, Los Angeles and NYNJ, and major ports in China such as Shanghai and Dalian. The same point is relevant for the major ports in Japan, such as Keihin and Hanshin, and the ports of Melbourne and Sydney in Australia. Characteristically, the ratio of transshipment is low for the volume of containers handled at any of these ports, and their hinterlands have sizable economic activity. However, such a large-scale economy in the hinterland can be subdivided into the following three cases:

a. the area of the hinterland is wide;

b. the area of the hinterland is narrow but the economic activity is dense; and

c. the area of the hinterland is wide and economic activity is dense.

Table 2.1 Number of Container Handling Ports

Classification		Representative Ports	
Continental hub port type			75
Wide-area, low-density type		LA/ LB, NYNJ, Virginia, Melbourne, Shanghai.	56
Wide-area, high-density type		Rotterdam, Hamburg, Le Havre, Felixstowe, Southampton	15
Narrow-area, extra-high-density type		Keihin(Tokyo, Kawasaki, Yokohama), Hanshin(Kobe, Osaka), Isewan (Nagoya, Yokkaichi), Northern Kyushu(Hakata, Kitakyushu, Shimonoseki)	4
Marine hub port type			31
Obstructing-terrain type	Narrow-terrain type	Singapore, Dubai, Tanger, Balboa, Port Said	12
	Protruding-terrain type	Gioia Tauro, Salalah, Jeddah, Algeciras, Port Elizabeth	10
Remote isolated-island type		Marsaxlokk, Freeport, Las Palmas, King Stone.	9
Container/Marine hub port type		Busan	1
Locally demand type			328
Total			435

Note: Boundary condition

a. Hinterland GDP: Over $500 billion

b. Wide-area, low-density:
Over 3 million km^2, bellow $0.1million/km^2

c. Wide-area, high-density:
0.03-1 million km^2, bellow $0.5million-3million/km^2

d. Extra-High-Density:
Bellow 0.05 million km^2, over $3million/km^2

e. Remote Isolated Island type is far more than 50 nautical miles from the ports and routes

f. Narrow-terrain type is located in the waterway where all container routes are concentrated.

g. Protruding-terrain type is located in the waterway where at least one route detours around.

In contrast, representative ports that heavily rely on marine transportation include those in Singapore and Marsaxlokk (Malta), Salalah (Oman), and Freeport (Bahamas). Any of these ports belong to either one group of ports with land areas such as straits, canals, or protruding land terrain that converge shipping routes by obstructing geographic features to constrain the cruising of ships or the other group of ports on islands far from continents, making them appropriate for connecting shipping routes.

Therefore, major container handling ports in the world appear to be classified into two types: the continental hub port that has a hinterland, is located on a continent, and engages in large-scale economic activity, and the marine-hub port that forms a shipping route hub located in a sea area with high geographical advantage. Busan Port, which has a large-sized hinterland and the geographical advantage of facing the Tsushima Strait, represents both types of ports and accepts numerous transshipments.

In addition, small ports that handle a relatively small number of containers have minimal volume in response to demand for marine transportation by the hinterland. Such ports and island ports, if classified, are ports responding to regional demands.

A comparison of the geographical advantages of ports based on distance between ports shows that ports in Europe and Southeast Asia are not different given their balanced geographical advantages. In contrast, Japanese ports represented by Keihin Port have no geographical advantage.

As was shown, relative to other countries, land in Japan has special geographical characteristics, such as being conspicuously high in economic activity density and spatially narrow to the coastline, and the ports have no geographical advantage in terms of the distance between them. The results of this research enabled the author to clarify that Japan has special geographical characteristics compared with the many ports in the world that are viable as the base of regional economic activity. Thus, the author credibly presented this world's first research result.

2.6 Growth Scenarios toward International Container Hub Ports

For international marine container transportation, hub ports exist at which large container ships call and non-hub ports exist in the main trunk sea route networks. The author considers the type of growth scenario of the ports that have

established themselves as international container hub ports. The author argues that, in principle, ports should appropriately enhance their "port services" and secure a "certain scale of container handling volume at all times on the premise of their geographical conditions." As previously described, the container handling volume of a port greater than that of other competing ports increases the likelihood of a port becoming a hub port in the region. This concept can be simply expressed by **Equation (2.1)**.

$$Qp = Qg + Qt \geq Qpc \tag{2.1}$$

where Qp refers to the port's container handling volume, Qg refers to the containerized cargo volume generated in the hinterland, Qt refers to the containerized cargo volume by transship, and Qpc refers to the containerized cargo volume required for an international container hub port to be established as such. If **Equation (2.1)** is assumed, the growth scenario for the port to become a hub port is that for which Qpc is increasing yearly with an expansion of the world economy, the growth scenario to improve the cargo booking structure for land transportation aims primarily at increasing Qg, and the growth scenario to improve the cargo booking structure for marine transportation aims primarily at increasing Qt.

2.6.1 Growth scenario to improve the structure of cargo collection for land transportation

As a whole, the growth scenario involves the attempt to expand the scale of the port by implementing expansion measures to improve the scale of economic activity such as promoting the efficiency of cargo collection networks, including the development of roads, railways, and river transportation facilities into the hinterland and preparing conditions to establish new business facilities there, while taking advantage of the larger scale of the hinterland and maintaining a certain distance from other neighboring ports. Because transshipment is done primarily between land and sea at first, transshipment handling volume is generally low. Through this development process, the likelihood of becoming a hub port increases, and if shipping routes are densely disposed with an increase in container handling volume, further efforts to become a hub port are made through an increase in transshipment cargo volume by taking advantage of converging shipping routes. The expansion of major ports of China in recent years is viewed as conforming to this growth scenario.

2.6.2 Growth scenario to improve the structure of cargo collection for marine transportation

The promotion of invitation of shipping routes for selected use of the port and realization of the convergence of shipping routes by using the geographical advantage of being located near straits, alongside canals, or on islands enables the formation of a marine network hub to enhance the likelihood of becoming a hub port. In particular, efforts need to be made to secure an institutional advantage to strengthen the relay function for marine transportation. Because transshipments are done primarily between sea and sea, transshipment handling volume is generally high at first. Then, increasing the volume of cargo generated in the region behind the port by securing new economic activity space and leveraging the advantage of the location for industrial sites for international logistics against this background will enhance the likelihood of the port becoming a hub port. This growth scenario is seen in the Singapore port and the Dubai port.

2.6.3 Growth scenario to improve the structure of cargo collection for land and marine transportation

Growth scenarios 2.6.1 and **2.6.2** are to be promoted in parallel. The corresponding case is Busan port.

Qp is represented in the following equation:

$$Qg = \int_A q dA = A \cdot \overline{q} \tag{2.2}$$

where A refers to the land area of the hinterland, q refers to the generated volume of container cargo at any position in the hinterland, and $\overline{q}$ refers to the average generated

volume of container cargo per hinterland land area.

According to **Equation (2.1)** and **Equation (2.2)**, for Qp to exceed Qpc in the growth scenario to improve cargo collection for land transportation, attempting to increase any one or more of Qt, A and $\overline{q}$ is necessary.

Figure 2.9 indicates changes in the ratios of GDPs by region of the world, including projected ratios, and shows a downward trend in the scale of economic activity in Japan, North America, and the EU relative to that of the world. Simultaneously, the ratio for the Asian region excluding Japan is significantly increasing. In the East Asian region in which the economic activity ratios of countries other than Japan have been relatively increasing, only Japan has experienced a decrease in its ratio, which is significantly different from the overall downward trends in the ratios for the EU and North America. These patterns reflect the increasing trend in transshipments of international cargo coming from and going to Japan through other countries in East Asia.

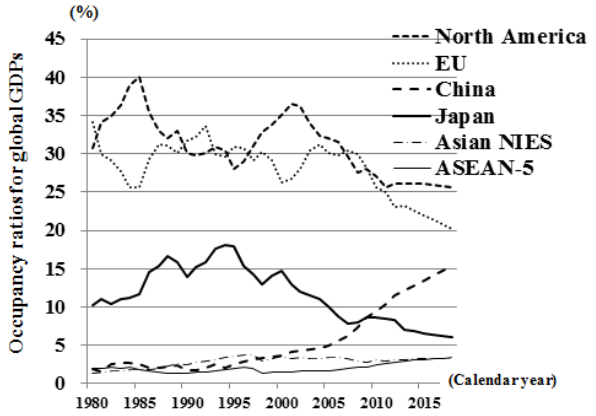

Figure 2.9 Trends in GDPs by Regions of the World
Source: World Economic Outlook Database 2013, IMF

2.7 Structure of Cargo Collection for Land Transportation

Figure 2.10 shows GDP values per inhabitable land area in **Figure 2.4,** indexed to a world average of "100". Thus, Japan's density of economic activity is still one of the highest in the world but, relatively, is on a declining trend.

Increasing container cargo volume generated in the hinterland requires an increase in either container cargo volume per land area generated in the hinterland or the spatial size of the hinterland. Container cargo volume per land area depends on the density of the economic activity and the efficiency of transportation in the hinterland. However, as shown in **Figure 2.10**, Japan's density of economic activity is on a relatively declining trend. Therefore, no other way exists to realize a growth scenario to improve the structure of cargo collection for land transportation except to work on the expansion of the spatial size of the hinterland. Achieving this goal by reorganizing port functions is possible, as mentioned in "International Strategic Container Ports," Japan's current policy on its major ports. However, "International Strategic Container Ports" aims to acquire direct transshipment cargo. In contrast, the main target of the growth scenario to improve the structure of cargo collection for land transportation is to acquire hub port positions.

In actuality, reducing the number of candidates for container handling hub ports to concentrate on and integrate the hinterlands is necessary. Port policies developed to date throughout the world are all premised on economic growth, and no predecessors exist in the reorganization of port functions by selective concentration.

If the hinterlands are integrated by reorganizing port functions, their depths from the coastline remain the same but their expansion will follow the direction of the coastline. By simplifying this matter into the relationship between the depth of the hinterland and the intervals between ports, the author experimentally attempted to discuss integration of port functions and the horizontal to depth ratio of the hinterland. As the simplest model, suppose that ports are placed at the same interval along the country's monotonous straight coastline. The author then considers the effects of integrating the hinterlands in the directions of the coastline. **Figure 2.11** graphically represents all of these prerequisites.

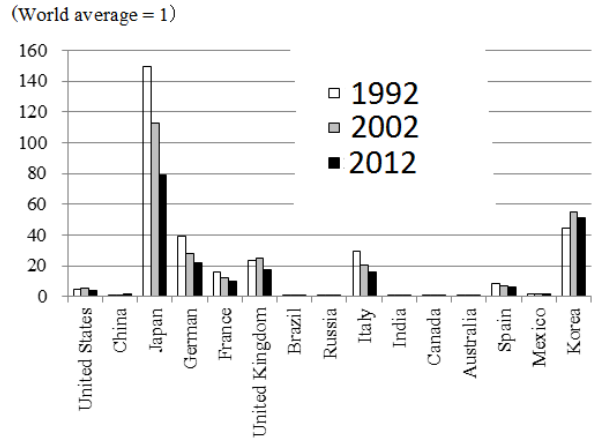

Figure 2.10 GDP per Inhabitable Land Area

Source: World Economic Outlook Database 2013, IMF
THE WORLD FACT BOOK, CIA, State of the World's Forest 2009.FAO

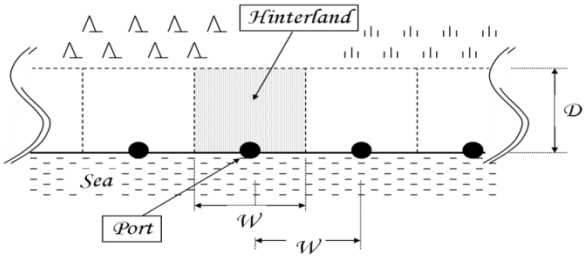

Figure 2.11 Simplified Image of Hinterland

Cargo volume per unit area q is generated at a certain point in the hinterland of a port, as previously mentioned, and the cost required to ship the volume via the port is *ct*, which is represented in the following equation:

$$ct = cl + cp = \alpha \cdot r \cdot q + \beta \cdot q = (\alpha \cdot r + \beta) \cdot q \tag{2.3}$$

where *cl* refers to the cost related to the workload including land transportation distance; *cp* refers to the cost related to the cargo volume including cargo handling at the port; r refers to the land transportation distance; α refers to the cost required for a unit-distance transportation of a unit cargo volume; and β refers to the total sum of the costs required to handle a unit of cargo volume at the port. If the area of the region of the hinterland of the port is represented by *A*, the cost for cargo transportation related to the port in the entire hinterland is expressed as follows:

$$Cl = \int_A \alpha \cdot r \cdot q dA = \alpha \cdot q \int_A r dA = \alpha \cdot q \cdot S \tag{2.4}$$

$$Cp = \int_A \beta \cdot q dA = \beta \cdot q \int_A dA = \beta \cdot q \cdot A \tag{2.5}$$

In **Equation (2.4)**, *S* forms the primary moment that defines as the pole the position of the rectangular port representing the hinterland. To calculate this *S*, the coordinates are set up as in **Figure 2.12**.

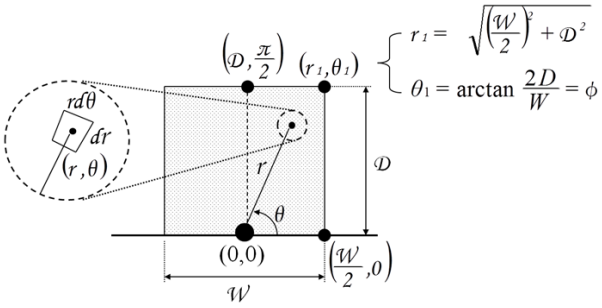

Figure 2.12 Definitions of Coordinates

If the average transportation cost throughout the hinterland is represented by $\bar{c}t$ and the average transportation distance throughout the hinterland is represented by $\bar{r}$, then equations are set up as follows:

$$\bar{\delta} = \frac{\bar{r}}{D} \tag{2.6}$$

$$\delta p = \frac{\beta}{\alpha \cdot D} \tag{2.7}$$

Then, **Equation (2.3)** can be expressed as follows:

$$\frac{\bar{c}t}{\alpha \cdot q \cdot D} = \bar{\delta} + \delta p \tag{2.8}$$

In addition, if equations are set up as follows:

$$\eta = \frac{W}{D} \tag{2.9}$$

$$\phi = Tan^{-1}\left(\frac{2}{\eta}\right) \tag{2.10}$$

and if the definite integral of *S* in **Equation (2.4)** is calculated and the result is applied to $\overline{\delta}$, $\overline{\delta}$ is calculated in the following equation:

$$\overline{\delta} = \frac{2}{3\cdot\eta}\left[\frac{\eta^3}{8}\left\{\frac{1}{2}\cdot\frac{\sin\phi}{\cos^2\phi}+\frac{1}{4}\cdot\ln\left(\frac{1+\sin\phi}{1-\sin\phi}\right)\right\}+\left\{\frac{1}{2}\cdot\frac{\cos\phi}{\sin^2\phi}+\frac{1}{4}\cdot\ln\left(\frac{1+\cos\phi}{1-\cos\phi}\right)\right\}\right] \tag{2.11}$$

Equation (2.11) makes it possible to determine the dimensionless amount of average transportation distance $\overline{\delta}$ by using the horizontal to depth ratio of the hinterland η, that is, the ratio between the distance from one port to another adjoining one and the depth of the hinterland. Further, δp is given, making it possible to calculate the dimensionless amount $\overline{c}t/\alpha\cdot q\cdot D$ of the average cargo transportation cost in the hinterland of the port using **Equation (2.8)**.

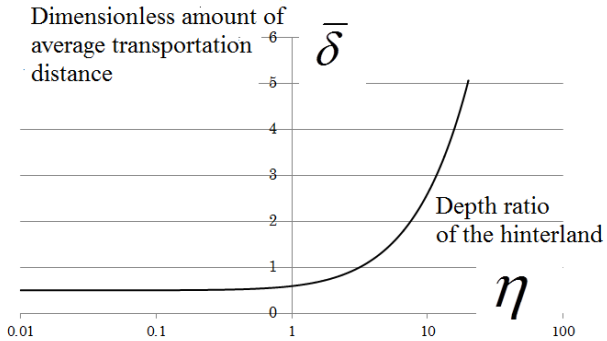

Figure 2.13 Relationships between Horizontal to Depth Ratio η and Average Transportation Distance $\overline{\delta}$

Figure 2.13 graphically represents the relationship between η and $\overline{\delta}$ in **Equation (2.11)**. If the depth of the hinterland η does not exceed 1, the effect of the change in η is minimal because the depth of the hinterland *D* is a dominating factor for average transportation distance $\overline{\delta}$. In contrast, if the depth of the hinterland η exceeds 1, the port placement interval *W* becomes a dominant factor and $\overline{\delta}$ drastically increases with an increase in η. In general, the depth of the hinterland of the port located on the continent is long in distance compared with the port placement interval, ensuring that η does not exceed 1. Therefore, port improvement is understood to have been made irrespective of the port placement interval. In contrast, the depth of the hinterlands of Japanese ports is quite short as previously mentioned, and η often takes a value of 1 or larger. Therefore, if the land area of the hinterland is within a range that allows for the constant operation of the port, the interpretation is that a reduction in η was asked for by narrowing down the port placement intervals as much as possible. Therefore, Japan is deemed to have placed many small-scale ports in its limited land area.

In Japan, the reorganization of port functions means increasing W and η, leading to an increase in the average container transportation distance in the hinterland. **Figure 2.14** shows the result of a sensitivity analysis of an increase in the average transportation distance. For example, assuming a condition of $\eta = 1.5$, a reduction in the number of ports will double the port placement intervals under the condition of no change in the depth of the hinterland, resulting in a doubling of η, or η = 3. If a calculation is made using **Equation (2.11)** and these figures for η or using **Figure**

2.14 and the same values for η, the average transportation distance indicates an increase of approximately 44% on average through the entire hinterland. The incremental cost associated with an increase in transportation distance needs to be mitigated by reducing cargo handling costs at the port.

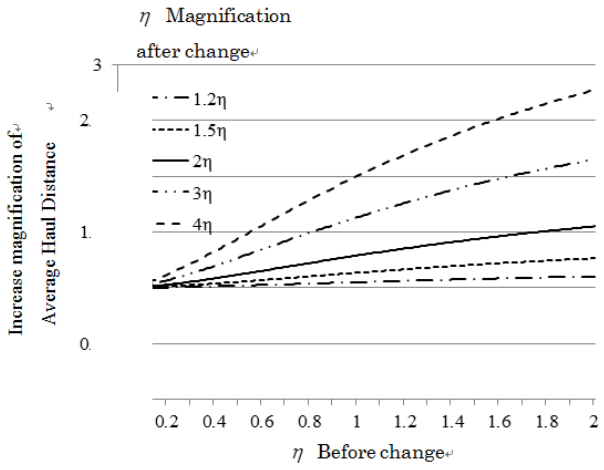

Figure 2.14 Effect of the Change of Horizontal to Depth Ratio of Hinterland

The most effective method involves fulfilling the reorganization of port functions without changing the spatial shapes of the hinterlands; that is, reorganizing many existing small-scale container ports in the national cargo collection network to make them cooperate with the hub ports to be focused on. According to "International Strategic Container Ports," which Japan is now implementing, taking measures to strengthen domestic coastwise transportation for the efficiency of the existing domestic marine network transport, and to improve the port-service levels of hub ports is most desired. In the future, in-depth discussions are required on ensuring integrated management of the domestic container network.

2.8 Evaluation of Japan's Strategic International Container Port Policy

As mentioned above, "**Figure 2.9** indicates changes in the ratios of GDPs by region of the world, including projected ratios, and shows a downward trend in the scale of economic activity in North America, the EU, and Japan relative to that of the world. **Figure 2.9** also shows that the ratio for the Asian region excluding Japan is increasing significantly. In the East Asian region, the economic activity ratios of countries other than Japan have been relatively increasing, but only Japan is expected to experience a decrease in its ratio that is significantly different from the overall downward trends in the ratios for the EU and North America. The increasing trend in transshipments of international cargo coming from and going to Japan through other countries in East Asia reflects a decrease in the share of Japan's economic activity in the East Asian region. **Figure 2.10** shows GDP values per inhabitable land area in **Figure 2.4**, indexed to a world average of "100". Thus, Japan's density of economic activity is still one of the highest in the world but is, relatively, on a declining trend."

Japan's current policy on international containers, "Strategic International Container Port Policy," centers around a policy on container trunk lines with an index of transshipment ratio set up to indicate the country's productivity using the concept of 'international competitiveness'. To be more specific about the content of the policy, regarding reduction of overseas transshipment ratios of cargo coming to and going from Japan as the target of its 'international competition', Japan attempts to solve the issue of enhancing 'international competitiveness' by improving the inferior aspects of its ports. Clearly, this policy is extremely important for 'international competition' between ports and beneficial to increasing the attractiveness of Japanese ports in the international container market; therefore, steadily and continuously going ahead with measures based on the policy is necessary. Japan's Strategic International Container Port Policy would be highly effective if Japanese ports had the geographical characteristics of marine hub ports. However, as shown in this report, Japanese ports have special geographical characteristics of the "Japanese port" type; thus, much beneficial effect cannot be expected of this policy.

Then, what should be done?

To keep Japanese ports viable, in response to the relative decrease in the density of Japanese economic activity, expanding the range of the hinterland is necessary. In other words, increasing the concentration of containers by reducing the number of container ports and integrating the port hinterlands must be accomplished.

As shown in **Figure 2.5**, Japan's national inland area is

extremely shallow for the length of its coastline. Therefore, the port hinterlands are not deep. Further, Japan has almost no undeveloped land area on which to build new bases of economic activity, indicating that the hinterlands behind the ports in the coastal areas cooperate with one another. Under such circumstances, if the hinterlands are integrated by reorganizing port functions, their depths from the coastline remain the same but their expansion follows the direction of the coastline.

However, to date, any of the port policies throughout the world were implemented on the premise of enhancing economic growth; thus, no preliminary cases exist of a balanced reduction policy in which reorganization of port functions aims to reduce ports through integration. Of course, because a balanced reduction policy requires painful efforts to implement, resistance to such a policy is expected. Therefore, in sufficient consideration of Japan's geographic characteristics, the Japanese government should develop the concept of an international hub port for an island nation and proceed with a national strategy of integrating ports through a balanced reduction policy.

2.9 Conclusion on Geographical Characteristics

As a result of our attempt to typify almost all of the container ports in the world, the author recognized that container hub ports can be divided into a group of continental hub ports whose mission is to collect cargo primarily from the hinterlands and a group of marine hub ports whose mission is to handle transshipment cargo as the mode characteristic of container transportation. From this viewpoint, the author noted that, although Japan is an island maritime nation, its container ports satisfy conditions for their continued existence close to those of continental hub ports. In addition, significant gaps exist between the economic growth rates of countries in the East Asian region and the geographical conditions of their respective ports compared with cases in other regions, and container ports in Japan are—including local circumstances—in unique conditions.

Japan's port policy focuses on working out hub ports that can compete effectively with foreign ports to intensively handle transshipment cargo based on the recognition that the acquisition of more transshipment cargo than other ports is a priority in the productivity using the concept of 'competition' among international container ports. Japan has a characteristic wherein there are many large-scale earthquakes and it has to consider the sustainability, which are the earthquake measures to reduce disaster risks. The author believes that prioritizing the recognition of productivity and sustainability is insufficient to realize this target. What are required are a bold reorganization of international hub port functions and a drastic reformation of the structure of collecting domestic cargo at major ports.

Additionally, the author would like to add that, to achieve all of these objectives, port management should be discussed at the national level.

The author suggests that Japan should further deepen its "International Strategic Container Port Policy" and, in full consideration of the countries geographical features, should work out a unique concept of the international hub port as an island nation to be implemented as a national strategy.

3. Analysis on Increased Construction Costs

3.1 Overview and Issues

The major shipping companies of the world are increasing the sizes of their containerships in order to reduce the construction and transportation costs per TEU of containerships. Accordingly, anchorage sites for such large containerships need to prepare deep water mooring facilities, and the construction costs of the container terminals is bound to increase.

Further, the 2011 off the Pacific Coast of Tohoku Earthquake (the so-called “the Great East Japan Earthquake of 2011”) and Hurricane Sandy of 2012 showed port management bodies of the container terminals around the world that some large-scale natural disasters might exceed the conventional maximum disaster prevention level.

As mentioned earlier, the expansion in containership sizes and preparation for preventive countermeasures against large-scale natural disasters is causing an increase in the construction costs of container terminals, and port management bodies all over the world share a common concern, namely limiting this increase in the construction costs.

Therefore, we first compared construction costs across major global ports, to clarify the gap between internalized and externalized costs within the construction costs and to identify the social and natural factors that would increase the construction costs. Then, we introduced efforts to reduce the construction costs in Japan and verified how the costs for improving the existing facilities at the Port of Nagoya, Japan, would rise in response to the upgradation of its disaster prevention level for expected large-scale natural disasters.

By verifying the Japanese cases, we clarified that it is possible to suppress an increase in the rate of the construction costs to around 10% of its total. Note that we could not estimate the total sum of money required for upgrading the disaster prevention level for future large-scale natural disasters, because the gaps between the internalized and externalized costs within the construction costs were large among countries.

Given current progress in the horizontal and vertical specializations of the global economy, any stoppage in the port functions caused by a large-scale natural disaster in one country may seriously damage the economic activities of many countries. Therefore, we hope this report will highlight the importance of reinforcing existing port facilities against large-scale natural disasters.

3.2 Gap between the Internalized and Externalized Costs within the Port Construction Costs

As mentioned in **Section 3.1**, the port construction costs of countries increases owing to social and natural factors. However, the extent of this increase varies according to social and natural conditions of each country and site. In this Section, we compared the construction costs of each country and verified the gap between the internalized and externalized costs within the port construction costs.

3.2.1 Prerequisite for verifying the gap between internalized and externalized costs

Port construction costs vary largely according to the social and natural conditions of the construction site. We focused on the gap between the internalized and externalized costs within the port construction costs for Europe, South Korea, and Japan, and we compared them under the following prerequisites in this report.

<Prerequisites>
Water depth: Quay around 17 m deep
Quay length: Quay around 400 m long
(Converted to construction cost per meter)
Seismic load: Seismic load outside Japan is indicated via a design seismic coefficient. Since Japanese quays are designed considering seismic motion, seismic load is not indicated (if using the conventional design seismic coefficient, this value corresponds to 0.25 g)
Construction cost: Direct construction costs
(Port cost estimation standards)
(Outside Japan, the construction costs may include project costs other than the construction costs of the quays)

3.2.2 Comparison between port construction costs inside and outside Japan

Table 3.1 shows the result of the comparison in quay construction costs among countries for a high-standard container terminal of depth 16 m or more. Generally, the structural form varies according to the design and conditions during construction, standards such as ground conditions and

earthquake resistance standards, and the ordering system. In this report, we estimated that the ports for large containerships in all countries include mooring structures, thus lowering the construction costs to the extent possible. In particular, we compared the construction costs in terms of secure mooring functions for large container ships. Since the port construction costs for outside of Japan might include the construction costs for other port facilities except quays (for example, freight handling area), there was a possibility that the actual gap between the internalized and externalized costs may be larger than that indicated in the comparison. However, when comparing costs for quays of 16 m depth or more, we found that the construction costs of the Ports of Rotterdam and Antwerp, which are not typically subject to earthquakes, were overwhelmingly lower than those of Japanese ports. Further, when comparing quays of 18 m depth, we found that the construction costs of the Port of Busan, an area subject to earthquakes albeit at lower seismic loads than those experienced at the Tokyo and Osaka Ports was lower.

Thus, it is clear that the port construction costs vary widely across countries. In other words, we cannot compare construction costs simply based on the large gap between external and internal prices.

3.3 Factors Increasing Port Construction Costs

Among the factors increasing port construction costs around the world, we selected offshore deployment to support larger ships as a social factor and countermeasures against earthquakes and soft ground as a natural factor.

3.3.1 Offshore Deployment to Support Larger Ships

Worldwide, value-added expensive products are carried by containerships. By utilizing economies of scale, shipping companies are rapidly increasing the sizes of their containerships (**Figure 3.1**), which go in service in the global liner routes, in order to reduce the transportation cost per TEU of the marine container. Until recently, the companies operated large container ships of total lengths of up to 460 m, drawing 16 m, and of over 20,000 TEU capacity. They just let larger container ships go into service with loadable capacities of over 20,000 TEU. Although some believe that very large container ships cancel out economies of scale and that the restriction at the Strait of Malacca will not allow passage of larger ships, globally, shipping companies continue to promote the construction of ever-larger container ships; this has been evidenced since the 1960s in three prime shipping areas: Europe, Asia, and North America. The mooring facilities of the ports in these regions have also been enlarged.

Enlarging ports requires not just deepening the water depth at the front of the quay, where ships come alongside, to match the draft line of the large ships but also enlarging the channel, anchorage site, and quay site areas and deepening the channel at the anchorage site.

Enlarging ports in areas without a large ground area requires offshore deployment of the construction site and the construction of port structures in deep-sea areas.

Enlarging port structures increases the construction costs considerably. For example, for a caisson type quay (a port structure) in deeper water, the landside ground pressure increases proportionally with depth, and the resultant force of the ground pressure increases proportionally to the square of the depth. Generally, construction costs rapidly grow exponentially with the increase in water depth.

Table 3.1 Comparison of container quay construction costs

Port Maximum water depth (m) Structure form	Project cost ($ million/m)
Rotterdam 16.7 Reinforced concrete sheet pile type with relieving platform	0.060
Antwerp 17 Gravity type (Reinforced concrete L-shaped retaining wall)	0.052
Busan 18 Gravity type (Vertical wave dissipating caisson)	0.24
Tokyo 18 Piled quay type	0.43
Yokohama 18 Cellular-bulkhead type	0.32
Osaka 16 Piled quay type	0.28
Kobe 16 Piled quay type	0.25

* The project costs outside Japan may include project costs other than the construction costs of the quays.

** Port project costs outside Japan are calculated as construction costs according to Koizumi et al. (2011).

*** Japanese port project costs are based on the hearing data of the Ministry of Land, Infrastructure, Transport and Tourism of Japan.

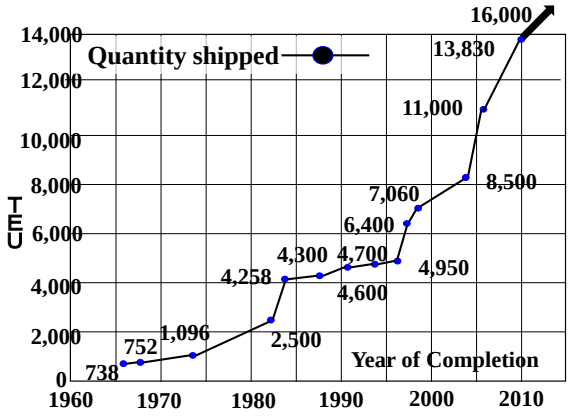

Figure 3.1 Transition in the largest containership size

Source: The author organized this figure based on Akakura (2011).

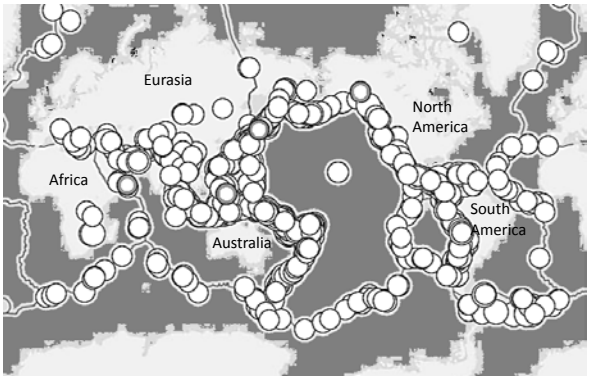

Figure 3.2 Distribution map of earthquakes

Note: Magnitude 6 or higher at depths of 100 km or less from 2004.07.14 00:00:00 UTC to 2014.07.21 23:23:59 UTC

Source: United States Geological Survey (USGS)

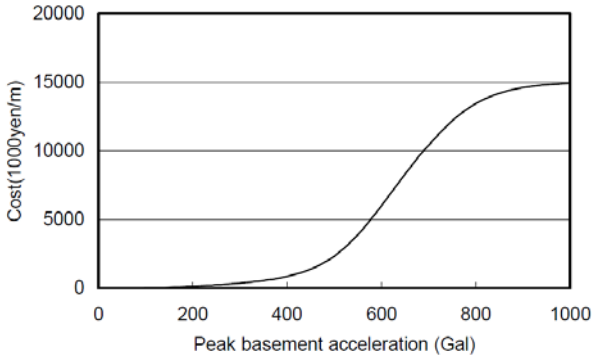

Figure 3.3 An example of estimated loss for each input excitation level,

Note: Unit 'Gal' means gravitational acceleration, Gal = cm/s^2

Source: Ichii (2002)

3.3.2 Countermeasures against earthquakes

Figure 3.2 shows the world earthquake distribution map issued by the United States Geological Survey (USGS), indicating the distribution of earthquakes of magnitude 6 or higher at depths of 100 km or less. Earthquakes originating at depths of 100 km or deeper have their hypocenters in specific regions, such as Japan and the west coast of North America (but not in Europe). Although the Japanese archipelago constitutes only 0.1% of the land area on earth, 10% of magnitude 6 or higher earthquakes have occurred in Japan. Some researchers estimate that this rate increased to 21% in 1994 and later years.

Figure 3.3 shows the estimated financial loss for gravity-type quays at each earthquake motion level indicated by Ichii (2002). This figure helps us understand that as the seismic load increases, the estimated loss increases rapidly. A facility with a structure receiving ground pressure consistently from one direction, such as a quay or seawall, is designed so that it remains stable because of the horizontal force resisting the seismic load. To resist a larger seismic load, the cross section must be enlarged horizontally to match the increased resisting force. To improve safety against seismic loads, quays constructed in earthquake zones like Japan and the west coast of North America entail higher construction costs than their counterparts in East Asian counties, such as South Korea, China, and Vietnam, and European countries.

3.3.3 Countermeasures against soft ground

Flat lands along coastal areas called alluvial plains were formed on the drowned valleys, which were eroded when the sea level fell during the Ice Age, by the accumulation of soft soil from the rivers. Therefore, the ground in alluvial plains comprises soft soil deposit.

Constructing a port facility on such thick and soft ground entails additional cost for ground improvement and settlement of long piles into the foundation layer, which increases the construction costs tremendously. Compared to the ground condition outside Japan where the foundation layer is shallower, the ground in alluvial plains is too soft and necessitates the introduction of new technologies, special work barges, and skilled workers in every design and construction phase. Therefore, it is not possible to reduce the construction costs of a port sited on soft ground.

Typical examples of structures constructed on thick and soft ground are the Sakishima Tunnel of the Port of Osaka and

Kansai International Airport in Japan. Located on the sea bottom of Osaka Bay, resting on alluvial and diluvial deposits several hundred meters thick, they were designed and constructed assuming that a large-scale consolidation settlement would occur. The construction costs for these projects increased drastically compared to the costs for cases without consolidation settlement.

3.3.4 Increase in administrative and maintenance expenses

The Ministry of Land, Infrastructure, Transport and Tourism (Japan) estimated future public works expenditures, upgrading costs, and administrative and maintenance expenses for existing facilities in Japan. Since the facilities were mainly constructed in the 1990s, they are in need of upgradation. The Ministry of Land, Infrastructure, Transport and Tourism estimates that these costs and the associated administrative and maintenance expenses will exceed the total investible funds.

Since Asian countries have relatively newer port facilities compared to those in Japan, we can estimate that their upgradation costs and administrative and maintenance expenses will be less.

3.4 Efforts to Reduce Port Construction Costs

How do countries reduce port construction costs? They are making efforts to suppress increases in port construction costs. In this report, we introduced the case of Japan, wherein efforts for reducing port construction costs are divided into two periods: from 1950 to 1999, when the design and analysis methods were improved through technological development, and post-1999, when reductions in the construction cost and administrative and maintenance expenses were practically realized.

3.4.1 Approach to technological development in Japan

Table 3.2 shows the history of technical standards applied for port construction works.

Constructing ports in Japan according to the specification requirements has necessitated moving from the conventional experience-oriented engineering approach to the knowledge-based approach. The first design standard in the postwar period, "Design Specification Guideline for Port and Harbor Construction," was issued in 1950.

Table 3.2 Revision history of the Technical Standards

Note: See Goda(2006) on "Goda's wave pressure formula"

Technical developments to improve accuracy and safety Technological developments for cost reduction
1950: Setting the earth pressure calculation formula and frictional coefficient of soil Setting the design seismic coefficient Setting the safety factors for sliding and falling Clarification of Hiroi's formula and Sainflou's formula as wave pressure formulae
1959: Introduction of the wave prediction method (SMB, etc.) Safety consideration of slope and slip circle analysis
1967: Specification design methods for various facilities Accuracy improvements in the design seismic coefficient considering the local seismic activity Indication of standard ship size
1973: Including safety requirements in the Port and Harbor Act
1979: Adoption of Goda's wave pressure formula as the standard wave pressure formula Inclusion of design methods for various facilities Introduction of rules pertaining to anchoring site calmness
1989: Setting the estimation method for liquefaction Introduction of bearing capacity analysis with the Bishop method Introduction of the soil improvement construction method Lowering the end bearing capacity coefficient for pile foundations
Note: The technological development can be charted through the history of changes in the external load setting method and the analytical and design methods used for the rational planning and design of safe facilities. These developments also include steps taken toward reducing construction costs. However, cost increases were inevitable in some cases where it was necessary to secure a certain level of safety.
1999: Introduction of Level 1 and Level 2 earthquake motions Introduction of the reliability design method with the expected sliding volume Improvement in flexibility introduced by notifications in the standards
2006: Definition of performance and transition to the reliability design method Performance-based design methodology was introduced. Introduction of Life Cycle Management (LCM) by preparation of maintenance and management standards

In 1973, the Japanese government incorporated the "Technical Standards for Port and Harbor Facilities in Japan" (hereafter, "Technical Standards") in the Port and Harbor Act, thus extending them legal sanction. These technical standards include the structural functions and safety procedures to be followed for all port-related construction works. In doing so, the Japanese government employed the Technical Standards not just to ensure safety at under-construction port facilities but also to serve as the standards that port management bodies would use to approve constructions within the port zone.

At the same time, the Japanese government urged the port management bodies and private business operators to improve their technological skills by improving the technical guidance and information required for port construction. These measures contributed to improving the functions of and the safety required at the port facilities of port management bodies and private business operators.

These Technical Standards included the findings of conventional theoretical studies, indoor experiences, and field observations, which contributed to secure the functions and safety of port structures. It defines criteria regarding the deformation and strength of the facilities as well as the materials to be used. The original technological developments mainly helped to refine the methods used to calculate the external forces the port facilities have to withstand and improve the methods for port design, thus aiming at reliable and safe construction.

In 1999, the Technical Standards reached a major turning point. In responding to public opinions about the construction costs being higher in Japan compared to costs in other countries, many researchers tried devising ways to reduce the cost while maintaining safety. The Japanese government included these results into the Technical Standards by revising them in 1999.

However, besides the Technical Standards in 1999, the conventional Technical Standards were specification-oriented standards, which defined the standardized materials and design methods for port construction works. This type of standard was convenient and reliable for the government and port management bodies, who were responsible for checking conformity with functions and safety. However, since these standards adopted methods that secured safety using overdesigned structural reinforcement, they tended to ignore cost issues.

3.4.2 Reducing construction costs using performance definitions in the Technical Standards

The conventional revisions of the Technical Standards show the history of safety-related improvements. Although the government revised the Technical Standards in 1999 in response to its policy of reducing public works expenditures, it did not review the fundamental system employed therein, and hence, it could not actually reduce the construction costs. On the other hand, in view of the international trend to define performance standards, the government revealed plans to define performance in the Technical Standards through a three-year deregulation program. As a part of its Public Works Cost Structural Reform Program (March 2003), it decided to change the Technical Standards for port facilities from specification-oriented standards to performance-oriented standards.

In 2006, the government revised the Port and Harbor Act to change the Technical Standards for port facilities, from the conventional specification-oriented standards to performance-oriented standards, and at the same time, hand over the responsibility of conformance judgments to the Technical Standards to the government or a third party. It is possible that the government defined the technical standards as being related to the required safety issues and commissioned the popular belief that specifications and designs must be performance-based instead of relying on safety certifications for port facilities by checking their adaptability to the standardized national Technical Standards. Accordingly, new design methods and special structures based on private inventive approaches could be adopted. Notably, it was possible for private corporations to design the facility's strength and durability to fit its intended importance and lifecycle. It was expected that these measures would help reduce not just the construction costs but also the upgradation costs and administrative and maintenance expenses.

Figure 3.4 shows an example of a breakwater with reduced construction costs, designed according to the performance-oriented Technical Standards. This breakwater was designed using the expected sliding volume method, allowing approximately 10% reduction in the construction costs.

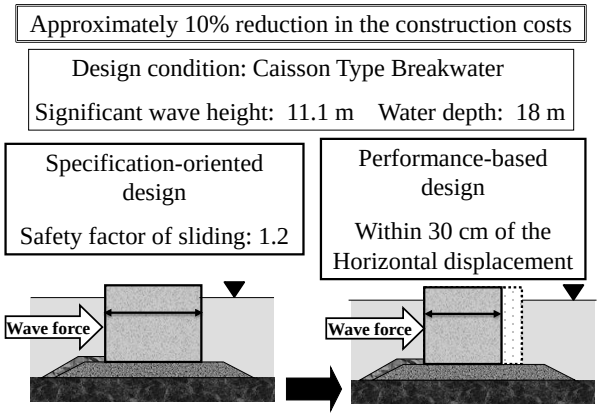

Figure 3.4 Design example of a breakwater with expected sliding volume

3.4.3 Reduction in Administrative and Maintenance Expenses by Introducing Lifecycle Management

Matsubuchi・Yokota (1999) released their "Basic Study on Lifecycle Cost Generation of a Mooring Facility and Establishment of a Maintenance Management Decision-making Support System".

The results described how ideal mooring facilities could be designed alongside their lifecycle costs. Several other studies about cost reduction through maintenance management are ongoing.

The Japanese government defined performance-oriented Technical Standards by revising the Port and Harbor Act in 2006, thus allowing the introduction of new design methods based on novel ideas. One particular revision was quite significant. The Technical Standards also stipulated the preparation of a maintenance management plan for all port facilities to allow long-term cost reduction by maintenance management across the lifecycle.

With regard to maintenance management, although the Japanese government stated in the Port and Harbor Act that "port facilities should be constructed, upgraded, or maintained so that they meet the Technical Standards," the conventional Technical Standards focused on securing a certain level of safety within the facilities, and definitions about the lifecycle cost, including maintenance management costs, were insufficient. It is undeniable that, until then, the management bodies had overlooked the significance of maintenance and management. The new Technical Standards, however, clarified the importance of maintenance and management, stipulating the preparation of maintenance and management plans and the minimization of lifecycle cost (and thus, total of construction costs), upgradation costs, and administrative and maintenance expenses. The government also released the "Port Facility Maintenance and Management Technical Manual," which introduced preventive maintenance and management procedures such as the Checkup/Diagnosis Plan and the Maintenance/Repair Plan.

3.5 Elicitation of New Risk

In spite of the aforementioned efforts to reduce port construction costs in Japan, the Great East Japan Earthquake of 2011 highlighted new risks that would increase these costs. The author now describe these risks.

L1 events and L2 events are defined as **Table 3.3**.

Table 3.3 Definition of L1 events and L2 events

Source: Government of Japan (2011)

L1 ground motion: Appropriately as a stochastic time history with considerations of source, path and site effects, based on the results of earthquake observation
L1 tsunami: Occurring more frequently than the largest-possible tsunamis and causing major damage despite their relatively lower tsunami heights
L2 ground motion: Appropriately as a time history with considerations of source, path and site effects based on the results of earthquake observation and the source parameters of the scenario earthquake.
L2 tsunami: Envisaged on the basis of developing comprehensive disaster management measures, which focus on the evacuation of local residents as the main pillar

3.5.1 New Risks Revealed by the Great East Japan Earthquake

The Great East Japan Earthquake of 2011 underscored the importance of preparing for unexpected events. In the past, the possible occurrence of events exceeding the design conditions was considered highly improbable. In addition, arguments about preparing for Level 2 events were unacceptable to port management bodies as no budgets were allocated for taking measures against such events. Therefore, arguments in favor of preparing for Level 2 events had been inactive for a long time.

A post-earthquake analysis revealed the following problems: lack of preliminary discussions about damage

reduction using a combination of hard and soft measures for preventing and mitigating Level 2 disasters, and insufficient information dissemination to the public although some concerns in this regard had been voiced previously.

Therefore, in the future, it would be prudent to analyze all events corresponding to Level 2 disasters and foreplan countermeasures against them on national and regional scales, in order to clarify the estimated risks.

Possible Level 2 disasters include earthquakes and tsunamis. Other presumable events, such as unexpected storm surges and tidal waves caused by strong typhoons generated because of global warming, should be targets for such discussions.

However, given the extreme improbability of certain events, such as the giant meteorite strike that killed off the dinosaurs, it is inappropriate to include such events in the discussion about Level 2 disasters in port operations.

Further, many locations are yet to establish facilities to help withstand Level 1 events, in terms of hard measures. Therefore, besides soft measures, port facilities must establish and maintain reliable hard measures to withstand Level 1 disasters. Moreover, they must also prepare for Level 2 disasters by including soft measures such as establishing refuge instruction methods and constructing refuge facilities for employees and inhabitants, especially in cases where hard measures such as construction and reinforcement of existing port facilities are unavailable.

In light of this discussion, the estimated emerging risks for port facilities are as follows.

a. Increase in the probability of earthquakes

Toward the end of 2012, the Headquarters for Earthquake Research Promotion of the Ministry of Education, Culture, Sports, Science and Technology (Japan) created the "Probabilistic Seismic Hazard Map". It shows that the possibility of earthquakes with seismic intensities of lower 6 or more as per the Japan Meteorological Agency's (JMA's) seismic scale, increased significantly within 30 years after 2012 mainly around the Kanto area. The possibilities of large-scale earthquakes in all three major harbors, which are the focal points of the Japanese economy, are very high, and thus, port management bodies must undertake immediate and urgent countermeasures.

b. Breakwater sinking caused by liquefaction after an earthquake

In addition to the quays and seawalls, breakwaters founded on sandy soil are likely to sink because the soil will undergo liquefaction during an earthquake. One example of this phenomenon is the sinking of the breakwaters of the Port of Kobe, which sunk by 2 m owing to the Hanshin Awaji Great Earthquake (formally 'the Southern Hyogo Earthquake') in 1995. In order to ensure that they continue to function as required in the event of a tsunami, a certain level of breakwater raising and reinforcement is necessary.

c. Partially functional breakwater after a tsunami

Damage reduction and (at least) partial functionality have been hotly debated topics after the earthquake. Clearly, measures and policies allowing the construction of robust breakwaters (**Figure 3.5**) are the need of the hour.

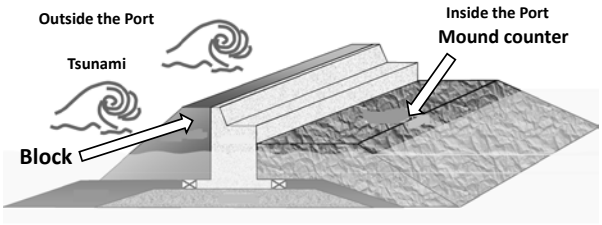

Figure 3.5 Reinforcing the breakwater

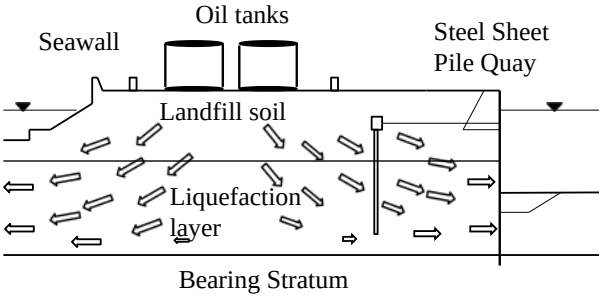

Figure 3.6 Horizontal soil displacement caused by liquefaction and lateral flow of landfilled areas

3.5.2 Lateral Flow of Landfilled Areas Caused by Liquefaction

The 2004 Chuetsu Earthquake caused land deformation severe enough to create lateral spreading across a wide

landfilled area owing to the liquefaction. However, the danger of this phenomenon was not taken into consideration in the design measures stated in the Technical Standards. **Figure 3.6** shows a model of such a phenomenon. Hamada (2012) had pointed out the danger posed by such an event. In particular, should such an event occur, he indicated the risks posed by the large oil tanks located in the coastal areas of the three major harbors. Since it is difficult to secure safety with breakwater design alone, it is important to consider the safety of the overall landfilled areas and take appropriate countermeasures.

3.6 Verifying Increase in the Construction Costs: The Storm Surge Breakwater of the Port of Nagoya

Although efforts to decrease port construction costs are already underway in Japan, it is expected that the costs will increase in the future owing to social and natural factors, such as the emergence of new risks as shown by **Table 3.4**. In this Section, the author provide estimates of the increase in the construction costs using the case of the breakwater of the Port of Nagoya as an example.

Located in the Chubu district (midland of Japan), the Port of Nagoya is the largest and busiest trading port in Japan. It is the largest exporter for several global manufacturing industries, such as automobiles and the aerospace industry. The author provide the estimated increase in cost owing to the construction of storm surge breakwaters to reduce the threat from storm surges. To do so, the author referred to the damage caused by Typhoon Vera (Isewan Typhoon) at the Port of Nagoya.

The main objective of building these storm surge protection breakwaters was to raise the breakwater crown to protect the port from a tsunami that would be generated after a large earthquake; the breakwaters would presumably sink owing to the liquefaction caused by the earthquake. Further, since they were already very (50 years) old, measures to upgrade them in preparation for large earthquakes were also necessary. Therefore, the Ministry of Land, Infrastructure, Transport and Tourism based their estimates considering that a tsunami likely to occur during the design life of the structure (the so-called “L1 tsunami”) and the maximum predicted tsunami that may attack the structure (the so-called “L2 tsunami”) would eventually occur. Accordingly, the Bureau estimated the amount by which the storm surge protection breakwaters would sink after the earthquake and checked the protection function against each tsunami and the storm surges that would attack the structure after the sinking of the storm surge protection breakwaters.

The Central Disaster Prevention Council of the Japanese government predicted that if a megaquake (Mw 9.1) occurred in the Nankai Trough off the Pacific coast, as shown by **Figure 3.7**, the quake and its ensuing tsunami would cause serious economic damage, and accordingly, the Ministry of Land, Infrastructure, Transport and Tourism was urged to consider taking the following appropriate protective measures.

Table 3.4 Assumed Megaquakes and Megaquakes of the past

Assumed Megaquakes	Assumed Magnitude
Nankai Trough Earthquake	9.1(Mw)
Tokai/Tonankai/Nankai consolidated Earthquake	8.7 (Mj)
Earthquake that directly hits the Tokyo area	7~8 (Mj)
Megaquakes of the past	**Mw (year)**
1946 Nankai Earthquake	8.4(1946)
Great East Japan Earthquake	9.0 (2011)
Hanshin Awaji Great Earthquake	6.8 (1995)

Note: ‘Mw’ is the moment magnitude scale, which is synonymous with the Richter scale and ‘Mj’ is the magnitude scale used by the Japan Meteorological Agency (JMA).

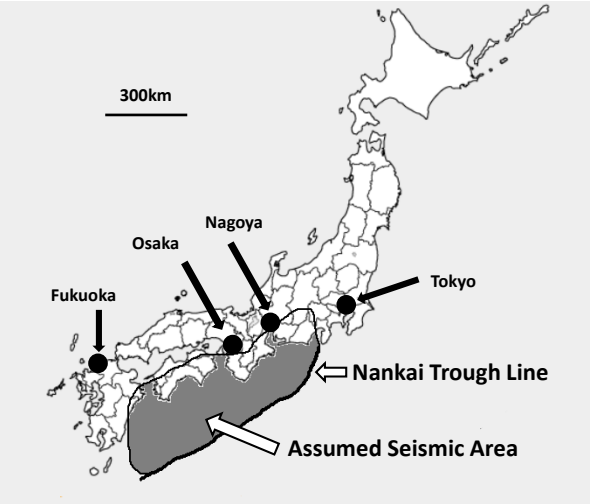

Figure 3.7 One of New risks: Nankai Trough Earthquake
Note: Assumption Mw 9.1

a. Checking the breakwater crown by analyzing the seismic response to L1 and L2 earthquakes

The calculation clearly showed that the storm surge protection breakwaters of the Port of Nagoya would sink by 3.4 m at most after an L2 earthquake, and almost all cross sections would fail to meet the required breakwater crown (N.P. + 5.4 m). To take measures against L1 earthquakes and to secure calm after L2 earthquakes, the Ministry of Land, Infrastructure, Transport and Tourism plans to raise the breakwaters to the required level as shown in **Figure 3.8**. It also plans to replace the packing sands inside the caisson with mortar for reinforcement, which are of questionable strength owing to aging.

b. Stability of the storm surge protection breakwaters against L1 and L2 tsunamis

The results of this verification indicated that all breakwater cross sections would be stable against both L1 tsunami and L2 tsunamis. The author also confirmed that they were sufficiently robust.

As mentioned earlier, the Ministry of Land, Infrastructure, Transport and Tourism discussed the robustness of the storm surge protection breakwaters of the Port of Nagoya to protect the port against L1 and L2 tsunamis, such that they can operate as intended even if they sink owing to liquefaction after earthquakes. Accordingly, concrete reinforcement measures have been in place since 2012. At the same time, measures are also being taken to reinforce the aging breakwaters, which were built nearly 50 years ago.

Figure 3.9 shows the cross section of the upgraded storm surge protection breakwater of the Port of Nagoya, wherein the crown has been raised (among other measures).

The total amount of investment (construction costs) for these measures amounted to 6 billion yen, including the cost for raising the breakwaters, fixing the caisson fillings, and reinforcing the foot protection blocks according to the breakwater cross sections. Thus, assuming that the same measures apply to a new storm surge protection breakwater, the increase in the construction costs derived from reinforcing the breakwater to withstand L1 and L2 earthquakes corresponds to 10% of the total project cost of a new construction, that is, 60 billion yen. In other words, it is clear that to secure measures against the emerging risks posed by L1 and L2 tsunamis and earthquakes, the construction costs would increase by about 10 % over the conventional costs.

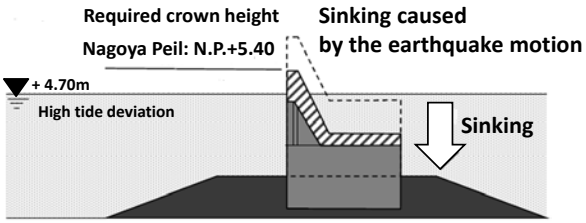

Figure 3.8 Concept of preventing Breakwater sinking
Source: Ministry of Land, Infrastructure, Transport and Tourism (MLIT) (2011)

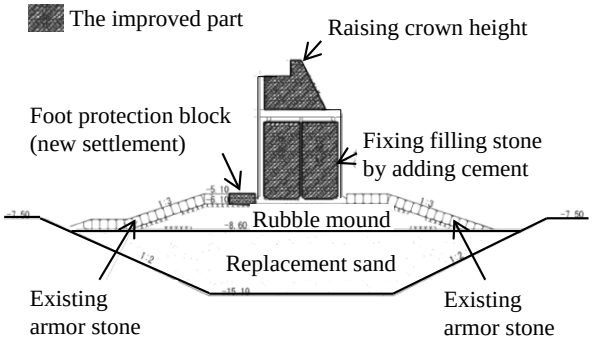

Figure 3.9 Cross section of the upgraded storm surge protection breakwater of the Port of Nagoya
Source: Ministry of Land, Infrastructure, Transport and Tourism (MLIT) (2011)

3.7 Conclusion on Increased Construction Costs

Considering the current progress in the horizontal and vertical specializations of the global economy, when a port of one country becomes functionally paralyzed, many countries suffer economic damage. However, countries charge either private companies or local governments with the management of ports, and these port management bodies cannot meet the construction costs for reinforcing port infrastructure, mainly owing to poor fund-raising capacity. In order to manage the container terminal soundly, it is essential that stakeholders clarify for investors the trends and future outlook of construction costs, which are important indicators of business management. To eliminate such an eventuality, in this report, the author verified the increase in the rate of the construction costs in the Japanese context. Note that the author could not compare the absolute increase in the cost of port construction

across countries, because of the large gaps between the external and internal prices within the construction costs. Our results showed that port construction costs increased by around 10% even though there were gaps between the external and internal prices within the construction costs for each country. The operators of the container terminals that increase only 10% of conventional facilities investment can reduce the risk of the large-scale natural disaster. This 10% is the cost that they can take in in the management of their container terminals. To ascertain the total increase in construction costs, the author would need to verify the amount of increase in cases other than the port facilities mentioned in this document; however, our result provides an approximated trend applicable to all ports in Japan.

Operators of the container terminals need to reinforce existing facilities for natural disaster. In addition, they need to construct refuge facilities for employees and inhabitants and establish refuge instruction methods for the time when a large-scale natural disaster strikes.

To sum up, this report underscores the importance of reinforcing existing port facilities, to prepare them to withstand large-scale natural disasters.

4. Analysis on Financial Condition

4.1 Overview and Issues

The ports of the world are operated by port management bodies. The systems for establishing port facilities are roughly classified into two types depending on their sources of revenue. In the first type of system (used mainly for channels, breakwaters, berths, etc.), the national/local government and the port management body share the cost of construction. In the second type of system (used for cargo handling facilities, reclaimed lands, etc.), the port management body alone raises funds through a port-related bond-financed project and issues bonds. One characteristic of such bond-financed projects is that the costs of operating the facility and redeeming the bonds are funded through usage fees for the ground and profit from the sale of reclaimed land. Port management bodies now require a smooth redemption policy for bonds issued in the past. However, port management bodies have found it difficult to choose between having to raise usage fees and land prices high enough to enable smooth redemption in bond-financed projects on the one hand and having to reduce usage fees and land prices to improve the productivity in port logistics on the other. Unless a solution to this problem is found quickly, the finances of port management bodies may become even more constrained, given the rising trend in port construction costs due to the risks of disasters such as earthquakes and due to growing interest rates. This is because prior investments are required for the construction of port facilities that takes a long time (between 5 and 10 years) and usage fees and profits from the sale of land must be suppressed to low levels because of political pressure. This will lead to larger bond issues and therefore a greater necessity for a smooth redemption policy of port facilities in the case of ocean space utilization. The author first describes the structure of port management in the world, and analyze the financial situation of port management bodies. Next, the author points out that as the capital, maintenance, and management costs of port facilities grow in response to large-scale natural disasters, which exceed existing assumptions, and other factors, port management bodies are being forced to take measures to address this. Lastly, the author argues that public incentive assistance to shipping companies and logistics companies can effectively address the conflicting demands of improving the productivity and the sustainability which means strengthening disaster restoration

capabilities, and enabling the smooth redemption of bonds in bond-financed projects.

Yajima･Nakamura･Inamura (1979) and Yajima･Nakamura (1979) proposed the financial simulation model. Saito(2002), Nagase (2004) and Akai et al. (2009) pointed out the financial issues of port management bodies. This report not only analyzed the financial issues but also proposed important solutions for both port management bodies and port management corporations.

4.2 Management Forms of the ports in the world

At first, in this report, the author analyzes the trend of the port management forms in the world.

4.2.1 Classification of the port management forms

The management forms of the ports generally used in the world today has been classified into four traditional forms.
The author analyzed the present conditions of the ports in the world in terms of asset ownership and service operation as shown in **Figure 4.1**.

While this traditional classification is basic, it is too vague to be applicable to a real port, so the author cannot use it to analyze management forms. Rather, the author subdivided forms of the private/public participation for port management and defined the traditional classification more definitely as shown in **Table 4.1**.

As shown in this table, each country chooses the most suitable management form that private enterprise participate in according to public policy, historic background, process of the development of ports, a financial status, labor circumstances, the legal frame of the country, and also the motive or purpose to further advance privatization.

The author analyzed the contents of the management form and newly defined it as follows.

a. Public Port

A port management body builds and owns all infrastructures (land, wharf, yard, channel, etc.) and superstructures (cargo handling machines such as gantry cranes, etc.) and, in addition, performs its own cargo handling operations. A Public Port does not have the participation of private enterprise. Many examples of this type of port are seen in the developing countries.

b. Tool Port

A port management body builds and owns not only infrastructure but also superstructure, and leases these to private enterprise.
A Tool Port is classified into three forms.

Outsourcing is the form where the port management body that is the public main constituent consigns some duties to outside enterprises.

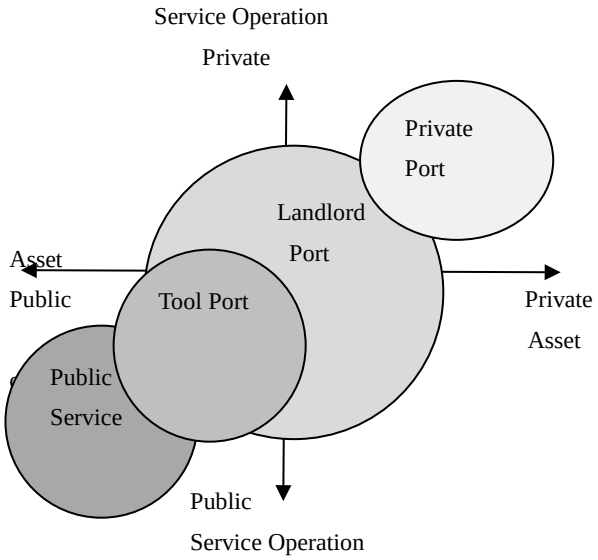

Figure 4.1 Trends in Management Form
Source: The author created this figure based on MOT (2000) and OCDI (2006)

Table 4.1 Classification of Port Management
Source: The author created this table based on MOT (2000) and OCDI (2006)

Public	Public Port	Public Management and Operation
	Tool Port	Outsourcing
		Management Contract
		Lease and Rent Contract
	Land -lord Port	Concession
		Joint Operation or Joint Venture
		BOT (Build, Own and Transfer) or BTO, BOOT (Build, Own ,Operate and Transfer）, WBOT（Wraparound BOT）
		BOO (Build, Operate and Own)
Privati -zation	Private Service Port	Divesture by License
		Divesture by Sale
		Private Supply and Operation

A Management Contract is the form where the port management body consigns duties and the management of port assets to a private enterprise for a certain period; it also uses the ability and know-how of the private enterprise.

A Lease is the form where the port management body leases assets to private enterprise for a short term and accomplishes the management of assets and offer of services using assets.

c. Landlord Port

A port management body builds infrastructure and leases infrastructure to private enterprise. Private enterprise builds and owns superstructure as well as performs cargo handling operations on its own. There are many examples of this type of port in the world.

A Landlord Port is classified into four kinds. While the port management body of the public main constituent holds the proprietary rights of the real estate, a Landlord Port is a form entrusting in large measure both competence and responsibility to private enterprise. A Landlord Port differs greatly from a Tool Port.

A Concession is a form that transfers the responsibility for port administration and maintenance from the port management body to private enterprise on a long-term basis, 15-20 years.

While the port management body of the public main constituent owns infrastructure, private enterprise has the competence to build, own and run superstructure freely. Private enterprise can profit by administration and pays a concession fee to the port management body.

A Joint Operation (JO) or Joint Venture (JV) is a form where a private enterprise together with the port management body provides capital and assumes port duties jointly for a certain period. Profit is distributed by the constitution ratio of the investment by the administration.

BOT is a form where the port management body grants permission concerning port development and administration duties to private enterprise. Private enterprise then carries out port development and administration.

The proprietary rights of all assets are transferred from private enterprise to the port management body at the end of the term of a contract. A characteristic of BOT is that the contract terms come later and that the port management body owns the proprietary rights.

Private enterprise pays a royalty to the port management body during the term of a contract.

Besides BOT, there are similar forms such as BOOT, BTO and WBOT. In addition, there is contract matter common to these. The proprietary rights of assets move from private enterprise to the port management body based on a contract. Private enterprise cannot hold assets for eternal assets.

BOO (Build, Operate and Own) is a form where proprietary rights move to private enterprise after the term of a contract. On the stage of development and management during the term of a contract, the port management body holds the proprietary rights of assets.

d. Private Service Port

Private enterprise builds and owns all port infrastructures and superstructures and, in addition, performs cargo handling operation on its own. A Private Service Port is classified into four entities. Their characteristics are that private enterprise completely holds proprietary rights or usufruct.

4.2.2 Trend analysis of management form of the world's ports

The author classified world ports according to four port management definitions and analyzed historic movement as shown in **Table 4.2**.

Privatization is moving ahead through ports in U.K., which is classified in Private Port. On the other hand, ports of U.S.A are advancing from Private Port to Landlord Port. U.S.A is increasing public participation in port management(direction of ←).

Because of this analysis, the world port was proved to aim at the Landlord Port form.

In other words, the port management body does not part with proprietary rights of real estate such as land, institution etc., but the port management body leases it and entrust port administration to the private enterprise to utilize private management know-how for the service operation of the port.

It became in this way clear that the port management body aimed at the Landlord port form.

4.3 Capital Cost and Recovery Ratio of Capital Cost of the Landlord Port

It is cost of capital (Capital Cost) and maintenance administrative expense (Maintenance and operation cost) to become the index of the judgment that private enterprise enters the port administration. The expense required for the

construction and administration of the port is roughly classified into cost of capital and maintenance administrative expense as shown in **Figure 4.2**.

The cost of capital is depreciation and the interest (credit interest expense) generally. Because the cost of capital is to occur with the construction of land reclamation and the port facilities, the author can arrange a breakdown to constitute cost of capital like **Table 4.3**.

Furthermore, the cost of capital is high and will tend to rise more with geographical conditions in the future. It is necessary to manage the cost of capital and to come up with resources to allot for the soaring cost of capital to continue in new investment. The quantity of the cost of capital fluctuates due to a variety of factors. For example, in the case of Japan, it is exposed to the severe natural conditions of earthquakes and typhoons.

Table 4.2 Classification of Main World Ports

Source: The author created this table based on OCDI(2006)

Public Port	Tool Port	Landlord Port				Private Port
		Conce-ssion	JO/JV	BOT etc.	BOO	
	→	Yokohama				
	→	Kaohsiung				
		Busan				
Dubai	→					→
	Le Havre	Hamburg				
	Barcelona	Antwerp				
		Rotterdam				
		Seattle				
		LA/LB				←
		NY/NJ				
		Hong Kong				
→	→	Shanghai				→
		Dalian				
→						Felixstowe
→						Southampton
						Metro
→						Vancouver
→	→	Buenos Aires				
		Port Klan				Singapore
Bang-kok						
Mumbai						

Note: Privatization advances historically in world ports from Public Port to Tool Port or Landlord Port (direction of →).

ort Cost	
Maintenance and Operation Cost	Capital Cost
	← Ratio of Capital Cost →
←	100% →

Figure 4.2 Port Cost

Table 4.3 Cost of Capital

Cost of capital	
Depreciation (construction costs)	Material procurement costs
	Labor administrative expenses
	Design costs
	Business loss costs (site purchase costs, compensation)
	Environmental measures costs
	Etc.
Interest	Credit payment interest, borrowed money fund out of the city

4.4 New Type of Concessions

Among Landlord Port forms, the Concession form is superior. The author suggests a New Concession model to clear a financial problem.

At first, the author comments on the structure of Concession.

As for the case of Concession, a port management body develops land for port use and leases it to a port operator on a long- term basis. The port management body allots a Concession Fee from the port operator for the repayment of creation costs. The port operator pays maintenance administrative expenses to run the port.

The port management body bears the capital cost in full, develops land for a port site, and repays the creation expense by transferred concession fee from a port operator. A deficiency occurs when the operator is unable to repay the Concession Fee in a port where the capital cost rises.

What occurs is that the case of the ratio of capital costs is less than 100 %, as shown in **Figure 4.3**, **Figure 4.4** and **Figure 4.5**?

The author was attentive to the receipt of benefits and expense burden by port logistics.

The range of port logistics is wide, and the economic advantage belongs to a company and the consumers of the district beyond the governorate of the port management body.

For example, the containerized cargo of the Tokyo Port is carried all over Japan across a governorate of Tokyo and becomes the advantage of companies and of consumers all

across Japan.

Therefore, the unfairness of the expense burden occurs between inhabitants receiving advantage and Tokyo inhabitants bearing an expense of the Tokyo Port. It is necessary to take in a system, which casts a national tax depending on advantage into the cost of capital of the port to cancel cost-benefit unfairness.

The author named this model the 'New Concession'.

In addition, the author is going to announce in different papers the theoretical grounds and the method of calculating the injection of the national tax depending on advantage.

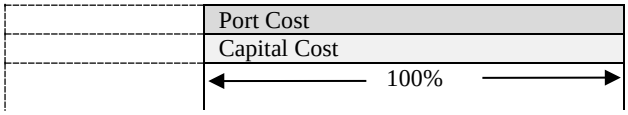

Figure 4.3 Port Management body Should Pay Capital Cost

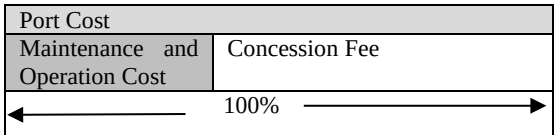

Figure 4.4 Port Operator Should Pay Maintenance and Operation Cost, and Concession Fee

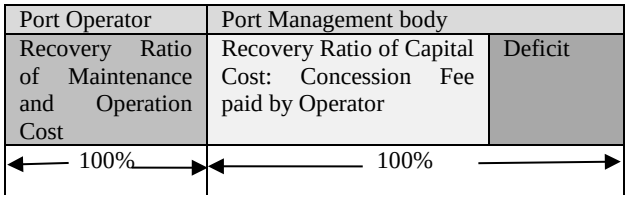

Figure 4.5 Recovery Ratio

4.5 Port Facilities and the Structure of Port Management in Japan

Table 4.4 shows the structure of Account budget of Infrastructures and Superstructures in Japan. There are mainly three types of accounts. The general account is for port improvement works for which the national government and port management body share costs.

The facility bond account is for port facility development projects, which include projects such as construction of cargo handling facilities (warehouses, cargo handling equipment) and cargo ports that are necessary for port activities. The reclamation bond account is for land reclamation projects in coastal areas, under which land is reclaimed for industrial, urban purposes, etc. The port management body issues "Facilities Bond (FB)" and "Reclamation Bond (RB)", respectively, to raise funds for these projects from domestic and international sources. The redemption of these bonds can be funded from facility usage fees and the profits from the sale of land.

Meanwhile, port management is entrusted to the autonomy of the port management body, and the fees from sources such as the usage of the berths and cargo ports are used to fund operational costs.

Table 4.4 Account Budget of Infrastructures and Superstructures

Account	Infrastructures and Superstructures
General	Breakwater, Quay Wall, Channel
Facility Bond (FB)	Cargo handling facilities (Warehouses, Wharf sites, Cargo handling equipment), Storage facilities
Reclamation Bond (RB)	Land for urban development and industry

4.6 Financial Conditions of Port Management bodies

In the analysis of the financial condition of port management bodies, RB must be evaluated separately. This is because RB is weakly related to port management when its purpose is land reclamation for housing and school facilities, although it is strongly related to port management if it benefits port logistics companies. In addition, the source of revenue for RB is different. Unlike port management, which depends on daily revenues, the profits from the sale of land are used to fund bond redemptions in RB. Therefore, the author limited the subjects of analysis of the financial conditions of port management bodies to FBs that can be classified as port management. The subjects of this analysis were all ports in Japan. Regarding RB, the author analyzed the individual financial conditions of Hakata Port as a typical example of ports expected to have corporate locations and other criteria related to port management; and the results of this analysis are provided in **Section 4.7**.

Figure 4.6 shows the revenues for port management and port construction, the administrative expenses related to management and construction expenses, and the difference

between both for all ports in Japan, based on port management body finance data provided by the Ministry of Land, Infrastructure, and Transport. This figure shows that expenditure is approximately 1.5 times revenue. This revenue shortfall is funded through transfers from the general account, profits from the sale of assets, etc.

Figure 4.7 shows the results of comparison between the revenue from port usage fees and management-related administrative expenses, with a focus on port management. These results show that large ports were profitable, with revenue exceeding expenditure by 20-30%. They also show that important ports were registering small losses, with revenue only slightly lower than expenditure.

Figure 4.8 compares revenue from disbursement and public bonds, with expenses related to construction and public bond redemption for port construction, as shown in **Table 4.4**. It shows that expenditure was approximately twice the revenue, and that half the expenditure went toward redeeming public bonds.

As discussed above, port management bodies are able to earn profits from port management, but incur losses during port construction. Since the revenue deficit from port construction is much higher than the surplus from port management, port management bodies record losses overall, forcing them to cover the deficit by drawing upon the general account and other revenues.

Revenue	US$4.3 bn
Expenditure	US$7.0 bn

Figure 4.6 Financial Conditions of All Ports in Japan
Note: port management and construction-related
Source: The author modified and analyzed average data for five years (2007 -2011) from MLIT
Exchange rate: US$1=JPY100 (¥100)

Revenue	US$1.4 bn
Expenditure	US $0.9 bn

Figure 4.7 Financial Conditions of All Ports in Japan
Note: port management
Source: The author modified and analyzed data from MLIT
Exchange rate: US$1=JPY (¥100)

Revenue	US$2.9 bn
Expenditure	US$6.1 bn

Figure 4.8 Financial Conditions of All Ports in Japan
Note: construction-related
Source: The author modified and analyzed data from MLIT
Exchange rate: US$1=JPY (¥100)

4.6.1 Issues with FB and RB

The purpose of the Act on Advancement of Construction of Ports, the foundation law for FB and RB, is to limit port improvement projects that directly input the national expenditure to facilities such as berths and breakwaters. Instead, it requires the port management body to procure funding through bond flotation for facilities such as transit sheds, cargo handling machinery, and land. The port management body can then redeem the bonds with revenues earned through various sources such as usage fees for the completed facilities and profits from the sale of land. If the cost of port construction is small, it is easy to redeem bonds from usage fees and the profits from the sale of land. However, this revenue has to be increased if the amount to be redeemed grows in concurrence with an increase in the cost of port improvements, as described later. If usage fees and the price of land exceed the market value, this may lead to stagnation in the usage of the facility and in land sales, leading to a bond redemption failure. Further, political reasons and competitive pressure often force port management bodies to lower their usage fees and the sale price of land below cost price, in order to attract international traffic and business. Given the possibility of an interest-rate hike, the author believes that the national government and port management bodies should implement a policy for the smooth redemption of bonds as soon as possible, in order to avoid the systematic collapse of bond flotation for designated port-facility construction projects.

4.6.2 Tendency of Construction Costs

The author has pointed out in Takahashi et al. (2014d) that the costs of FB and RB are likely to increase further because of social factors such as expansion to accommodate the increase in the size of ships, as well as natural factors such as earthquakes and softening ground. An outline of the author's claim follows.

a. Offshore development to address increase in ship size

Ship companies are rapidly increasing the size of their container ships and bulk carriers in order to create economies of scale and reduce the cost of marine transport. It is necessary to prepare ports to accommodate these large ships.

However, size increases in ports essentially result in offshore development, since Japan has insufficient land. The cost of constructing port structures in the sea generally grows exponentially with the depth of the water.

b. Protection against earthquakes

Although Japan's islands constitute only 0.1% of the total land area on earth, 10% of all the earthquakes of magnitudes 6 or higher occur on these islands. This proportion has been estimated to be as high as 21% from 1994 onward. Therefore, construction costs in Japan are inevitably growing faster than in East Asian nations, such as South Korea, China, and Vietnam, or in Europe and Australia to protect against seismic activity in this earthquake-prone zone.

Further, the importance of preparing for unexpected phenomena is being seen in a new light since the Great East Japan Earthquake of 2011. According to the calculations of the author, using the storm-surge breakwater in Japan's Nagoya Port as a case study, the reinforcement of the breakwater as a measure against L1 and L2 earthquakes would require 10% of the total project cost. In other words, construction costs for this type of breakwater would be 10% higher than conventional costs, if measures against new earthquake risks were to be implemented.

c. Measures against soft ground

Much of the economic activity in Japan occurs in its flat lands or the thick, soft grounds of Japan's coastal regions. Attempting to construct port facilities over these thick, soft grounds leads to a dramatic rise in construction costs, as the soil has to be improved and long piles have to be driven into the basement stratum. Since the ground is softer in Japan than in other countries and has a shallower basement stratum, the construction costs for port facilities tend to grow when new technologies, special project ships, experienced workers, etc. are required in all stages of design and construction.

d. Offshore development in FB and RB due to rise in construction costs

In addition to a tendency for construction costs for Japanese port facilities to increase due to social and natural reasons, the author has pointed out that construction costs in Japan are generally higher than those in other East Asian nations.

An increase in port construction costs leads to an increase in the amounts of FB and RB issuance and eventually pushes up usage fees and land-sale profits. Countries facing challenges similar to Japan must think of procurement of construction funds and smooth redemption with the assumption that port construction costs will keep increasing.

4.7 Port Management body's Finances Constrained by Redemption of RB

There have been several cases where port management bodies have experienced RB redemption pressures. Therefore, the author will study RB redemption pressures in the example of Hakata Port and Kitakyushu Port, whose port management bodies are Fukuoka City and Kitakyushu City.

In addition, tax revenue is estimated by each port management body. In case of Hakata Port, as preconditions to estimate tax revenue from 2008 to 2039, the port management body of Hakata Port, which is Fukuoka City, assumed that the price of land in the port region would not change at \$560/㎡ and the price of land in the residential region also does not change at \$630/㎡. The port management body of Hakata Port also assumed that the population composition of Hakata Port Island City would experience a change the same as that of the whole of Fukuoka City. Therefore, as for the population composition of Hakata Port Island City, low birthrates and aging advance for 2039.

Furthermore, about the sale of Hakata Port Island City, the port management body of Hakata Port assumed that private enterprises and residents would continue purchasing land in the same ratio and that the land in the port region would be sold out by 2027 and that the land in the residential region would be sold out by 2033.

The port management body of Kitakyushu Port, which is Kitakyushu City, estimated the past tax revenue using land prices and population from 1964 to 2009.

4.7.1 Case study of RB of Hakata Port

Hakata Port is a Major International Port located in western Japan. There have been several cases where port management

bodies have experienced RB redemption pressures. Therefore, the author will study RB redemption pressures in the example of Hakata Port, whose port management body is Fukuoka City.

As shown in **Figure 4.9**, Hakata Port is a Major International Port located in northern Kyushu. **Figure 4.10** shows the location of Hakata Port Island City that is the subject of RB verification.

Figure 4.9 Location of Hakata Port

Source: The author organized this figure based on Fukuoka City (2011b) “Island City Future Forum” materials

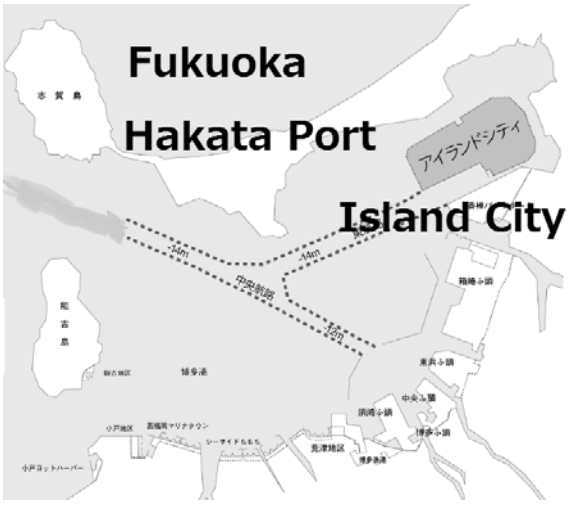

Figure 4.10 Location of “Island City” in Hakata Port

Source: The author organized this figure based on Fukuoka City (2011b) “Island City Future Forum” materials

Table 4.5 shows the financial balance for RB in both the port region of Hakata Port Island City, which is related to port management, and in the residential region, which is not related to port management. Both balances were negative over US$100 million each, bringing the total deficit to US$160 million for both regions.

This balance is calculated for 45 years from the start of the project (1994) to its completion (2039). Since 20 years have passed since the project was launched in 1994, the balance has been calculated based on the records for the 20 years, assuming a drop in land prices to promote land sales, as well as the introduction of various systems such as tax benefits for the next 25 years.

While RB redemptions are calculated based on various assumptions such as sales and settings for fixed-term land leasehold based on the future plan for land sales in lots, the balance is expected to be negative at -US$2 million even in 2039 when the RB will be completed. This indicates how difficult it is to reimburse RB only through land sales. While land sales could occur according to plan, there are uncertainties such as the risk of economic-climate changes.

It is also necessary to reduce port usage fees and land prices as a policy to promote the port for international passage and to attract businesses, so that the port can remain productive. In this case, the funds available for RB redemption would shrink, making it even more important to ensure additional sources of funds for redemption. What can be done? The author believes that the incentive assistance described in the next Chapter can play an important role in smooth and early redemptions.

Table 4.5 Financial Balance for Hakata Port Island City (RB)

Source: The author organized this table based on Fukuoka City (2011a, 2011b, 2012)

Region		US$ Million
Port region	Revenue	1516
	Expenditure	1628
	Balance	-112
Residential region	Revenue	1243
	Expenditure	1291
	Balance	-48
Total	Balance	-160

4.7.2 Compensation of Financial Sources for Redemption by Local Tax Revenue

In this Chapter, the author studies the financial sources of funds for the redemption of FB and RB. It is difficult to use the profits generated from the facilities and lands established through FB and RB (specifically, local taxes) as a source of funds for bond redemption. Therefore, the author proposes that the profits be offered to private companies as incentive assistance. The reason for this is that some of the local taxes should be used as the financial source for FB and RB redemption as profits for the port management body considering that the port functions are delivered with the facilities and land as one unit while both FB and RB are bonds for procuring the construction costs. **Table 4.6** shows the results of a trial calculation of local tax revenue in the example of Hakata Port Island City. It shows the future estimate of business office tax (asset rate), fixed assets tax, city planning tax, and individual municipal tax as local tax revenue. The tax revenue, approximately US$9 million as of 2010, is expected to exceed US$70 million in 2030.

However, from the viewpoint of financial sources of redemption, it seems possible to reimburse RB at an early stage by using at least 1/3 of the tax revenue as incentive assistance, although it is necessary to determine what rate of the overall tax revenue should be used to redeem RB by calculating the profits.

Table 4.6 Estimated Tax Revenue of Hakata Port Island City

Source: Data from Fukuoka City HP processed by the author

Anticipated tax revenue US$ million	
2010	9
2015	31
2020	52
2025	65
2030	73

Exchange rate: US$1=JPY (¥100)

4.7.3 Attracting Businesses through Incentive Assistance

To use local tax revenue as financial sources for FB and RB redemption in the form of incentive assistance, it is necessary that the profits from port facilities and land be estimated to obtain the understanding of the public about transfer of the tax revenue.

Therefore, the author proposes the construction of a system to subsidize port users and land purchasers, drawing upon the general account. Incentive assistance from the general account will not only lower practical usage fee and land sales price, but will also lead to an increase in port users and land purchasers that will consequently increase local tax revenue. The extent of incentive subsidy can be determined by estimating future local-tax revenue.

The example of Fukuoka City is used to study this. Fukuoka City passed an industrial-location promotion ordinance in 2012 and offers three-year subsidies for businesses located in the city, as described in **Table 4.7**. When a logistics-related business purchases land in Island City and constructs a transit shed measuring 1,000 square meters or more in area, 30% of the land-purchasing expenses and 10% of the acquisition expenses for buildings are reimbursed from the general account of Fukuoka City as a subsidy. The upper limit for this subsidy is 3 billion yen (US$30million), and it amounts to a 30% reduction in land price.

While incentive subsidies aim to reduce the facility usage fee and land price, using local tax revenue as a source for funds, they also allow the early redemption of FB and RB. In addition, such a policy can trigger a positive spiral, as the construction of new businesses will lead to an increase in local tax revenue.

Table 4.7 Details of Incentives to Businesses for Relocation (logistics-related and urban businesses)

Source: Fukuoka City HP

New establishment, relocation, or facility provision in important regions (total floor space larger than 1,000 square meters)
[Subject] Land, buildings, and mechanical facilities [Standard] 30% of land price, 10% of building/mechanical machinery acquisition [Limit amount] ¥3 billion (US$30million)
New establishment or relocation in regions other than important regions (logistics industry area, seaside region, etc.); (total floor space larger than 2,000 square meters)
[Subject] Buildings and mechanical facilities [Standard] 2.5% of the above price of acquisition [Limit amount] ¥200 million (US$2million)

4.7.4 Case Study of RB of Kitakyushu Port

Kitakyushu Port is also a Major International Port located in western Japan.

As shown in **Figure 4.11**, Kitakyushu Port is a Major International Port located in northern Kyushu. As shown in **Figure 4.12**, the distance between Kitakyushu Port and Hakata Port is 60km. Both ports have almost the same economic hinterland in the Northern Part of Kyushu.

Kitakyushu Port is managed by Kitakyushu City as a port management body which is a local government as well as Hakata Port is managed by Fukuoka City. Reclaimed land in Kitakyushu Port is the subject of RB verification.

Table 4.8 shows the financial balance for RB in Kitakyushu Port, which is related to port management. The financial balance is a negative US$130 million, bringing also the total deficit to US$130 million.

However, this table shows the results of a trial calculation of local tax revenue in the example of Kitakyushu Port. It shows the future estimate of business office tax (asset rate), fixed assets tax, city planning tax, and individual municipal tax as local tax revenue. The tax revenue is estimated at approximately US$932 million from 1964 to 2009.

From the viewpoint of financial sources of redemption, it seems possible to reimburse RB at an early stage by using the tax revenue. It is necessary to determine what rate of the overall tax revenue should be used to redeem RB by calculating the profits in a like way as in the case of Hakata Port.

Figure 4.11 Location of Kitakyushu Port and Hakata Port

Figure 4.12 Distance between Location of Kitakyushu Port and Hakata Port

Note: The distance between both ports is 60km.
Both ports are located in the same Fukuoka Prefecture

Table 4.8 Financial Balance of Kitakyushu Port

Source: The author created this table based on the hearing from Kitakyushu City.

Assets	US$459 million
Liabilities	US$589 million
Balance	-US$130 million
Tax revenue	US$932 million (Estimated from 1964 to 2009)

Exchange rate: US$1=JPY (¥100)

4.7.5 Comparison between Hakata Port and Kitakyushu Port

Hakata Port and Kitakyushu Port are ports located in northern Kyushu. The distance of both ports is approximately 60 km. However, the redemption method of RB of both Port Management bodies seems to make a great difference.

The port management body of Hakata Port (Fukuoka City) is carrying out a plan to redeem RB of the Hakata Port only by the sale of land. However, because Fukuoka City carries out incentive assistance by the general account at the same time, the author considered this incentive assistance to be the same redemption resources from the general account

Fukuoka City was afraid that the debt of RB would suppress

the general account, so the city chose the method to retain the special accounts of RB and clarify the redemption situation of RB.

In contrast, Kitakyushu City abolished the special account of RB and integrated RB with the general account. Kitakyushu City chose the method to simplify its complicated accounts and clarify the financial status to private enterprises and residents comprehensively.

Each policy of Fukuoka City and Kitakyushu City reflects the difference mentioned above, but the two share the common following points:

a. Adoption of the method to redeem RB by the resources of the general account

b. The economic theoretical grounds that tax revenue from private enterprises and residents in the land should allot for the construction cost of the land

The economic value of the land is comprised of sale income and tax revenue of the land.

Most port management bodies pushed forward the construction of land by RB from 1960 to 2000 because demand was excellent and because construction costs of reclaimed seaside land were cheaper than inland construction costs.

The port management body was able to redeem RB only by the sale income of land. As a result, most Port Management bodies limited redemption resources of RB to only the sale income of land and classified the tax revenue of land into the general account.

One of the causes of the lack of success of the special account of RB was the failure to evaluate reversion of the economic value of the land fairly.

4.8 Conclusion on Financial Condition

In the past, Port Management bodies have found it difficult to choose between having to raise usage fees and land prices high enough to enable smooth redemption in bond-financed projects (FBs/RBs) on the one hand and having to reduce usage fees and land prices to improve the productivity of port logistics on the other. Unless a solution to this problem is found quickly, the finances of Port Management bodies may become even more constrained, given the rising trend in port construction costs due to the risks of disasters such as earthquakes and growing interest rates. It is against this background that the author has addressed the matter of financial sources for the redemption of bond-financed projects (FBs and RBs) by Port Management bodies.

In this report, the author has provided an overview of the financial conditions of Port Management bodies in Japan, and pointed out that the construction of ports has been a major cause of deficits, while port management has been either profitable or balanced.

Further, the author has analyzed the trend in port construction costs in Japan, to estimate future increases or decreases in FB and RB. This analysis has revealed that construction costs are expected to increase in the future, depending on the increase in the depth of port structures and the reinforcement of the aseismic strength required after the Great East Japan Earthquake. The author has surmised that the rise in construction costs would lead directly to a rise in FB and RB issuance.

The author has also argued that that early redemption is desirable for RB, given uncertainties such as changes in the economic climate, although no problems will occur if land sales take place as planned.

Based on the above analysis, the author proposes that facility usage fees and land prices be reduced through incentive subsidies as a measure to reduce the deficits of port management bodies. This will enable the early redemption of bonds and an increase in local tax revenue, since a greater number of businesses can be attracted, as shown in the case study of Hakata Port and Kitakyushu Port.

The author hopes this report will help port management bodies reduce their deficits.

5. Analysis on Legal Problems

5.1 Overview and Issues

Across the world, port management is increasingly adopting a scheme of separating infrastructure and operations; this is also the case in Japan.

In the midst of this global trend, Japan experienced the Great Hanshin and Awaji Earthquake of 1995 and the Great East Japan Earthquake of 2011, both of which devastated major ports, forcing Japan to face challenges related to its port management system. In addition, with major earthquakes expected to strike again in the future, it is urgent for Japan to solve the current problems. Japan's challenges have much in common with those faced by port management abroad. This report reveals legal problems with the current port management system in Japan, which is designed to separate infrastructure and operations. It also contributes to the risk management by foreign ports adopting the scheme.

5.2 An Overview of the Japanese Port Management

Figure 5.1 shows the locations of major ports fulfilling important functions in Japan.

Table 5.1 shows the classification of ports and harbors. There are five "International Strategic Ports," which serve as bases for an international maritime transport network and efficiently link the international network with the domestic maritime transport network. Eighteen "Major International Ports," serve as bases for the international "Major Ports," 102 in total, which serve as bases for the domestic sea transportation network and other ports critically tied to the national interest. **Table 5.2** shows the types of port management bodies managing these ports. One characteristic of the Japanese port management system is that local governments manage all ports.

The current port management system is set out in the Port and Harbor Law, which was enacted under the supervision of "the General Headquarters, the Supreme Commander for the Allied Powers (GHQ/SCAP)" in Occupied Japan in 1950. **Table 5.3** describes the division of roles between the national government and port management bodies based on the Law. The national government is not directly involved in port management, confining itself to mandating basic policies for port construction and management or technological standards for facilities. Port management is entrusted to port management bodies (local governments).

Figure 5.1 Locations of Ports in Japan **(Figure 1.1**)

Table 5.1 Classifications and Numbers of Ports (**Table 1.2**)

Classification		
International Strategic Ports	Extremely Significant Role for International Trade	5
Major International Ports	Significant Role for International Trade	18
Major Ports	Significant Role for Mainly Domestic Trade	102
Local Ports	Role for local area's trade	808
Article 56 Ports	Designated Water Ares	61
Total		994

Sixty years after the Port and Harbor Law was enacted, however, the inefficiency of management by local governments became widely recognized, which led to the introduction of the port management corporation system. This system used private companies to manage ports, thereby separating port infrastructure from port management. This report will review the history leading to the introduction of this system.

5.3 Striving for Regional Port Management

Japanese local governments were established in accordance with the Local Autonomy Law. **Table 5.4** is an excerpt from the law stipulating the roles of local governments and the national government. According to the law, the role of a local public body is to "promote the welfare of its residents, for which purpose it shall carry out a wide range of tasks in the autonomous and comprehensive performance of local public administration," while the role of the national government is to enforce policies on the national level.

On the other hand, activities related to the logistics part of port activities are administered regionally, beyond the jurisdiction of local governments. Ports are also managed in accordance with international agreements.

Table 5.2 Type of Ports and Port Management bodies (**Table 1.3**)

Note: (*) shows numbers of “Ports of Refuge”. Total includes number of “Ports of Refuge”.

Port Management Bodies governing several types of ports are classified into the high rank division.

Source: “List of Port Management Bodies” of MLIT (2016)

		Port Management Body			
Division	Total	Prefecture	Municipality	Port Authority	Administrative Association
Int’l Strategic Ports	5	1	4	0	0
Major Int’l Ports	18	11	4	0	3
Major Ports	45	25	16	1	3
Local Ports	98	2	96	0	0
Total (*)	166 (29)	39 (23)	120 (6)	1 (0)	6 (0)

Table 5.3 Major Roles in Port Management

National Government • Policy formulation for the development and administration of nationwide ports and harbors • Establishment of necessary laws and regulations • Providing advice and guidance on port administration and operation to port management bodies • Authorizing development plans for major ports • Financial assistance for port management bodies in relation to port construction projects • Implementation of port construction projects (projects under the direct control of the national government) • Improvement and maintenance of shipping channels outside the port area • Establishment of technological standards for planning, design, and construction of ports and harbors • Surveys and research concerning port technology
Local Government (Port management Body) • Formulation of port development/management plan • Construction and maintenance of port facilities • Permission for and restrictions on facility use in port management districts (marine districts, land districts) • Leasing and management of port facilities • Setting and collection fees for use of port facilities • Establishing conditions for providing port services • Land reclamation in harbor districts • Environmental protection in ports and harbors • Statistics collection for ports and harbors • Marketing and promotion of ports and harbors

Table 5.4 Role of Local Government according to the Local Autonomy Law

Article 1-2 The task of a local government shall be to promote the welfare of its residents, for which purpose it shall carry out a wide range of tasks in the autonomous and comprehensive performance of local public administration.
Article 1-2 In order to accomplish the purpose of the preceding paragraph, the role of the national government shall mainly be to attend to: matters relating to its position as a nation in the international community, matters concerning basic rules on national activities or local autonomy that should be standardized nationally, or matters concerning policies and programs to be implemented on a national level or from a national viewpoint. As a rule, administrative matters close to the people shall as far as possible be referred to local government entities, so that there is an appropriate sharing of roles with local government. In the working out of rules and the implementation of programs relating to local administration, the autonomy and independence of the local government must be fully exercised.

Given the limited role of local governments, how did regional port management schemes develop?

5.3.1 The First Period: Management by Public Corporations

The national government enacted the Foreign Trade Terminal Public Corporation Law in 1967, establishing two public corporations, Keihin and Hanshin. The corporations took sole responsibility for regional port administration, wielding management body over port management bodies (local governments). The corporations also constructed and managed the regional container terminals necessary to manage marine container logistics. As part of administrative reform by the national government striving for small government, however, the corporations were dissolved in 1982. Port administration was returned to local governments

5.3.2 The Second Period: The Introduction of Private Management through the Super-hub Port System

The national government revised the Port and Harbor Law and introduced the Super-hub Port System in 2005. In three areas — Keihin, Hanshin, and Isewan — the system enabled a single private company to manage contiguous, multiple container terminals as a whole, allowing it to pursue economies of scale in its operations. This revision created the current system of regional port management by private companies.

5.3.3 The Third Period: Private Regional Management through the Port Management Corporation System

The national government revised the Port and Harbor Law in 2011, establishing the scheme that separates infrastructure and operations. This revision has entrusted port management to free management by private companies, creating conditions for them to engage in regional management. More than sixty years after the Port and Harbor Law of 1950, the regional management system has become a reality.

5.4 Remaining Challenges for Port Management

In the wake of this complicated history, the port management corporation system bears a heavy responsibility to implement port policies. However, the system faces still other challenges. Port management corporations are required to make use of the knowhow accumulated in private companies while looking out for the public interest. Furthermore, because Japan does not have a long tradition of port management by private companies, these corporations face a series of challenges. For example, if a particular port management body (local government) invests large amounts of money in a port management corporation, the local government, as an investor, can press the corporation to act for the sole benefit of the local community, rather than the interests of the corporation. To improve the management environment faced by port management corporations, the author examined challenges for port management helping improving the productivity. **Table 5.5** is the results.

Creative management, quick decision-making, and regional or diversified management covering multiple ports to streamline management through economies of scale are essential means for port management corporations. In addition, what is optimal for a single port is not optimal for Japan as a whole. The country needs a system that aims for the optimization of the whole rather than an optimization of parts. Therefore, this report points out weaknesses of the current system.

5.4.1 Creative Management and Quick Decision-Making

Port management bodies are local governments, which as public institutions are required to judge and act fairly and impartially. Port management bodies are not permitted to set management policies that are favorable or unfavorable to particular companies. This emphasis on fairness or impartiality might hamper creative management and quick decision-making by port management corporations.

In addition, port management corporations are entitled to plan their business and make management plans on their own. If they receive contributions from particular port management bodies, however, they may have difficulty in making decisions that are unfavorable to the management bodies, even if the decisions are appropriate on a regional scale. For port management corporations to manage creatively and make decisions quickly, they need to be independent of the restraints of local governments.

On the other hand, because port management must be consistent with the national interest, the national government needs the power to supervise those corporations.

Table 5.5 Remaining Challenges

	Port Management Body (Local Governments)	Port Management Corporation
Management	Limited guidance based on port master plan	1) Limited financing by port management body 2) Creative management and quick decision-making 3) Regional or diversified management
Supervisory power of the national government	National government lacks the power to encourage port management bodies to consider the best interests of the whole	There is an obligation to report
Disaster	Limited capability to respond 1) Obligation to report 2) Disposal 3) Management of a regional network 4) Quickness	1) Lack of measures to restore management quickly 2) Obligation to report
Finance	Principle of limited income	Financial support to maintain and expand navigation routes

5.4.2 The National Government's Involvement in Building Infrastructure

For port management corporations to manage ports smoothly under the scheme of separating infrastructure and operations, they need to be provided with ample infrastructure. If it is decided that a local port management body can bear the cost of building an infrastructure, the body may delay building the infrastructure if it does not benefit the local community. Local governments are willing to build infrastructure that benefits their communities but not the country, but not to build infrastructure that benefits the country but not their communities. The national government needs to secure the power to get involved in building port infrastructure.

5.4.3 The National Government's Involvement in Management and Operations

To support creative management and promote management beneficial to the country, the national government needs secure the power to get involved in port management.

In addition, although there are many stakeholders involved in ports, no one has the power to take the initiative in coordinating those stakeholders. The power to facilitate the coordination should be granted to the national government.

5.5 Port Management in Disaster

The Great East Japan Earthquake in March 2011 completely destroyed ten major international ports, mainly on the Pacific side in the Tohoku Region. Although local port management bodies should have restored port functions as soon as possible, they appropriated limited human resources, equipment, materials, and financial resources for the relief of affected residents. As a result, only port personnel worked on restoring the ports. Such policies were natural and in accordance with the spirit of the above-mentioned Local Autonomy Law stipulating "tasks in the autonomous and comprehensive performance of local public administration." In terms of port management and operations, however, it is necessary to apply the following three lessons as a hedge against another major disaster.

5.5.1 Lessons

Three lessons as a hedge against another major disaster are as follows;

Lesson 1: An Essential Backup System

Figure 5.2 illustrates that unaffected ports on the Japan Sea side operated as backups, taking over the logistical functions of affected ports on the Pacific side. Because it takes anywhere from a few months to a few years to restore damaged ports, it is essential to develop a backup system through cooperation among ports.

If different management bodies or port management corporations manage ports, however, the activation of a

backup system can be delayed. It is desirable to develop a backup system run by one port management body or corporation. To establish a backup system as a contingency against a major earthquake affecting a wide area, it might also make sense for a centralized port management body with an organizational structure covering the whole country to manage and operate ports and harbors.

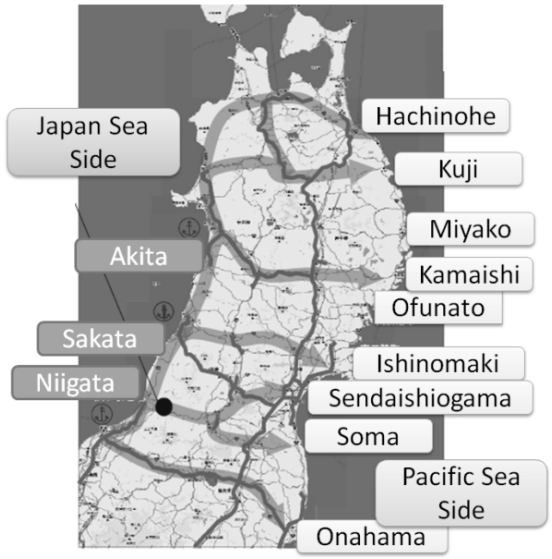

Figure 5.2 Backing up Ports on the Pacific Side (right side)

Note: Logistics of Goods from Ports on the Japan Sea (left) to Ports on the Pacific Side (right) affected by the Great East Japan Earthquake.

Note: The green line shows the logistics lines on the road where support supplies were carried in 2011.

Lesson 2: The Loss of the Function of a Port Management body

As mentioned earlier, immediately after the earthquake, port management bodies (local governments) appropriated limited human resources, equipment, materials, and financial resources for the relief of affected residents, leaving the restoration of ports to port personnel. Although these policies were based on the Local Autonomy Law, they resulted in those bodies neglecting port management functions. A comparison of infrastructure clearing operations of roads versus ports clearly reveals that roads, directly controlled by the national government, were rapidly cleared, whereas ports took several months to clear.

The fundamental problem is that the Port and Harbor Law does not anticipate that a port management body will neglect its functions in times of disaster. To avoid the possibility that port management bodies (local governments) will become functionally paralyzed and fail to fulfill their management functions, alternative measures should be introduced, such as regional port management, port management by other port management bodies, or management by the national government, and other bodies should manage the restoration of devastated ports.

Lesson 3: Financial Problems caused by the Annual Accounting System and Complex Ordering Procedures

The national government and local governments use an accounting system that requires them to include the expenditure for a purchase to be made next year in the budget for the current fiscal year. In addition, to order construction or supplies, they have to follow complex procedures including gathering price estimates and issuing public notice, which take several months. Beyond these procedures, in the case of restoring a disaster-stricken area, the national government has to assess the damage so that the order reflects the extent of the damage, which further extends delays. Among the ten major international ports affected by the earthquake of 2011, Hachinohe Port was the first to be restored, but the restoration was not completed until August 2013, two years and five months after the earthquake. Restoration work on the other ports is still underway.

On the other hand, roads directly controlled by the national government, the Shinkansen, and expressways were restored quickly. It is necessary to introduce a contract method free of the annual accounting system and complex ordering procedures.

5.5.2 The National Government's Involvement in Disaster Response

Major disasters, where local public bodies as a whole are busy providing relief to affected residents, necessitate the involvement of the national government. In countries such as Australia, where a state and county system is used, it is replaced by the "involvement of state and county governments."

For the national government's involvement in a disaster to be effective, port management bodies and corporations need to be obliged to report the damage to the national government.

The national government in turn needs to control the disposal of debris in restoration, and it needs to be able to decide for other bodies. The details are as follows.

a. An Obligation to Report Disaster Damage

One characteristic of Japanese ports is that, in a disaster, port management bodies or management corporations do not have an obligation to report the damage to the national government. The national government cannot collect information about the damage through legal systems. On the other hand, operators of railways or airports are obliged to report accidents to governmental bodies such as the Ministry of Land, Infrastructure, Transport and Tourism (Minister of MLIT), not only in cases of disaster but also in ordinary times. To facilitate the sharing of information, the obligation to report in disaster and ordinary times should also apply to port management bodies and management corporations.

b. Disposal Right

In emergencies, local port management bodies have the legal right to dispose of debris or flotsam and to enter others' premises; the national government does not. To facilitate rapid restoration in major disasters, these legal rights should be granted to the national government as well as port management bodies.

c. The Power to Decide Priorities in Restoration Efforts

It is crucial to decide in terms of a nationwide network which ports should be first restored. However, neither port management bodies (local governments) and management corporations nor the national government has the power to make this decision. As a result, the decision is made through consultation, but reaching an agreement can be delayed when stakeholders have conflicting interests. For the sake of the nationwide network, the national government needs to be the decision-maker when prioritizing restoration.

5.6 Legal Problems

The above discussion reveals that the current port management system, where port management bodies (local governments) manage the ports, has the following legal problems.

5.6.1 The limitation of Port Management/Operations by Local Governments Bordering the Sea

The Port and Harbor Law enacted in 1950 allows only localities bordering the sea to participate in the establishment of port management bodies.

It is questionable whether administrative decisions by local governments can appropriately manage ports when the scale of port logistics is expanding, domestically and internationally.

5.6.2 The Port Management System is divorced from the Spirit of the Local Autonomy Law

According to the Local Autonomy Law (**Table 5.4**), a local public body's function is to "promote the welfare of its residents, for which purpose it shall carry out a wide range of tasks in the autonomous and comprehensive performance of local public administration." Port management by multiple local governments brings different benefits depending on the bodies. Is it possible to maintain free port management?

5.6.3 The Risk of the Breakdown of Port Management and Operations

The Port and Harbor Law does not anticipate that a port authority could cease to function. To avoid the possibility that port management bodies (local governments) could become functionally paralyzed, alternative plans should be introduced, such as regional port management, port management by other port management bodies, or management by the national government (or state and county governments).

5.6.4 Creative Management, Pursuing Economy of Scale while Safeguarding the Public Interest

For port management corporations to manage freely and creatively, it is important to provide a management environment in which they are free of the administrative restraints imposed by local governments and can pursue economies of scale by, for example, managing multiple ports as one system.

On the other hand, to secure the public interest in port management, the then Minister of MLIT stated in the Diet: "Concerning these port management corporations, I would like to safeguard the public interest through restrictions on holding too much stock, supervisory orders to the corporations, or revocation of designation" (at the Committee of Land, Infrastructure, Transport and Tourism of the House

of Representatives on March 15, 2011). In addition, both Houses of the Diet passed a supplementary resolution stating: "The government shall take necessary measures particularly to safeguard the public interest, considering that port management corporations become exclusive management bodies for public goods, ports and harbors" (at the Committee of Land, Infrastructure, Transport and Tourism of the House of Representatives on March 15, 2011 and the Committee of Land, Infrastructure, Transport and Tourism of the House of Councilors on March 31, 2011). It is necessary to safeguard the public interest while pursuing creative management.

5.7 Solutions to Legal Problems

This Section examines how to solve the above problems. There are helpful precedents in Japan. **Table 5.6** and **Table 5.7** compare port management corporations with other transportation management companies. They comprise the airports of Narita, New Kansai, and Central Japan, which integrate infrastructure and operation; the Japan Railway Construction, Transport and Technology Agency (JRTT), which separates infrastructure and operation; and the Japan Expressway Holding and Debt Repayment Agency (JEHDRA), which also separates infrastructure and operation.

The Narita International Airport was built and is managed and operated by a wholly government-sponsored special corporation; Kansai International Airport, by a special corporation financed by the national government, local governments, and private companies; and Central Japan International Airport, by a designated corporation financed by the national government, local governments, and private companies.

The Shinkansen separates infrastructure and operation: JRTT builds, owns, and leases infrastructure to JRs, which manage and operate it. The defining characteristics of the arrangement are as follows:

a. JRTT respects decisions made by JRs.
b. JRs pay only lease fees, which are set below JRs' profits, namely, the difference between their earnings with the Shinkansen and those without it. They do not have to pay construction costs.
c. Part of the income from the lease fees is allocated to pay construction costs, while the balance of the costs is paid by the national government (2/3) and local governments (1/3).

JRTT, financed almost entirely by the national government and local governments, builds and owns the Shinkansen, allowing JRs to use it exclusively. This is similar to ports: the national government or other bodies build port facilities, and then lease them to port management corporations.

Expressways also use the scheme of separating infrastructure and operations: JEHDRA owns road facilities and leases them to Nippon Expressway Companies (NEXCOs), which manage and operate them. The defining characteristic is that JEHDRA adjusts the loan fees so that NEXCOs do not generate profits.

The comparison of these cases reveals the following trends:

a. Kansai International Airport, Central Japan International Airport, Metropolitan Expressway, and the Hanshin Expressway are infrastructures closely tied to their local communities. Local governments finance them thanks to these close relationships. On the other hand, Narita International Airport and Nippon Expressways (East, Central, and West) are not locally financed.
b. Except for the completely privatized JR-East and JR-West, the national government finances infrastructure.
c. Except for the completely privatized JR-East and JR-West, the national government guarantees debt. (JR Hokkaido and JR Kyushu have funds for stable management.)
d. For all these infrastructural elements, the Minister of MLIT reserves the power to issue supervisory or advisory orders.

These forms of involvement by the national government and local governments suggest how to support port management corporations. Namely, for port management corporations to engage in regional management, it would be necessary to increase support from the national government, in the form of financing and debt guarantees, or to review financing by local governments.

Table 5.6 Management and Operations of Public Facilities by Private Companies

	Port	Airport			Shinkansen		Road	
	Port Management Corporation (Inc.)	Narita International Airport (Inc.)	New Kansai International Airport (Inc.)	Central Japan International Airport (Inc.)	JR (East, West)	JR (Hokkaido, Kyushu)	Nippon Expressway (Inc.) (East, Central, West)	Expressway (Inc.) Metropolitan, Hanshin
Corporate form	Designated company	Special company	Special company	Designated company	Joint-stock company	Special company	Special company	Special company
Capital Structure	Local governments, Private companies	National government	National government, Local governments, Private companies	National government, Local governments, Private companies	Public	National government	National government	National government, Local governments
Management form	Separate infrastructure and operation, Owned by the national government and a port authority	Integrated infrastructure and operation	Integrated infrastructure and operation	Integrated infrastructure and operation	Separate infrastructure and operation, Owned by JRTT		Separate infrastructure and operation, Owned by JEHDRA	

Table 5.7 Management and Operations of Public Facilities by Private Companies

	Port	Airport			Shinkansen		Road	
		Narita	New Kansai	Central	JR (E,W)	JR (H,K)	N.E	E.M, E.H
Obligation of the national government to hold stocks	No	No	Yes, 1/2 or more	Yes, No regulations about the share	No	No	Yes, 1/3 or more	Yes, 1/3 or more held by the government and local governments
Support	・Interest-free loan ・Tax break	・Interest-free loan ・Financing by the national government ・Debt guarantee	・Interest-free loan ・Financing by the national government and local governments ・Debt guarantee ・Tax-free reserve	・Interest-free loan ・Financing by the national government and local governments ・Debt guarantee ・Tax-free reserve	No	・Funds for stable management	・Debt guarantee	
Supervision by the Minister of MLIT	Supervisory orders etc.	Supervisory orders etc.	Supervisory orders etc.	Supervisory orders etc.	Advisory orders etc.	Supervisory orders etc.	Supervisory orders etc.	Supervisory orders etc.
Administrator	Not a port authority	Airport administrator in the Airport Law			—		No road administrator in the Road Traffic Law	

5.8 Conclusion on Legal Problems

This report has discussed the Japanese port management system, focusing on regional port management or diversified management; the kind of management necessary to make use of the knowhow of joint-stock companies and port management corporations; and the development of the Super-hub Port policy since the Port and Harbor Law was enacted in 1950. It has also shown that port management by private companies has been required to safeguard the public interest since the Great East Japan Earthquake. This report also shed light on the fact that the power of the national government is limited because it entrusts port management to port management bodies, although port management and operations seriously affect the national interest.

On the other hand, in Japan, port management corporations as well as the national government and port management bodies have not yet accumulated enough management knowhow. Therefore, this report compared port management with precedents — cases of the management of other infrastructural elements adopting the scheme of separating infrastructure and operation — to see what kinds of problems should be solved to achieve the goal of improving Japan's productivity and sustainability through aggressive management by fledgling port management corporations making use of private knowhow.

As a result, this report was able to prove the following in analyzing regional port management by port management corporations:

a. The power of the Minister of MLIT is weak both in ordinary times and in disaster.
b. Management by port management corporations is not independent enough of port management bodies.
c. For port management corporations to expand their operations, it is imperative to examine the possibility of the national government financing them or giving them debt guarantees.

Considering these findings, the author proposes shifting to the following system to solve the legal problems of the port management system:

Port management strategy follows the precedent of separating infrastructure and operation, and

a. The creativity of port management corporations is respected. Corporation management is placed outside the jurisdiction of local governments; or the bodies' involvement is limited or eliminated. The national government finances the corporations.
b. Public institutions build infrastructure with financial support from the national government, leasing them to port management corporations.
c. To safeguard the public interest, the national government obliges port management corporations and public institutions to report disaster damage and reserves the power to get involved in their disaster management.

The author hopes that, considering in the Japanese strategies introduced in this report, those involved in port management across the world will pursue the ideal port management system for their own countries.

6. Analysis on Large-Scale Natural Disasters

6.1 Overview and Issues

As mentioned in **Chapter 2**, Shipping companies consider two types of factors when setting up trunk shipping routes for international container transportation. The first is geographical factors, such as geographical positions on a global scale, sea area conditions to set up shipping routes, economic sizes of port hinterlands, and international affairs. The other is factors related to means of transportation, such as scales and functions of container ships and container terminals. Fujita･Krugman･Venables (1999) had shown why ports and other transportation hubs become sites for cities. By focusing on the "economic activity density" and "vertical depth" of the port hinterland, which are the least studied among geographic characteristics so far, an analysis of the geographical characteristics of ports throughout the world clarified that three types of ports exist in terms of port placement: a. "Continental hub port type," which has dense economic activity and is large in vertical depth; b. "Marine hub port type," which has low density economic activity and is small in vertical depth; and c. "Japanese-type," which has dense economic activity and is small in vertical depth. The analysis also clarified that, to prevent further decreases in the shares of economic activity in other countries, Japanese-type ports are required to implement a balanced minimization policy that does not depend on improved indexes of overseas transshipment ratios but on the integration of port facilities.

In contrast, the Great East Japan Earthquake in Japan of 2011 paralyzed the functions of ports on the Pacific side in the Tohoku region in Japan. Including Japan, which suffered from the Great East Japan Earthquake, many countries harbor the risks that large-scale natural disasters will cause serious damage to their lands. Using the sacrifice model, the variation in container logistics caused by earthquakes was analyzed for the Nankai Trough Earthquake, which is expected to occur in Japan in the future. The following points were clarified: the necessity of establishing hub ports as backups for ports that are functionally paralyzed during disasters, that countries whose economic activity density is now declining should implement a balanced minimization policy based on port integration, and that countries facing the risk of large-scale natural disasters should establish hub ports to back up sacrificed ports in addition to implementing a balanced minimization policy.

6.2 Response to Large-Scale Natural Disaster Risks

Of the major ports in Japan (**Figure 6.1**), the Great East Japan Earthquake of 2011 destroyed 10 ports located on the Pacific side of Tohoku Region (See **Figure 5.2**) and paralyzed port logistics. The ports on the Sea of Japan side functioned as backup for port logistics on the Pacific side. In addition to being responsible for transporting emergency supplies to stricken areas, the ports on the Sea of Japan side took on the necessary logistics to enable private businesses to resume operations. Oddly, the Great East Japan Earthquake enabled the realization of the importance of healthy ports to back up disaster-stricken ports.

Meanwhile, the Nankai Trough Earthquake is predicted to occur in the future and cause damage concentrated in the Pacific-side ports in the Middle Western part of Japan based on the expected point of origin, as shown in **Figure 6.2**. This report decided to verify the ports that would function as backups for the stricken ports if the Nankai Trough Earthquake occurs to fully utilize the lessons learned from the Great East Japan Earthquake. This verification considered as the subject cargo the marine container shipments that can be horizontally transported on land over long distances, and the sacrifice model improved by Iyama･Watanabe (2010, 2011) was adopted as the estimation model. Although bulk cargo such as completed automobiles may be transported on land over long distances, this method was not included in the estimation. The supposition was that transport routes would be changed for these shipments in accordance with the container cargo.

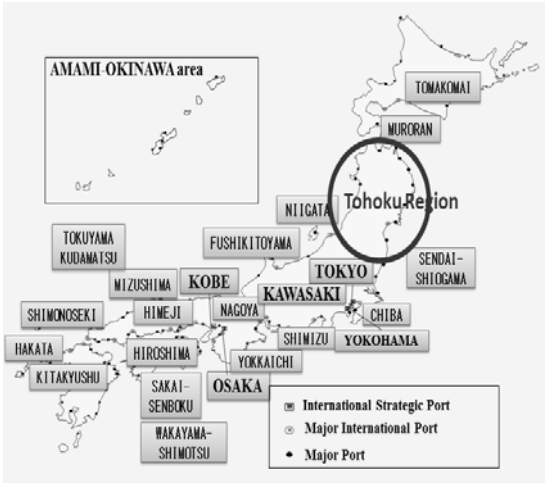

Figure 6.1 Locations of Ports and Tohoku Region in Japan

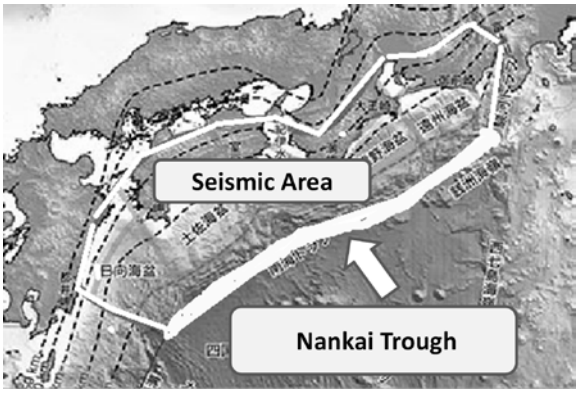

Figure 6.2 Focal Area Affected by the Nankai Trough Earthquake Likely to Occur in the Future

Source: The author create this figure based on HP of the Headquarters Earthquake Research Promotion

6.2.1 Overview of the Sacrifice Model

The sacrifice model is a decision-making model that digitizes behavior patterns to select the route that wastes the least time and cost (in other words, has the least sacrifice) for transport or movement when cargo is transported or when a traveler moves. A characteristic of this model is that it simply digitizes the two main factors for route selection, which are time and cost.

The sacrifice model is expressed using the following **Equation (6.1)**:

$$Sr = Cr + \alpha \cdot Tr, \quad (6.1)$$

where Sr represents total sacrifice, Cr represents cost, α represents the time value, and Tr represents time.

The total sacrifice Sr for route r is expressed as the cost Cr required for each route, including fares and transport expenses added to the product of the estimated time Tr required for the corresponding route and the time value α, which is determined by the characteristics of the cargo or the traveler.

Now, how is a route selected using the sacrifice model? The concept is shown in **Figure 6.3**, in which the vertical axis plots the total sacrifice and the horizontal axis plots the time value. For example, supposing that three routes may be selected to transport cargo from the departure location to the destination, these three routes vary with respect to transport expenses and required time. Thus, the sacrifices expressed by **Equation (6.1)** are calculated as S1, S2, and S3. S1 is a route with low transport expense but long transport time, whereas S3 has high transport expense and short transport time. S2 has intermediate transport expense and its transport time is between that of S1 and S3. On any of these routes, the total sacrifice S becomes larger in proportion to the time value.

Therefore, the route to be selected varies depending on the time value. In **Figure 6.3**, Route 1 is selected if the time value is smaller than α12, Route 2 is selected if the time value is between α12 and α23, and Route 3 is selected if the time value is α23 or larger.

Meanwhile, the time value varies depending on whether cargo or a traveler is being transported, and each forms a point on a line when viewed individually. Thus, expressing the time values as a collection is possible by grasping how they are distributed when considered collections of shipments or travelers.

In general, practically no studies exist on shipping cargo, although research on estimating the time value for travelers has been more extensively conducted. Therefore, this report presumed that the time value for cargo would have a logarithmic normal distribution pursuant to the estimation method for travelers. Moreover, this report also presumed that the probability of the person making the choice to select the transport route is the same as the actual measurement value for a container cargo flow survey.

Table 6.1 shows time value and the time value distribution curve is expressed using the following **Equation (6.2)**:

$$f(x) = \frac{1}{\sqrt{2\pi}\sigma x} \exp\left[-\frac{1}{2}\left(\frac{\ln x - \mu}{\sigma}\right)^2\right] \quad (6.2)$$

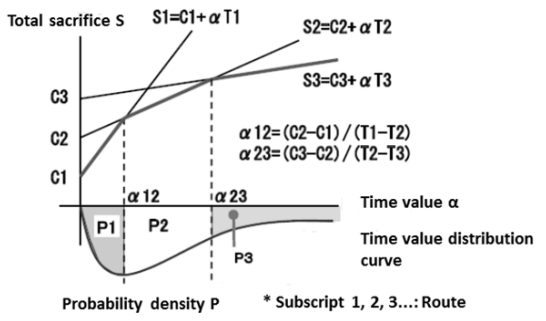

Figure 6.3 Concept of the Sacrifice Model

Table 6.1 Time value

	Asia Lines		Trunk Lines	
	Export	Import	Export	Import
Average μ	7.37	7.12	7.67	7.58
Standard deviation σ	1.19	1.90	1.85	2.29
Coefficient of Determination R^2	0.48	0.49	0.53	0.44
Number of Data	254	268	96	110
Time value (Median):α ¥/hour・TEU	1,590	1,233	2,146	1,963

Cost is determined based on the results of an investigation of the Ministry of Land, Infrastructure, Transport and Tourism.

6.2.2 Simulation Results

Figure 6.4 shows the simulation results, which are now reviewed.

The cargo volume of Keihin (Tokyo, Kawasaki and Yokohama), the ports on the Sea of Japan side (Hakata, Kitakyushu, Shimonoseki and Tsuruga etc.), the ports on the Setonaikai (Hiroshima and Mizushima etc.) and others is increasing. Those ports would function as backups for 7.4 million TEU per month, corresponding to 42% of Japan's total marine container cargo (17.4 million TEU per month).

The red portion of the graph shows the cargo via Busan Port. The number of transshipment containers would nearly 3 times at Busan Port. What should be mentioned specially is that the cargo volume of Tsuruga Port is almost occupied by the cargo via Busan Port.

Backup ports, which function as a backup for the ports destroyed by the earthquake, would double or more cargo volume. It means that cargo volume to be handled exceeds the capacity of container terminals in backup ports. Thus, the author believes that Japan must consider the following backup scenario when they develop a backup system in the event of earthquakes:

6.3 Backup scenario for Establishing Backup Systems

What can be commonly said about all cases is that the handled volumes for each port that functions as a backup for ports destroyed by earthquakes would double or more than double. Because shipments exceeding the capacities would be concentrated on the backup ports, these ports' limits for handling shipments would be practically exceeded. It is also expected that a concentration of transshipments would occur at Busan Port, Shanghai Port, Kaohsiung Port, Hong Kong Port, and Singapore Port, where an increase in transshipment containers is predicted. **Figure 6.4** shows the increase in transshipment cargo volume at overseas ports such as Busan Port. Overall, at overseas ports, the volume of cargo handled would increase to 3 or more times. In particular, in the rate of increase, Shanghai, Singapore, Hong Kong and Busan are high.

Thus, the author believes that it is necessary for Japan to consider the following backup scenarios when they develop a backup system in case of earthquakes:

Backup scenario 1: Provide full support with backup ports

As shown at **Figure 6.5**, in this case, expansion in capacity will be necessary in terms of facilities, including capacity to allow the docking of large ships and handling capacity for marine container shipments. It is difficult to handle 40% of the marine container shipments for the entire country of Japan in terms of the scale of facility capacity and the size of investment, and it is not easy to change the ports of call for large ships that make tours around the world.

Backup scenario 2: Set up domestic hub ports for backup and coordinate by feeder transport

As shown at **Figure 6.6**, because shipments were concentrated at Northern Kyushu, Niigata Port, this backup scenario tries to position these ports as the hub ports for backup and to establish coordination with other healthy ports through feeder transport.

Although it is difficult to change the trunk routes for large ships, because the service patterns for the large ships all over the world would be affected, it is possible to change the service patterns for collection at ports where they already regularly dock or in concurrence with reducing the number of the ports of call. On this point, Northern Kyushu, Shimizu, Mizushima, Hiroshima, Kanazawa, etc. would play the important role of backup hub ports.

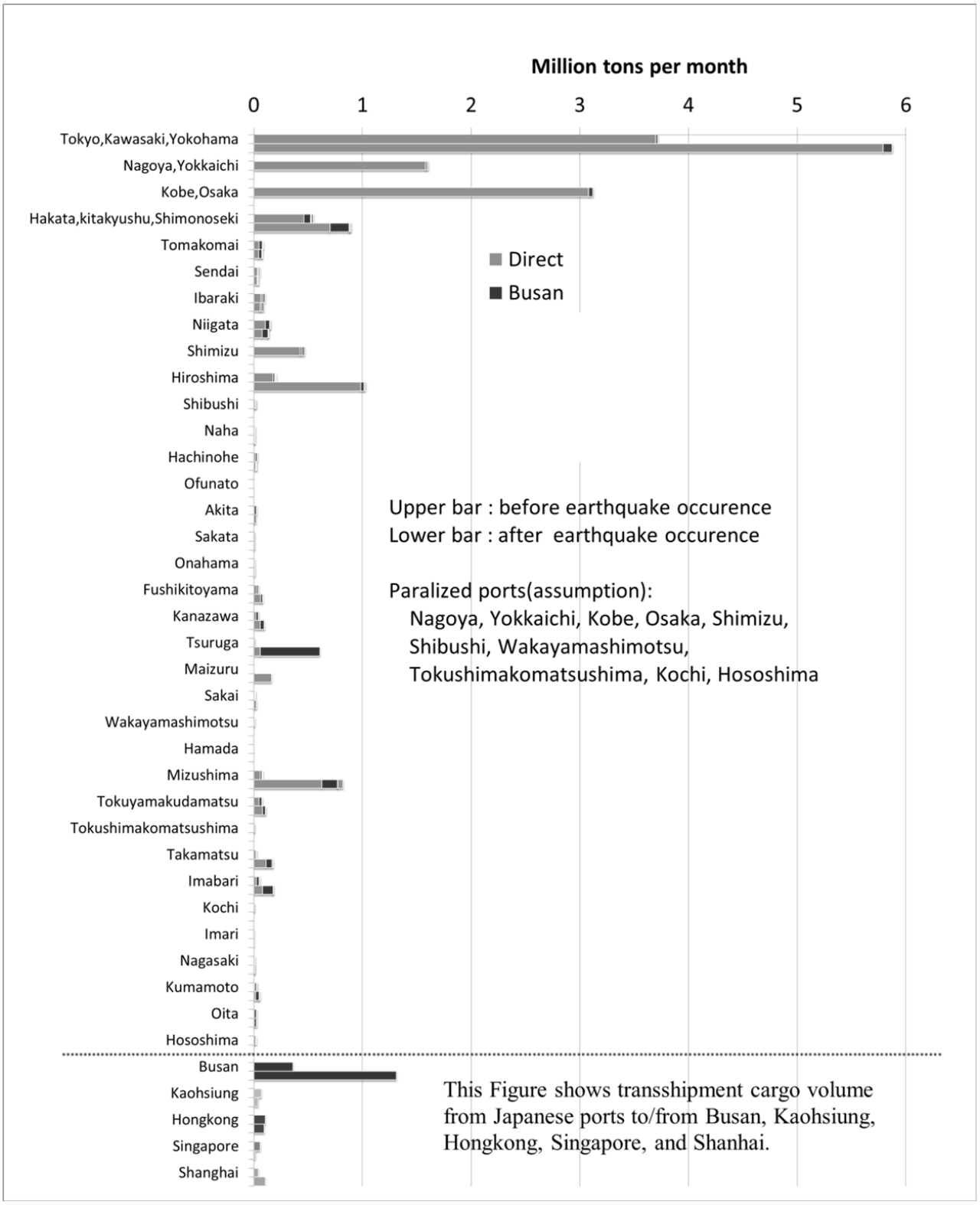

Figure 6.4 Changes in Container Logistics affected by Nankai Trough Earthquake
Note: Black shows the volume of Busan Port.

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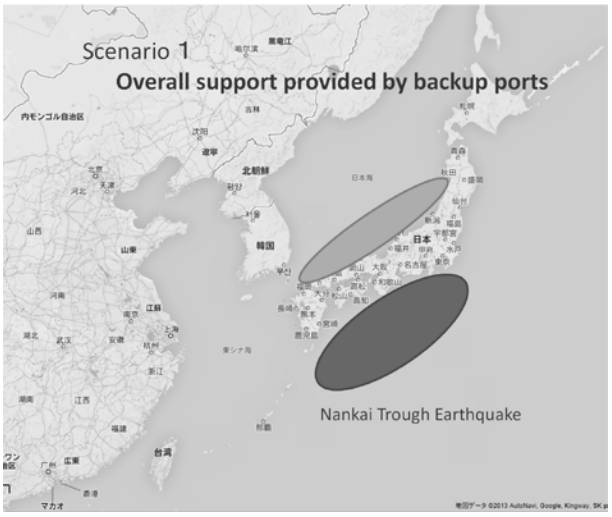

Figure 6.5 Backup scenario 1

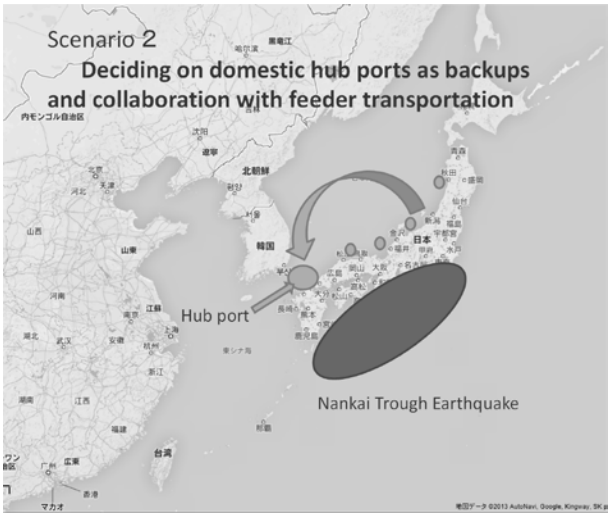

Figure 6.6 Backup scenario 2

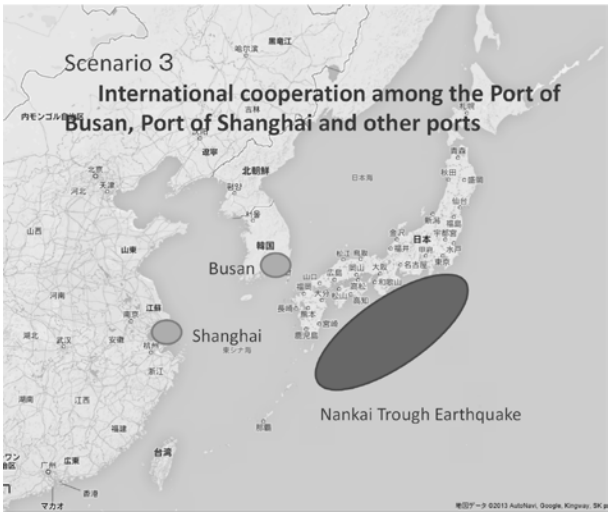

Figure 6.7 Backup scenario 3

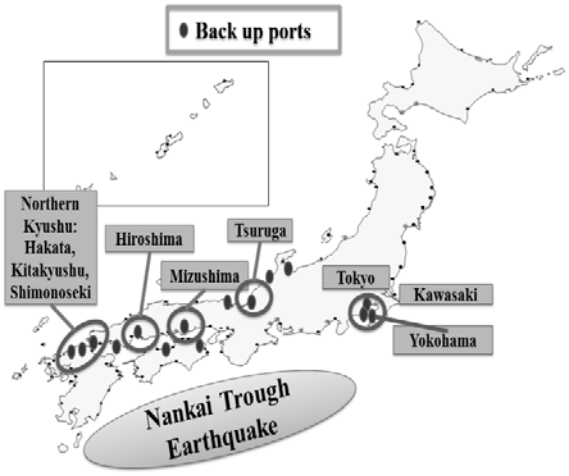

Figure 6.8 Location of Back up ports
Note: In case of Nankai Trough Earthquake occurs.

Backup scenario 3: International coordination with foreign ports such as Busan Port and Shanghai Port

As shown at **Figure 6.7**, this is the backup scenario for using transshipment of Japanese cargo at Busan Port, Shanghai Port, and others through international coordination. There has already been a case of international port integration between Copenhagen Port in Denmark and Malmö Port in Sweden (See **Section 7.4**). In this backup scenario, the national government of Japan would adopt a policy to promote the international coordination of ports. However, concluding an international agreement in case of disasters with Busan Port, which is a rival port to those of Japan, would inevitably force Japan to change its policy on international coordination.

Because the shipments are concentrated on Keihin, Northern Kyushu (Hakata, Kitakyushu and Shimonoseki), Hiroshima, Mizushima, Tsuruga, and others in **Figure 6.8**, these ports should be set up as backups for the stricken ports. Therefore, they will be functionally developed and will establish coordination with other healthy ports through feeder transport. In particular, the Northern Kyushu region is geopolitically close to Busan Port, and developing hub ports that enable the callings of large ships is important

Although changing the trunk routes for large ships is difficult because doing so would affect the service patterns for such ships all over the world, changing the service patterns for collection at ports at which they already regularly call or

that are in accordance with the reduction in the number of ports of call is possible. On this point, Keihin and Northern Kyushu would play an important role as backup hub ports.

6.4 Conclusion on Large-Scale Natural Disasters

The attempt to typify almost all of the container ports in the world clarified that container hub ports can be divided into three groups. The first group is of continental hub ports whose mission is to collect cargo primarily from the hinterlands. The second group consists of marine hub ports whose mission is to handle transshipment cargo as the mode characteristic of container transportation. The third group consists of Japanese-type ports with high economic activity density and world-unique geographical characteristics, to which Japan—even though an island maritime nation—belongs.

In addition, this report clarified that significant gaps exist between the economic growth rates of countries in the East Asian region and the geographical conditions of their respective ports compared with cases in other regions, and that Japanese container ports require integration.

Japan's port policy focuses on working out hub ports that can compete effectively with foreign ports to intensively handle transshipment cargo based on the recognition that the acquisition of more transshipment cargo than other ports is a priority in the competition among international container ports. The author believes that prioritizing the recognition of the productivity and the sustainability is insufficient for realizing this target. A bold reorganization of international hub port functions and a drastic reformation of the structure of collecting domestic cargo at major ports are required.

In contrast, to fully utilize the lessons learned from the Great East Japan Earthquake, the author verified the changes in the logistics for marine container shipments through a simulation using a sacrifice model by presuming damage from earthquakes expected to occur in the future. Approximately 40% of all marine container shipments in Japan need to be handled by healthy backup ports, and the volume of marine container shipments to be handled by the backup ports would nearly double or more. Moreover, the simulation clearly showed that Keihin (the ports of Tokyo, Kawasaki and Yokohama), the ports on the Sea of Japan side and Setonaikai Sea between Shikoku area and Chugoku area would back up stricken ports.

However, in reality, the backup ports are incapable of accepting a significant amount of cargo volume and are not big enough to allow large ships to reach the berthing facilities. Therefore, in light of the port placement theory, the author proposed from the geopolitical viewpoint that the port functions of the three largest bays should be enhanced and that domestic hub ports should be developed in Northern Kyushu.

In this report, the author classified all container ports throughout the world according to their geographical characteristics. This report also clarified that the response to Japan's decline in relative position in economic activity in the world and large-scale disaster risks should be a Japanese port policy that enables integration of ports through a balanced reduction policy and develops ports to hedge risk.

The author expects that this report will be helpful for countries in developing their own port policies.

7. Analysis on Leadership of National Gov't

7.1 Overview and Issues

The national governments of the world grope for how a port operation system with high productivity and high sustainability against large-scale natural disasters can be established. In other words, how should the national government exercise its powerful leadership to implement policies aimed at overall optimization instead of partial optimization?

The author hypothesized that a method to solve this problem was that the national government should develop and implement a comprehensive policy and participate in the port management/operation. However, few studies have verified the importance of a government's leadership in port policies. This report is the first research outcome obtained from an analysis of the significance of a government's leadership by comparing port operation systems of each country. This is in contrast to the many research outcomes on decentralization of authority or privatization that have been obtained along with the progress of decentralization of authority or privatization of port management/operations worldwide.

Previously, the change of the Canadian port policy is the typical example that the port policy switched by the administration change of the federal government in countries participating in the Group Eight (G8). Canadian port policy was on track to decentralization of authority/privatization, but they changed this approach as they realized the importance of the federal government's leadership. Therefore, in this report, the transition of Canadian port policy is reviewed first, and the background of the shift made by the federal government and the detailed government's leadership are then analyzed. Subsequently, port management/operation integration in Denmark, Sweden, and Japan are reviewed to verify the effect of the national government's involvement for improving the productivity.

On the other hand, the Great East Japan Earthquake in Japan paralyzed functions of Japanese ports operated by local governments in 2011. If an anticipated Nankai Trough Earthquake occurs, port functions may be paralyzed just as in 2011 under the current port operation system conducted by local governments. Today, horizontal/vertical division of work has been expanded in the global economy, and thus, paralysis of Japanese port functions may result in severe damage on the global economy. Accordingly, through the case of Japan, it was demonstrated that the national government's leadership could establish port operations resistant to large-scale natural disasters.

In addition, "reform" is defined in this report as a policy that changes the scope of the government's leadership. In detail, reform contains decentralization of authority, privatization, and orders from the government.

Furthermore, the Canadian port system was analyzed in accordance with the review conducted by Ircha (2001, 2002, 2008), Brooks (2007), Debrie (2010), AAPA (2009), Heaver (2009), and Hall et al. (2011), Sharman (2012), and the results of a hearing investigation performed by the author from Ms. Kazuko Komatsu who had been a director of board of both Vancouver Port Authority and Port Metro Vancouver as a representative of the Canadian federal government. The port management/operation integration in Denmark/Sweden was cited from Hirano (2009) who had been the first secretary of Embassy of Japan in Denmark. The analysis of the Japanese port system was conducted based on the achievement of Takahashi et al. (2013a, 2013d, 2013g, 2014a) who were officials of the Japanese Government.

7.2 Switch of the Port Policy by the Administration Change of Government: Canadian Case

7.2.1 Reform of the Canadian Port System

The change of the Canadian port policy is the typical example that port policy switched by administration change of the federal government in countries participating in the Group Eight (G8). Author focused on the relations of the administration change of government and the port policy and analyzed the influence that the administration change of government gave in the port policy. As a result, the federal government of Canada has executed a large-scale reform of the port policy three times to date.

Table 7.1 shows the flow of the reform of Canadian port system. Notably, Canadian port reform policy was largely changed because of administration changes.

The first reform, executed before 1983, was transferred all ports under national management/operation to local governments, and privatization was conducted by creating public corporations. The management and operation system of the ports was systemized using public corporations; however, there are many limitations in this system.

Table 7.1 Historical Transition of Administration Change and Significant Port Reform in Canada

Note: ***These characters show the major polices.***

Source: The author created this table based on the hearing from the Canadian Government

Ircha (2001, 2002, 2008), Brooks (2007), Debrie (2010), AAPA (2009), Heaver (2009) and Sharman (2012)

Liberal Party became the governing party
1963 Change of administration

1964 ***Establishment of harbor commission***
✓The harbor commission was established and given management responsibility.

1979 Change of administration

Conservative Party became the governing party
1979 Change of administration
1980 Change of administration

Liberal Party became the governing party
1980 Change of administration

1983 ***Canada Ports Corporation Act***
✓Past debts were cancelled and privatization was adopted.

1984 Change of administration

Conservative Party became the governing party
1984 Change of administration
1993 Change of administration

Liberal Party became the governing party
1993 Change of administration

1995 ***Declaration of national ocean policy***
1998 ***Establishment of Canada Marine Act***
✓Defining the port types, the port authority system was applied to major ports.

2006 Change of administration

Conservative Party became the governing party
2006 Change of administration

2006 ***Declaration of the Asia-Pacific Gateway and Corridor Policy***
✓This declaration made priming economic growth through soft/hard improvements in ports that serve as the gateway and railways/roads that serve as the corridor in response to the remarkable expansion of trade between China and the North American continent.
2008 ***Major amendment of Canada Marine Act***
✓Incorporating financial improvements of port authorities and provisions of integration, three port authorities in British Columbia were integrated.

2015 Change of administration

Liberal Party became the governing party, up to the present date
2015 Change of administration

The second reform set forth national marine policy in 1995, established the Canada Marine Act in 1998, and developed port management bodies to enable independent management and operations at major ports. However, because this reform imposed various constraints on the port authority while introducing an independent accounting system, significant facility investment became impossible because of funding problems; thus, port call opportunities by maritime companies were lost.

The third reform, which established the "Asia-Pacific Gateway and Corridor Initiative (APGCI)" in 2006 and implemented logistics policies (including railway/road modes with efforts of public and private sectors under governmental leadership), is currently in effect. The federal government altered the policy characteristics of the third reform of promoting decentralized and self-managed port operations, choosing to integrate three port management bodies in the Greater Vancouver area and make major improvements to port/railway/road infrastructure. Regarding the alteration of the federal government's port policy, there was a serious sense of crisis in the administration arising from the trade competition between Canada and the United States related to the rapid growth of trade between Asian countries. Especially, the change of administration in 2006 became a distinctive watershed point. The Liberal Party of Canada privatized and aimed for a financially independent port operation before 2006. Since 2006, the leadership of the Conservative Party of Canada has changed this path to enabling the federal government to become powerfully involved with port operations and public works.

7.2.2 Characteristics of the Canadian Federal Government's Leadership for the Port Management/Operation

A significant change was made by the powerful leadership ability of the federal government after the administration change in 2006.

The APGCI announced by the Canadian government in 2006 was well received within the country. In the program's first 4 years, the government implemented specific policies in order to improve the capacity and efficiency of "Gateways" (i.e., ports) and "Corridors" (i.e., railways/roads). Based on the APGCI, these policies are intended to produce synergistic effects, such as a combination of port/railway/road modes, implementation of public works through efforts of public and private sectors, integration of port management bodies, and integration of concerned people in addition to respective independent effects.

Policies implemented in the APGCI ranged widely across port/railway/road modes, and the fact that the prime minister and responsible ministers visited Japan and China for top APGCI sales implies that the government responsibly exercised leadership by placing an exclusive minister for the implementation system. The powerful leadership of the government after the administration change was largely affected (Transport Canada (2012a, 2012b)).

In addition, concurrently with the development of an integrated environment to streamline the management/operations of the port authority organization through amendments of laws and regulations (e.g., the Canada Marine Act), implementation of large-scale port works by public and private sectors became the driving force to reorganize port management bodies into organizations with effective management/operations, because it is conducted on the premise of improvements of the financing capability of port management bodies (WESTAC(1999)).

Table 7.2 shows the board and directors of Port Metro Vancouver (PMV). The federal government decided to strongly integrate three ports (i.e., the Ports of Vancouver, Fraser River, and North Fraser) on the west coast within the Greater Vancouver area through the federal government representative participating in a board. The port authority has a board, which is the highest organ of management/operation, and the board provides management/operation instructions to managers in the system. The board consists of 7 to 11 directors, who are appointed by the representative bodies. The federal government does not have a right and a budget on the port management/operation. However, a representative of the federal government is included in the board to reflect the intentions of the federal government.

In summary, the characteristics of Canadian federal government's leadership are the following:

a. Canadian port policy was on track to decentralization of authority/privatization, but they changed this approach as they realized the importance of the federal government's leadership.
b. The federal government does not have a right and a budget on the port management. However, a representative of the federal government is included in

the board to reflect the intentions of the federal government.

7.3 Switch of the Port Policy by the Administration Change of Government: Japanese Case

7.3.1 Reform of the Japanese Port Management System

Table 7.3 shows the transition of the Japanese port policy including port management systems. The Japanese government executed significant reform of port policy three times after 1950. The first reform, executed in 1950, left all ports including ports managed/operated by the national government to independent management/operation by local governments. The second reform established two national foreign trade port public corporations in 1967 and transferred the container terminal operation from local governments to two foreign trade port public corporations; however, the operation was transferred to the local public corporations as the national foreign trade port public corporations were dissolved in 1982. In the third reform, the Super-Hub Port Initiative was announced in 2004 and the International Strategic Port Policy was declared in 2011, and the container terminal operation was transferred from local public corporations to private corporations. The third reform continues to the present date.

By contrast, from a viewpoint of the administration power balance between Liberal Democratic Party (LDP) and non-LDP, looking at the transition of port policy caused by administration changes from 1993 to 1994 and from 2009 to 2012, non-LDP-related regimes affected significant port policies. First, the relationship between the port policy and the administration after 1950 is reviewed.

a) Establishment of the Port and Harbor Act (1950)

The current Port management/operation system is regulated by the Port and Harbor Act established under the instruction of the General Headquarters, the Supreme Commander for the Allied Powers (GHQ/SCAP) in 1950. (**The first reform was executed under the administration of GHQ/SCAP**.)

b) Challenge to Wide-Area Operation of Ports (Port Policies under Liberal Democratic Party (LDP)-related Regimes from 1950 to 1993)

Logistics, which are important port activities, involve not only the range of administration of local governments of the port but also a wider range operated under internationally agreed rules such as international supply chains..

Thus, it is of interest to determine how these wide-ranging port activities have been realized while the roles of local governments were limited.

In 1967, the national government newly established the Foreign Trade Port Public Corporation Act and setup two national public corporations: Keihin (Tokyo, Yokohama) and Hanshin (Kobe, Osaka). These public corporations solely undertook port management of a number of ports and conducted construction and operation of container terminals from a wide range viewpoint required for international marine container logistics. However, the national government, which was aimed at a small government, judged that construction and management by two national public corporations became unnecessary and thus dissolved them in 1982 as administration reform. All container terminals constructed and operated by the national public corporations were transferred to local public corporations owned by local governments for operation. (**The second reform was executed as part of LDP's administration reform.**)

The Ministry of Transport established the first Port Policy hurriedly when the national public corporations were dissolved. The Ministry of Transport worried not to be able to continue to construct port facilities. The Port Policy indicates the necessity of constructing port facilities other than the basic ones. However, the Port Policy mainly considered construction, and port operation was not mentioned.

c) Reform under the Non-Liberal Democratic Party (Non-LDP) Regime from 1993 to 1994

The Fiscal System Council, which was the consultative body of the Non-LDP regime, concluded that port investments should be inhibited (rank C among ranks A/B/C that imply investment control). Consequently, the budget allocated to port construction was less than to public works in other fields.

Although ports worldwide were in the course of construction and operation of large-scale container terminals because of predicted size growth of container ships, the Japanese government announced that they would decline this investment.

Table 7.2 Board and Directors (11 members) of Port Metro Vancouver (PMV)

Source: "The Canada Marine Act" of the Canadian Government

Canadian federal government	1 member	Based on the recommendation of the minister of Transport Canada, appointment by the chairperson of the council
Person appointed by province government	1 member	Province of British Columbia
	1 member	Governments of western provinces (Alberta, Saskatchewan, and Manitoba)
Person appointed by local government	1 member	Representative of 16 neighboring cities, including Vancouver
Port user	7 members	After consulting with the industry, recommended by the minister of transportation and appointed by the chairperson of the council

Table 7.3 Historical Transition of Administration Change and Significant Port Reform in Japan

Source: The author created this table based on the data of the Ministry of Land, Infrastructure, Transport and Tourism of the Japanese Government (MLIT), and Takahashi (1998, 2007, 2008, 2010).

	Port Policy	**National Movement**
1950–1982 (LDP) Development of port facilities	Post-War Reconstruction	a. Port and Harbor Act b. Foreign Trade Public Port Corporation Act
1982–1993 (LDP) a. Development of facilities other than basic facilities b. Creation of comprehensive port space	a. Port Policy for 21st Century b. Follow-up of Port Policy for 21st Century	a. Dissolved Foreign Trade Public Port Corporation b. Structural Impediments Initiative c. Basic Plan for Public Investment
1993–1994 (Non-LDP)		a. Finance System Council: Port is rank C (Investment Control) b. The Great Hanshin-Awaji Earthquake
1994–1998 (LDP) a. Selection and concentration b. Development of hub port	Internationalization	a. Amount increase for the Basic Plan for the Public Investment b. Fundamental Principles of General Logistics
1998–2009 (LDP) a. Selection and concentration, b. Development of hub port c. Concession	Super-hub port policy (Privatization of public corporations)	a. Advance comprehensive approval system for public facilities b. Private Finance Initiative law c. Act on Special Zones for Structural Reform
2009–2012 (Non-LDP) a. Selection and concentration b. Development of hub port c. Port operation by vertical separation	International Strategic Port Policy (Management Corporation System)	a. The Great East Japan Earthquake
2012–present (LDP)	(ditto)	

(Note) **LDP: The Liberal Democratic Party-based Administration**

Non-LDP: Non-Liberal Democratic Party-based Administration

d) Introduction of Private Operations with the Super-Hub Port System (Liberal Democratic Party Regime from 1994 to 2009)

The national government became aware that logistics was significant economic activities for growing Japan's economic Power. The first comprehensive logistics policy of the national government that included a strong cooperation of ports, roads and other infrastructures was announced in 1997.

Realizing the necessity of constructing a large-scale container terminal to accommodate for larger container ships, in 2005, the Japanese government introduced the super-hub port system by amending the Port and Harbor Act and by enabling a single private business operator to integrally operate a number of successive container terminals at three ports (Keihin, Hanshin, Isewan). Thus, terminal operators could pursue the managerial advantage of scale. This led to the establishment of the current system of wide-area port management/operation by the private sector. (**The third reform was started the awareness of the importance of logistics under administration of LDP.**)

e) Wide-area Operation by Private Sector under Port Management Corporations (Non-Liberal Democratic Party-related Regime from 2009 to 2012)

In 2011, the national government amended the Port and Harbor Act to establish a two-tiered (separating infrastructure and operation) system, and while leaving the port/management to the private sector, an environment to enable wide-area management/operations was developed. Sixty years after the first reform in 1950, the wide-area operation system was realized

7.3.2 Characteristics of Japanese Government's Leadership

As seen in **Table 7.4** by the allocation of roles between the national government and local government including port authority under the Port and Harbor Act, the national government was not directly involved with the operation of ports, and its role was limited to provision of instruction by basic policies of port construction/management and technical standards for facilities. It abandoned the operation of ports to port management bodies, who are the local governments.

Local governments in Japan were established under the Local Autonomy Act. As indicated by the roles of local governments and the national government shown in **Table 7.6**, the Local Autonomy Act defines that "a local government shall be to promote the welfare of its residents, for which purpose it shall carry out a wide range of tasks in the autonomous and comprehensive performance of local public administration" and specifies that the role of the national government is to implement measures from a national point of view.

Since the operation system by local government was introduced in 1950, the Japanese port management system has been concentrated to constructing port facilities, but there has been no change in the basic system. Because a local government must maximize the public welfare of residents in the area under its jurisdiction, it implements the measures optimal to its respective locality, including those against investment competition between neighboring ports. However, those measures may not be optimal in Japan as a whole.

As a result, port management/operation functions were paralyzed when the Great East Japan Earthquake affected the functions of local governments in 2011.

Figure 7.1 shows the focal region of the Nankai Trough Earthquake, whose occurrence in the pacific sea surrounding Japan is anticipated. If the Nankai Trough Earthquake occurs, the damage is expected to be more severe than that in the Great East Japan Earthquake of 2011. Particularly, because the assumed disaster-stricken region includes a number of ports, such as the Ports of Nagoya, Osaka, and Kobe (major ports for international trade), according to Takahashi et al. (2014a), ports serving as transportation routes of 7.4 million TEU of marine container cargo, that is, 42% of the entire marine container cargo in Japan (17.51 million TEU; 2011), would be paralyzed. The damage is expected to expand far beyond the administrative district of each local government, and thus, the damage level would be beyond that local governments could handle and recover.

In addition, because horizontal/vertical division of work on international trade has been advanced, this type of paralysis of Japanese logistics would cause significant damage to the global economy. It is the mission of the national government to prevent such damage from spreading to the world.

In summary, the characteristic of Japanese government's leadership is that the Japanese Government lays emphasis on decentralization/privatization of the port management /operation too much and lowers the leadership of the government. When a large-scale natural disaster occurs, this characteristic becomes remarkable

Table 7.4 Allocation of Roles between the National Government and Port Management Bodies under the Port and Harbor Act (Abbreviated **Table 5.3**)

Source: The author created this table based on the Port and Harbor Act of the Japanese Government.

National government	Port Management Bodies (Local Governments)
a. Policy formulation for the development and administration of nationwide ports b. Establishment of necessary laws and regulations c. Providing advice and guidance on port administration and operation to port management bodies d. Financial assistance for port management bodies in relation to port construction projects e. Implementation of port construction projects (Limited to projects under the direct control of the national government) f. Improvement and maintenance of shipping channels outside the port area g. Establishment of technological standards h. Surveys and research concerning port technology	i. Formulation of port development/management plan j. Construction and maintenance of port facilities k. Permission for and restrictions on facility use in port management districts (marine districts, land districts) l. Leasing and management of port facilities m. Setting and collection fees for use of port facilities n. Marketing and promotion of ports o. Establishing conditions for providing port services

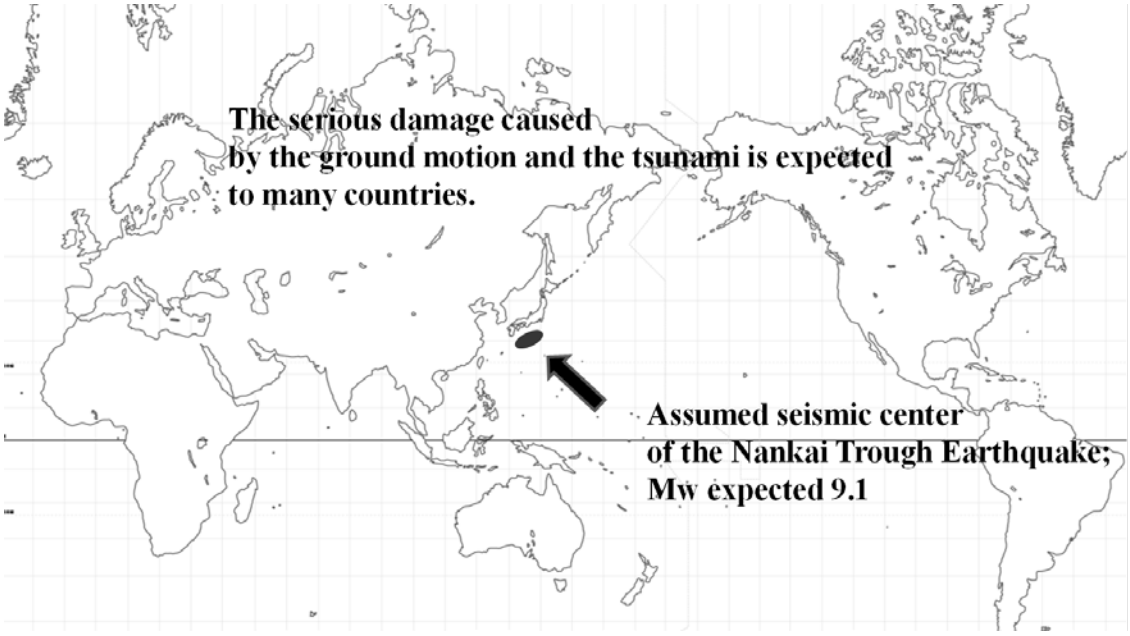

Figure 7.1 Assumed Seismic center of Nankai Trough Earthquake (Mw 9.1)

Source: The author created this figure based on Earthquake Research Committee (2013)

7.4 Management/Operation Integration Case of the Ports of Denmark/Sweden

7.4.1 Formation of Transnational Economic/Living Area

Öresund Link, the bridge and underwater tunnel used for both road and railway, was opened in 2000 (**Figure 7.2, 7.3**). It connects Copenhagen and Malmö and reduces the travel time to approximately 45 minutes by car and 30 minutes by train. There are many people commuting across the border from Malmö and the neighboring area to Denmark, and an economic/living area termed the Öresund Region reaching the outskirts of both cities has been formed.

In the Öresund area, integrated economic growth was achieved regardless of the border: for instance, a major industrial cluster of biological research called Medicon Valley was formed that crosses the border. The Port of Copenhagen and Port of Malmö were located across each other over the border at the Strait of Öresund, but the opening of the Öresund Link led the two countries to agree to integrate the management/operation of ports, and integrated port operations began in 2001.

7.4.2 Structure of Port Operations

Figure 7.4 shows the operational structure of the Copenhagen Malmö Port. The cities of Copenhagen and Malmö were originally the managers of the Port of Copenhagen and Port of Malmö, respectively, and the city mayors agreed to integrate the management/operation of those ports in 1998. The Port of Copenhagen was initially owned by the city of Copenhagen, but the ownership was transferred to a port corporation 100% owned by the Danish government in 2000. The port ownership was split among Copenhagen city and the port development company CPH City & Port Development: 45% was owned by the Danish government, and 55% was owned by the city of Copenhagen; furthermore, the Port of Malmö was owned by the city of Malmö.

Copenhagen Malmö Port (CMP) is integrally operating both ports. CMP is 50% owned by Copenhagen city and the port development company and 50% owned by the Malmö port corporation. Separating the owners and operators of both ports, the owners are participating in port operations via a financing relationship. Currently, the ownership ratio in the port operation is as follows: the Danish government, 22.5%; the city of Copenhagen, 27.5%; the city of Malmö, 27%; and private corporations, 23%. CMP is managing/operating the port while borrowing port assets from CPH City & Port Development and the city of Malmö.

7.4.3 Involvement of National Government in CMP

Ports in Denmark used to be managed and operated by the national government, but operations of all ports were transferred to local governments. Furthermore, aiming at management/operation by private companies, the port act was revised in 1999 to systematically enable management/operation by private bodies. This movement adheres to the line of privatization taken by England in the 1980s. However, in 2000, the policy was changed to enable the national government to manage/operate the company, and the government is now involved by making investment to CMP, the company owning the Port of Copenhagen and operating the Port of Copenhagen and Port of Malmö.

Figure 7.2 Öresund Link beyond the border

Figure 7.3 Enlarged view of Öresund Link
Source: The author created this figure based on Google map.

Table 7.6 Role of Local Government and National Government according to the Local Autonomy Law

(Abbreviated **Table 5.4)**

Local/National	Role according to the Local Autonomy Law
Local Governments	The task of a local government shall be to promote the welfare of its residents, for which purpose it shall carry out a wide range of tasks in the autonomous and comprehensive performance of local public administration.
National Government	In order to accomplish the purpose of the preceding paragraph, the role of the National Government shall mainly be to attend to: matters relating to its position as a nation in the international community, matters concerning basic rules on national activities or local autonomy that should be standardized nationally, or matters concerning policies and programs to be implemented on a national level or from a national viewpoint.

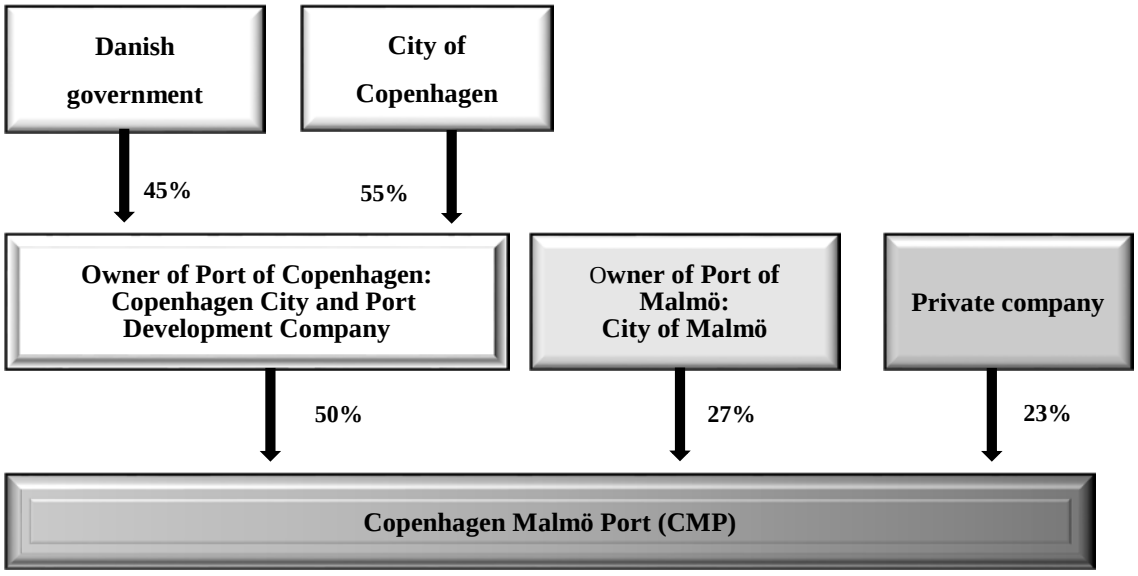

Figure 7.4 Owners of Port of Copenhagen and Port of Malmö, and Ownership of CMP

Note: Number shows the ratio of capital investment.

Source: The author created this figure based on the homepage of CMP and Hirano (2009)

7.5 Comparison of the Participation of the National Government

The author introduced the three forms in this report, which the national government participates in in the port management/operation body. The first is a participation form by the government representative such as the Canadian port authority. The second is a participation form by the capital investment of the government such as CMP. The third is the form the national government does not participate in the port management/operation and entrusts it to the local government or the port management/operation body financed by the local government.

By the comparison of three forms, the difference in participation forms of the national government becomes clear.

The power of the participation in the port management/operation is decided according to the capital investment ratio. Generally, capital investment ratio more than 50%, which can hold the right of management/operation completely, is the strongest. The power of the participation by the government representative is decided according to the

cooperation with other members of board. If other members go along, the government can show powerful leadership, but unless other members go along, intention of the government may not be necessarily reflected.

On the other hand, each port management/operation bodies in Japan completely becomes independent each other, which is under perfect competition in economics. It is the method that is most suitable when it is necessary for this form to raise capability to the uniform standard that there is in a delayed part. However, when economics surpass a constant standard and the perfect competition produces the problem of the overinvestment, which is a worldwide economic problem. The port management/operation affects national interest directly and the government must prevent the mutual destruction by the overinvestment legally, but the system as of one of Japan cannot reflect intention of the government legally.

For reinforcement of the international competitiveness between national nations as well as reinforcement against the large-scale natural disaster, the powerful leadership of the government is important. This problem is common throughout the world.

7.6 Conclusion on Leadership of National Government

The author identified the following facts in this report.

The case of Canada presented an example of a foreign port in which the federal government developed policies to establish the system, realize the integration of three neighboring ports, and engage in realizing integrated, effective port management/operations and enhanced transportation capability of logistics infrastructure as Port Metro Vancouver. Canadian port policy was on track to decentralization of authority/privatization, but they changed this approach as they realized the importance of the federal government's leadership. This was conducted in the context of an economic mission and powerful leadership exercised by the federal government who chose to spark the domestic economy by focusing on the tremendous trade growth between North America and China. In the case of port management/operation integration at the cross-border CMP, the Danish government became involved with the ownership and operation of port assets because it was a port operation matter concerning two countries.

On the other hand, the Japanese case indicated that port operation has been left to local governments since 1950 and that the national government is involved only with budget allocation. As a result, Japanese port policy is capable of providing partial optimization for residents within each administrative district through local government administrations; however, this is not optimal for Japan as a whole. Furthermore, assuming a large-scale natural disaster, it became apparent that port management by local governments might have considerable negative effects on the global economy as the functions of local governments are paralyzed.

Accordingly, the author concludes that the following three points are important to raise the productivity and disaster-handling capabilities (i.e. the sustainability) in port management and to implement policies aimed at overall optimization instead of partial optimization.

a. The national government should develop and implement a comprehensive logistics policy of ports, railways, and roads with international competitiveness and strong resistance against large-scale natural disasters.
b. The logistics policy can be established through items such as implementing public works, promoting port integration and so on.
c. The national government should participate in the port management/operation by the capital investment to the port management/operation body.

However, there will not be the effect of c. if the government does not perform a. and b. at the same time. The author appeals to port-related people globally through the case of Japan in that from the aspect of productivity and sustainability, port operation requires policies developed by the national government, the establishment of a management system in which the national government is involved, and powerful leadership of the national government.

8. Analysis on Stakeholders

8.1 Overview and Issues

As mentioned in **Chapter 1**, the author presented an overview of the current state of stakeholders concerned with port management of Japan. Stakeholders of Japan are very complicated as well as more numerous than that of the world as shown at **Table 8.1**.

Figure 8.1 is a correlation diagram of concerned parties of the port management corporations. The author conducted surveys with the concerned parties on port management of container terminals, and asked about the issues they were facing. According to the answers, the issues can be classified into three groups based on their characteristics to be solved as shown at **Table 8.2**. As the result of analyses, issues that port management for container terminals face are shown as **Table 8.3**.

The problems categorized as "Group A: issues that need to be resolved with their own effort" could not be found in the answers from cargo owners and the three Japanese shipping companies, but only in MLIT, port management bodies and port transport business providers. This is because cargo owners and the three Japanese shipping companies are under the competitive situation in which the issues are shaken out due to their self-improving function, which can be seen in the process of pursuing their interests as private sector businesses. However, on the other hand, MLIT and the port management bodies are public sector organizations in which the self-improving function cannot be seen, and up to now, port transport business providers have maintained business practices in which a competitive principle has hardly ever existed since the postwar period.

There are a few issues classified into "Group B: issues that are inseparably connected to more than one of the concerned parties of the port management in one port." The only problem that can be found in the group is about human resources. In order to tackle the issue, changes need to be made in the policy of human resources between port management corporations, port management bodies and private companies.

"Group C: issues that need to be resolved by the third parties as they cannot be solved with the effort of the concerned parties of the port management in one port", can be seen in the answers from cargo owners and the port management corporations. In other words, the third parties are expected to work on solving the issues in Group C.

As a result of the classification of the issues, the following points became clear;

a. The national government, port management bodies and port transport business providers cannot be expected to use self-help efforts to improve the current situation.
b. The issues that the cargo owners and port management corporations have need to be solved by the third parties.
c. The mutual point of all the issues is that the third parties need to tackle them in order to resolve them.

Table 8.1 Stakeholders of Port Management

Note: See **Chapter 1**, **Table 1.1** (Reprint)

U.S.A.	Japan
Port Authority Terminal Operator Labor Union	National Government Port Management Body Port Authority Local Government Administrative Association Port Management Cooperation Terminal Operator Port Terminal Corporation Port Transport Business Prime Provider Shipping company Warehousing company Pure-play company Sub Provider Pure-play company Labor Union
EU	
Port Authority Terminal Operator Labor Union	
U.K.	
Terminal Operator Labor Union	

8.2 Changes in a Social Economy

Measures to deal with socio-economic issues such as the environment, a declining birthrate and an aging population, an industrial safety and health environment, disaster prevention, and fiscal reforms must be taken by the country as a whole. Port management is no exception—this sector must also take measures to tackle these issues in step with the rest of the country. **Table 8.4** details the issues which require measures in port management to deal with changes in a social economy.

In particular, in order to comply with CO_2 emissions regulations, improving productivity in response to a lack of human resources, and enhancing the safety of a working environment to realize a zero rate of work accidents, the swift introduction of "a. Electric Motorization and automation of port cargo handling equipment" is anticipated. However, according to the author's research, as shown in **Table 8.5**, the

introduction has pros and cons. In order to overcome the cons, taking the time for coordination between stakeholders, securing temporary sites and considering developing a compensatory system are needed beforehand.

Meanwhile, it is necessary to transplant perfectly knowledge of experienced port workers with a high degree of skill into an electric motorized and automated system. As it will be too late to transplant this knowledge after the experienced workers have retired, this will have to be completed while they are still actively working. As there is a risk that the electric motorization and automation of the loading equipment could lead to an excess of workers, before the system is started, it will be necessary to ensure that positions ready to accept excess port transport workers as well as a safety net to pay those workers compensation are developed. Also, since among port transport business providers, those specialized in port transport operations traditionally respect their prestige and reputation, measures that respect these trade customs will be required.

In comparing **Table 8.4** and **Table 8.5** with **Table 8.3,** it is clear that all the issues are included in **Table 8.3**. Thus, this report will examine the issues detailed in **Table 8.3**.

8.3 Stockholder structure and the strengths

In **Section 8.1** and **Section 8.2**, problems that port management of container terminals have, and issues that the stakeholders of port management need to tackle in order to deal with socio-economic changes, are shown. Here, what are the strengths that port management corporations in charge of managing container terminals are expected to have? In other words, what are the issues that port management bodies have with restrictions as local governments?

Table 8.6 shows the strengths of port management corporations as private companies. Behind the establishment of port management corporations as private companies, as the government and port management bodies (The original organization are local governments.) are public organizations, there is the fact that restrictions such as the prohibition of unequal treatment, budget measures based on a fiscal year, and the approval from the Local/National Diet to implement budgets and new policies are placed prevents the realization of highly productive port management. On the other hand, in the case of private companies, guarantees of contract confidentiality, new investment unrestricted by a fiscal year or the Local/National Diet, and the business integration between port management corporations can take place. When compared with management by public organizations, in the degree of freedom, private companies have a considerable advantage. This point is the strength of the private companies, which is not available for port management bodies.

Port management corporations are stock companies, and as such, are bound by the Companies Act of Japan to follow the will of their stockholders. So, what are the restrictions placed on stock companies?

Table 8.7 shows the stockholder structure of a port management corporation. The top name on the list of stockholders for Kobe-Osaka International Port Corporation is the national government, followed by local governments (Kobe and Osaka Cities), which are port management bodies, with the same proportion of stocks. As no stockholder has a controlling stake of more than 50% of issued stocks required for ordinary resolutions or resolutions to elect or dismiss directors, no one stockholder can act unilaterally at general meetings; however, if Kobe and Osaka cities were to cooperate, they would control 62% of issued stocks, and thus would be able to pass ordinary resolutions. On the other hand, port management corporations located in Yokohama and Tokyo, i.e. Yokohama Tokyo Port Corporations and Tokyo Port Terminal Corporation, which receive no public investment from the national government, are controlled by Yokohama City and the Tokyo Metropolitan Government, each of which has a stock of close to 100%. The port management corporations are in a position where unless the big stockholders, namely the national government and the port management bodies, express their clear views, their corporation policies cannot be made.

What is a code of conduct held by local governments?

Local governments, according to the Local Autonomy Act, are seen as entities, which “pursue the fundamental of promoting the welfare of residents, and take a broad role to conduct governance independently and comprehensively within the district (the Local Autonomy Act, Section 1.2).” As shown in **Table 8.3** and by Takahashi et al. (2013d), this role of local governments, which conduct local governance, is a hurdle to the port management, which conforms to market principles. In the same way, the involvement of these local governments, as large stockholders conducting local governance, is a hurdle to port management which conforms to market principles.

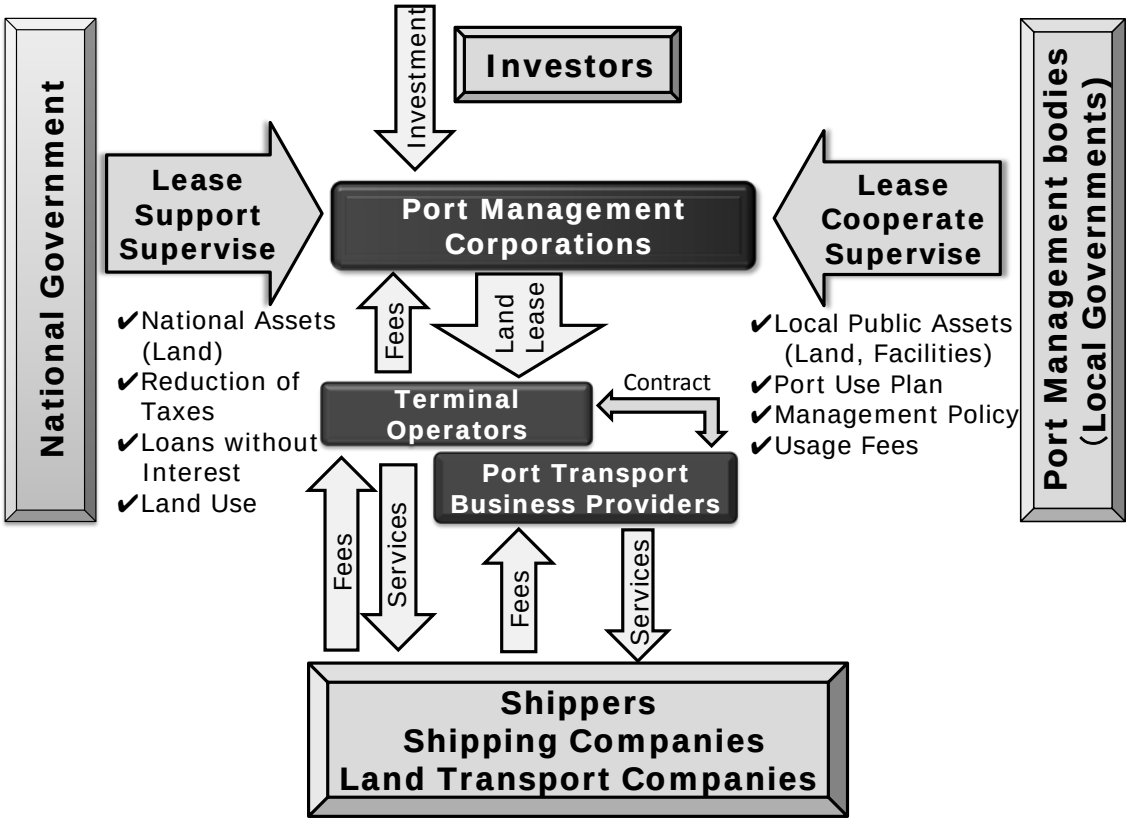

Figure 8.1 Correlation Diagrams of Concerned Parties of Port Management (**Figure 1.2)**

Source: The author created this figure based on Acts of Japan.

Table 8.2 Classification of Issues Based on the Characteristics of Stakeholders

Group	Characteristics	
A	Issues that need to be resolved through one's own effort	It is possible to solve issues with ones' own effort, but incentives that motivate the stakeholders to solve issues are needed.
B	Issues that are closely connected to more than one stakeholder in one port	In order to resolve the issues, the stakeholders need to share the awareness of the issues, and make an effort to solve them together. To achieve that, the stakeholders need to clarify duties and responsibilities, and have incentives that they all can benefit from, by solving the issues.
C	Issues that need to be resolved by third parties as they cannot be solved with the effort of stakeholders in one port	In order to work on the issues, the stakeholders need to have third parties take the initiative, and let them resolve the issues. As the third parties need to be fair, their candidates are the national government or economic organizations. However, to make this work, the same as with Group B, the concerned parties need to have incentives to solve the issues.

Table 8.3 Issues that Port Management for Container Terminals Face

Source: Based on surveys that the author conducted

Stakeholders and Issues	
1. Cargo Owners	Classification
The market share of Japan's transportation has been relatively increasing in the Asian service-route network, while it has been relatively decreasing in the North American direct line, which is said to be 'a trunk service-route network'. Even though the market share of Japan's transportation in the North American direct route has relatively decreased, the direct route remains of high importance to Japanese companies; hence, cargo owners need to maintain the direct route in order to continue to stay in business in Japan going forward. However, the national government of Japan has discussed the importance of shipping routes concerning port management focusing only on the market share of Japan's transportation. It is necessary to discuss the importance of the service-route separately as the market share of Japan's transportation has been large and the North American direct service-route is also important to Japan even though that of Japan's transportation has been small.	C

2. MLIT that holds Jurisdiction over Port Management	
a. The Ports and Harbours Bureau of MLIT, with jurisdiction over port management, has the ability to analyze the economic trends of cargo owners and shipping companies; however, since it has lost a network of contacts with shipping companies, the ability to collect credible information has fallen behind. b. Port transport business providers can be classified into three groups, the pure-play company group specializing in port transport, the shipping company group, and the warehousing group, based on their business types. The Ports and Harbours Bureau of MLIT holding jurisdiction over port transport business maintains a close personal network of contacts with the pure-play company group specializing in transport, and does not have a close network of contacts with the shipping company and warehousing groups among port transport businesses. MLIT's information on port transport business tends to run low on the information of the shipping company group and the warehousing company group. c. The Ports and Harbours Bureau of MLIT with jurisdiction over port transport business has a number of highly-skilled civil engineers; however, they do not have enough know-how to analyze port management from the perspective of business economics. d. There is a lack of communication between the Ports and Harbours Bureau having jurisdiction over port management and port transport businesses, with the Maritime Bureau holding jurisdiction over maritime transport businesses, the Road Transport Bureau holding jurisdiction over road transport businesses, and the Road Bureau holding jurisdiction over road infrastructures due to a vertical administrative organization based on sectionalism in MLIT; that is, "there are no ministries, only bureaus. e. The ability of the Maritime Bureau of MLIT having jurisdiction over maritime transport businesses has weakened to control Japanese affiliated shipping companies via administrative guidance. This is represented by the fact that the global alliance of shipping companies in the world, which accelerate the global business strategy, has been made at the initiative of Japanese affiliated shipping companies.	A

3. Port Management Bodies i.e. Local Governments	
a. Even though they have been in a financial crisis, most of the port management bodies, since they are public institutions, have not created financial statements that show their financial situations and management indexes. Because they do not provide precise information on their financial crisis to the citizens, they never receive pressure from the citizens to implement fiscal reconstruction, and consequently, they never think of working on fiscal reforms. b. Regular personnel reshuffles spur an outflow of know-how and human resources on port management and port facility maintenance. Furthermore, small and middle-sized port management bodies do not have almost any know-how or human resources for maintenance and port management, due to a surge in an outflow of know-how and human resources. c. Since local governments perform the work of port management bodies, the scope of the port management bodies is limited to within the administrative districts of the concerned local governments. In other words, the port management bodies have to take policies providing a priority on local area; they place priority on the benefit of the administrative regions, and cannot take an action based on the viewpoint overlooking the whole Japan, which are called	A

'local egos'. As a consequence, the following facts can be commonly seen; excessive investment in port facilities out of the sense of rivalry to neighboring ports, possession of surplus facilities rarely used, and shipping routes invited forcibly by using incentive subsidies without paying attention to the market principles. d. With the deterioration of the financial crisis, a large amount investment has been made for the gubernatorial/mayoral election to contribute to a victory. e. With the decline of coastal industries such as steel and chemical businesses, and the development of inland industries such as value-added product manufacturing, container cargo which are more suitable to unit transport, have been taking over the bulk cargo market which is made for mass transport. As a result of the change in the industrial structure of Japan, an economic effect driven by ports affecting their administrative districts of local governments has decreased, leading to a reduction in the organizations of local governments at ports. As the port management bodies have been continuing their port business with their downsized institutions, they have not been able to design new port policies, and are also having trouble with their businesses.	

4. Three Japanese Shipping Companies Operating Containerships on Overseas Routes	
a. At container terminals of shipping companies with lowered operating rates, the reorganization of port transport business providers at the shipping companies has been advanced. b. Due to a decrease in the volume of containers handled at ports of call in Japan, the leadership of deciding ports of call in Japan among shipping companies constituting the alliance of container transport, has been lost. In order to regain this leadership, it is necessary to increase the volume of containers handled at one port, a port of call by integrating ports of call and reorganizing container terminals in Japan.	C

5. Port Transport business providers in charge of Loading and Unloading at Container Terminals	
a. Facilities and personnel need to be optimized due to reorganization of container terminals. b. Due to severe working conditions such as high accident rates at loading and unloading, and work in the intense heat during summers and intense cold during the winters, a shortage of young personnel and aging personnel has worsened. Securing human resources is urgently needed by improving the working conditions. c. Introducing IT has not been promoted as many companies have little capital.	A

6. Port Management Corporations Established to Operate Container Terminals	
a. Many of the workers are temporarily assigned from port management bodies and private companies. The temporarily transferred employees will return to their original employers an average of two years, with an appointment letter of a personnel reshuffle. Such a personnel reshuffle in the short term, has made these workers have a narrow-minded view and lose their willingness to tackle new challenges.	B
b. Since the relation between the goals of port management that the national government and the port management bodies set, and the business strategy of the port management corporations are unclear, the business strategy remains unspecified. For example, the national government sets three pillars as the goals of port management, namely 'cargo collection' gathering cargo at hub ports, 'cargo creation' in the volume of handling cargo by promoting the industry, and 'strengthening of the international competitiveness of ports' by improving the productivity of the ports. The national government is required to show economic indicators to evaluate the degree of achievement of their goals, as well as the concrete goals regarding the three pillars. c. Even though the business strategy and port masterplan are not linked together, some regulations, which are not related to business strategy, exist. Port management corporations need their business strategy. d. The sources of information are limited to shipping companies and cargo owners who are related to their designated ports, since the ports to be targeted for port management are limited.	C

Table 8.4 Issues which Require Measures in Port Management to Deal with Changes in a Social Economy

Source: Survey by the author

Issues
a. Introducing electric motorization and automation to loading and unloading facilities.
b. Establishing a cooperative relationship in the industry for practical management.
c. Securing and training human resources engaged in port management.
d. Accelerating the transparency of the financial situations of the port management bodies; the introduction of corporate accounting.
e. Improving the continuity of business in the case of large-scale disasters. ; Formulating Business Continuity Plans(BCP) and establishing an implementation system

Table 8.5 Pros and Cons in Introducing Electric motorization and Automation to Loading and Unloading Facilities

Source: Survey by the author

1. Pros
a. Requesting a reduction in CO_2 emissions.
b. Taking alternative measures for decreasing excellent port workers and lack of such workers.
c. Reducing operation costs at terminals by improving efficiencies.
2. Cons
a. Due to the large amount of capital investment needed at the first stage, and the limited extent of terminals to have their systems based on the ability to recover invested capital, it is difficult to introduce the systems to all terminals in terms of funding.
b. If efficiencies are low, terminal management will be costly.
c. Regarding the introduction of existing terminals, prior coordination with the existing users of the terminals, securing temporary terminal sites for construction, and off-work compensation benefits for the port transport business providers might be required.

Table 8.6 Strengths of Private companies as Port Management Corporations

Source: Survey by the author

Factors of Strength
a. Accumulating human resources and skills (know-how) of port management.
b. The ability to service facilities promptly and perform maintenance meticulously (port facilities and loading and unloading facilities, among others), complying with wishes of tenants.
c. Powerful negotiation skills with cargo owners, shipping companies, port transport business providers, and road transport business providers.
d. Improving productivity and bringing more balance to facilities and personnel.

Table 8.7 Stockholders of the Port Management Corporations (as of March 31, 2015)

Source: Business reports released by the port management corporations

1. Kobe-Osaka International Port Corporation		
Stockholders	Number of Stocks	Ratio
National Government (Minister of Finance)	10,000	34%
Kobe City	9,000	31%
Osaka City	9,000	31%
Sumitomo Mitsui Banking Corporation	800	3%
Mizuho Bank, Ltd	200	Less than 1%
Bank of Tokyo-Mitsubishi UFJ, Ltd.	200	Less than 1%
Total	29,200	100%

2. Yokohama Port Corporation		
Stockholders	Number of Stocks	Ratio
Yokohama City	540,400	99.9%
Yokohama Port Transport Association	191	Less than 1%
Sumitomo Mitsui Banking Corporation	95	Less than 1%
The Yokohama Chamber of Commerce and Industry	19	Less than 1%
Total	29,200	100%

3. Tokyo Port Terminal Corporation				
Stockholders	Total Stocks	Common Stocks	Ratio	Special Class Stock
Tokyo Metropolitan Government	269,654	240,100	50%	56,554
Tokyo Rinkai Holdings, Inc.	240,100	240,100	50%	-
Total	509,754	480,200	100%	56,554

Note 1: Stockholders of special class stocks do not have voting rights at general meetings. In addition, stockholders of special class stocks do not have voting rights at general meetings for stockholders with special class stocks, except in the case of changing the articles of incorporation.

Note 2: Tokyo Rinkai Holdings, Ins. is a stock company that the Tokyo Metropolitan Government owns 85% and more of the outstanding stock

Note3: Yokohama Port Corporation corporatized Kawasaki Port and changed its corporate name to "Yokohama-Kawasaki International Port Corporation" in 2016.

Stakeholders stocks (ratio) are as follows;

National Government	10,000 (50%)
Yokohama City	9,000 (45%)
Kawasaki City	900 (4.5%)
Sumitomo Mitsui Banking Corporation	100 (0.5%)
Total	20,000 (100%)

Source: Business reports released by Yokohama-Kawasaki International Port Corporation (as of 2016).

This corporation is expected to integrate Tokyo Port Terminal Corporation in the near future.

In order for port management corporations which conform to market principles to display their strengths, local governments must put aside their local egos.

8.4 New National Targets and Solution Policies

The author has stated in this report that in order to solve various issues, intervention from third party organizations is necessary. Furthermore, in order to solve the issues of port management corporations and bring out the strengths of private companies, which conform to market principles, a clear goal of the national government as a stockholder, as well as the elimination of the local egos of local governments are necessary.

Now, what kinds of goals should be set by the government, and how can port management corporations utilize their strengths in port managements?

Table 8.8 shows all the possible solutions for the challenges of port management. However, these are under the premise of adjustments of various restrictions and vested interests. The details will be described later.

What is shared by these solutions is they all exclude interference in management by port management bodies and the national government, aim at management that maximizes profits as private companies, and suggest overseas expansion from Japan, where the domestic market has remained contracted, to realize economies of scale.

Next, the consistency with the policy of International Container Strategy Ports, Japan's latest port policy, will be discussed. Comparing the solutions in the **Table 8.8** with the policy of International Container Strategy Ports, the following points become apparent, showing that the policy does not suit the present condition.

a. The national government will need to shelve the objective of the policy of International Container Strategy Port, which is a reduction in the rate of a foreign transshipment, and ask port management corporations to aim for management to maximize their profits as private companies.
b. In order to pursue economies of scale as private companies, port management corporations will need to undertake port management to maximize their profits according to market trends and invest in foreign port management in consideration of the economic rise of Asia.

In other words, according to the above points, the national government will need to revise the policy of International Container Strategy Port in order to affect the policy.

8.5 Forming Public Opinion by Third Party

In **Section 8.1**, the author has stated that in order to solve the issues in port management, solutions made by third party organizations are necessary. In this Section, the author will discuss the role of third party organizations and what kinds of organizations are suitable third parties.

The role of third party organizations is to make the national government, port management bodies and port transport business providers, who cannot be expected to help themselves achieve improvements, recognize the need for self-help efforts and create an environment where they can solve their own problems. As a result of this, it is necessary for third party organizations to be impartial and expert, and to have no special relationships with those involved in port management. They will be required to form public opinion to argue for the necessity of the rapid implementation of the solutions, as well as to lend authority capable of dealing with stakeholders equally.

Thus, in real terms, the third party organizations will fulfill the following roles:

a. Survey and proposal for port management policies and individual items for implementation.
b. Coordination and mediation between stakeholders (as shown **Table 8.2** for the issues created by the implementation of port management policies.

However, as port management corporations are, in the end, private companies, their managerial autonomy is ensured, and third party organizations do not participate in port management.

Table 8.8 Possible Solution Menu for the Issues on Port Management

1. Realizing management that can promptly respond to the global market trend
1.1 Logistic systems by the port management corporations which comply with wishes of cargo owners
a. Formulating and practicing scenarios to increase shipping routes and cargo by each shipping company. b. Achieving the goal of luring a large number of shipping companies by revising contracts from an exclusive lease to lease based on the amount of usage. c. Meeting the objective of increasing the amount of cargo handled at ports through negotiations (luring shipping routes and cargo, and focusing on port sales) with cargo owners and shipping companies for Japan as whole, by gradually promoting cooperation, investment and integration with port management corporations across the country. d. Abolishing port sales which involve petitions from groups visiting cargo owners and shipping companies with written requests as well as for photos taken as souvenirs. e. Business cooperation with foreign container terminals.
1.2 Reducing the Power of the Port Management Bodies that Represent Local Benefits
a. Reviewing the large investment from the port management bodies and reducing it to the scale that does not affect port management.
1.3 The Relaxation of Regulations
a. Upgrading the ability by the improvement of existing loading and unloading facilities. b. Creating business space for the port related industry by providing real estate. c. Improving the cooperation and unification of the port transport business. d. Cooperating with domestic and international shipping companies (the relaxation of cabotage regulations including the introduction of a tag-end cabotage system).

2. Pursuing Economies of Scale by the Port Management Corporations
2.1 Collective management of loading and unloading facilities across Japan
a. Reducing costs by procuring loading and unloading facilities en bloc at several ports. b. Receiving maintenance business for port facilities from port management bodies throughout Japan, by accumulating human resources and know-how regarding maintenance of port facilities. c. Introducing electric motorization and automation to loading and unloading facilities.
2.2 Integration of the Computer System
a. Establishing the information network between the port management corporations.
2.3 Expanding Business to Growing Overseas Markets
a. Capital participation in port management of overseas container terminals. b. Establishment of an information network by integrating computer systems.

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3. Improvement of Container Terminals in Japan
3.1 Reorganization of container terminals in Japan
a. Selecting terminals in the country where the port management corporations could achieve economies of scale and participating in management.
3.2 Reorganizing the Port Transport business providers in Japan
a. Reorganizing the port transport business providers due to reorganization of container terminals.
3.3 Sorting out the Complicated Relationship of Owning and Leasing Facilities
a. Removing multi-layered terminal management systems that create the situation of no one claiming responsibility, and unifying the systems for the management of the port management corporations. New terminals will be “Common Terminals,” which are publicly built and privately operated, and will be provided with the labor right of loading and unloading for the port transport business providers. b. Centralizing the proprietary right of lands and quays in the national government and the port management bodies. c. Unifying operators as a group at each port into consolidated companies of the port transport business providers.
3.4 Accelerating the Transparency of the Financial Situations of Port Management Bodies
a. Introducing corporate accounting (double-entry bookkeeping) to finance the port management bodies and releasing the financial statements.
3.5 Diversion and Sale of Surplus Port Facilities
a. Diverting surplus port facilities to logistic sites. b. Upgrading the ability by improvement of the existing loading and unloading facilities.

4. Reinforcing the Port Management Corporations
4.1 Cooperation and integration of the port management corporations throughout Japan
a. Integration between the large-scale port management corporations. b. Management cooperation with local port management corporations. c. Establishment of computer networks between the port management corporations.
4.2 Hiring and Training Regular Employees
a. Transferring from other organizations and hiring from the outside to become specialists. b. Training regular employees as specialists of port management.
4.3 Training the Ability to Deal with Problems at the Time of Disasters
a. Formulating a Business Continuity Plan (BCP). b. Establishing backup systems for port management, with cooperation and integration between the nation-wide management corporations.

9. Three possible scenarios

9.1 Overview and Issues

Chapter 8 has detailed the solution policies and has described the utilization of third party organizations to solve issues. In order to realize these policies, various restrictive requirements and vested interests need to be considered in creating the scenarios.

9.2 Possible scenarios

Among the solution policies, some are easy to implement, and others need a great deal of coordination with numerous stakeholders. Thus, the author proposes three possible scenarios ranging from a 'minimum requirement' scenario to achieve an initial goal of port management corporations, to a 'middle scenario,' and the future scenario requiring a great deal of coordination (**Table 9.1**).

Table 9.1 Three Possible scenarios

1. **Scenario 1**
Implementing the Solutions listed in **Table 8**. Note that the solutions below, which require loads of adjustments, are excluded. 1.3d Cooperating with domestic and international shipping (the relaxation of cabotage regulations including the introduction of a tag-end cabotage system) 3.2 Accelerating the cooperation and unification of port transport business 3.3 Promoting the rationalization of systems by organizing complex owner-tenant relationships for facilities
2. **Scenario 2**
Implementing the Solutions listed in **Table 8**. Note that the solutions below, which require loads of adjustments, are excluded.
3. **Scenario 3**
Implementing all the Solutions listed in **Table 8**.

9.2.1 Scenario 1

Scenario 1 is comprised of items which can be carried out through the port management corporations' own efforts without infringing any vested interests under existing restrictions.

9.2.2 Scenario 2

Scenario 2 is comprised of items, which, within existing restrictions and vested interests, the National government and port management corporations need to improve going forward, and port management corporations' performance improves.

In particular, in this scenario, in order for port management corporations to utilize the public-built private-management system fully, the following points are pivotal:

a. Cooperating and unifying port transport businesses due to reorganization of container terminals
b. Promoting rationalization of systems by organizing complex ownerships and owner-tenant relationships for facilities.

The former has been carried out in some ports but the three largest bays i.e. the bay of Tokyo, Osaka and Ise in Japan. For example, the introduction of electric motorization and automation at the Port of Hakata, which is located in the western part of Japan, has led to the cooperation and unification of port transport business providers. It is thought that movements toward cooperation and unification at the largest three ports will be stimulated by the introduction of electric motorization and automation. However, in respect of operators who are forced out of business, or will have to cut down business due to electric motorization and automation, a safety net is necessary for port workers and their companies to distribute profits through dividends, along with the investment to merged companies.

In the latter, the process of changing from national government's public corporations to port management corporations over time has resulted in the complex relationships and owner-talent relationships between the rights and liabilities to rent facilities. Reorganizing the rights belonging to rent facilities is needed, by putting the debt management of facilities and privately owned facilities back into the hands of port management bodies for the public interest.

9.2.3 Scenario 3

Scenario 3 is comprised of all items which should be carried out, and with the added relaxation of cabotage regulations, and the introduction of tag-end cabotage to be used at main ports from **Scenario 2**.

Against the background of including the relaxation of

cabotage regulations, a serious shortage of Japanese laborers is predicted in domestic shipping lines, the same as other industries, and “Asian Low Cost Carriers” in shipping lines are expected to come into Japan with the explosive expansion of Asia’s economy.

Furthermore, the coast of the Japan Sea has practically no domestic shipping lines served by domestic shipping companies. South Korean shipping companies fulfill a role of domestic shipping lines using the Port of Busan as a hub and are connected to foreign major ports across the world through this hub. The relaxation of cabotage regulations may potentially cause the management of existing domestic shipping companies to deteriorate; however, this is considered to mainly lead to a strengthening of shipping capacity in domestic shipping lines including the coast of the Japan Sea. In addition, even if the relaxation of cabotage regulations does not lead to a comprehensive cabotage system, an increase in shipping capacity can be expected by introducing tag-end cabotage to be used in main ports.

If the domestic shipping function of the Japan Sea Coast can be recovered, the Port of Kitakyushu and the Port of Hakata, which are located close to the Port of Busan in South Korea, will become topographically more convenient, bringing about the expectation that this will allow not just these two ports, but the entire country of Japan to benefit greatly.

9.3 Process for the Realization of Scenarios

The three scenarios shown in **Section 9.2** are a menu of the solution policies. The menu does not include a concept of time. **Table 9.2** shows the process including a concept of time for **Scenario 1** to **3.**

At first, **Step 1** shows launching the supporting businesses for port management such as authority of the third parties that stand on neutral and specialized positions to form public opinion and conduct coordination and mediation, the introduction of electric motorization and automation to loading and unloading systems, establishing a port management support corporation or newly adding the port operation supporting business to the existing port management corporations, and unification and cooperation of the port transport business

Step 2 shows the national government invests in main local ports and changes the management policies of port management.

Step 3 shows an integration of port management corporations in order to bring out the strengths of the port management corporations.

9.4 Remaining Issues for Research

The objective of establishing port management corporations for container terminals is to revise of the inflexible port management system of the local governments, and to develop a structure that can rapidly adapt to global economic changes, and the intentions of shippers and shipping companies.

This report has provided a qualitative analysis of port management systems, and shown the challenges and their solution policies, and scenarios and processes for solutions. The remaining research tasks are to determine when to implement the solution policies based on the results of the qualitative analysis in this report, with the addition of a quantitative analysis. The quantitative analysis will require clarification of the items in **Table 9.3**.

The Japan’s three biggest shipping companies (K Line, MOL and NYK) announced their container business restructuring plan on October 31, 2016 appeared in The Japan Times (2016). Based on the recent changes of the world economy, the author plans to publish the research results of these items in another report.

Table 9.2 Process to Implement the Scenarios

Step 1: Launching the Supporting Businesses for Port Management
a. Authority of the third parties that stand on neutral and specialized positions to form public opinion and conduct coordination and mediation. The third parties discuss the way of port management, advocate (forming public opinion) plans for systems and assistance measures to support the operation of the port management corporations, and develop structure (authority) to make coordination and mediation for concerned parties.
b. The Introduction of electric motorization and automation to loading and unloading systems The national government is to promote electric motorization and automation for loading and unloading systems with an emphasis on the measures for CO_2 emission regulations, lack of human resources and the improvement of labor safety. As part of these measures, the national government is to provide the supporting system of technological development for electric motorization and automation, as well as to create subsidies, preferential tax measures, and loan systems without interest for cargo facility makers to introduce electric motorization and automation for loading and unloading facilities. New terminals can be motorized and automated at the time of use; however, the existing terminals need to be improved while being used, leading to the need of temporary sites for refurbishment. The introduction will be sequentially implemented from terminals that can secure a temporary site. In order to maintain the high quality of the loading and unloading work, the introduction needs to be advanced while experienced workers are not yet retired.
c. Establishing a port management support companies or newly adding the port operation supporting business to the existing port management corporations Port operation supporting businesses will be responsible for ordering new cargo handling facilities and electrically motorized and automated cargo handling facilities all together, leasing these facilities to borrowers of container terminals, and managing necessary personnel and equipment for the maintenance of the cargo handling facilities. There are some methods to launch port operation supporting businesses such as establishing a new corporation or adopting a new business into the existing port management corporations.
d. Unification and Cooperation of the Port Transport Business The National government will advance the unification and cooperation of the port transport business, together with the introduction of electric motorization and automation as well as reorganization of container terminals. With the examination of the situation of labor supply and demand at the port transport business, if there is an excess of workers, the National government will take a central role in creating work for the port transport business, and building a safety net to protect the wages of employees. Establishing consolidated companies with investment in port transport business providers is one solution to preserve their prestige and reputation. Regarding shipping company-style port operators, the National government will take a central role to accelerate their unification with the goal of shipping company unification.

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Step 2: The National Government to Invest in Main Local Ports

As local governments (see Note) lead the management of main local ports, port management corporations at these ports are operated based on the pursuit of local benefits. In order to realize port management which seeks to benefit the nation as a whole, the National government, instead of the local governments, needs to invest in port management corporations and change the management policies of port management.

Note: Possible Main local ports to be reviewed: Tomakomai Port, Ishikari Bay New Port, Sendai Shiogama Port, Ibaraki Port, Niigata Port, Tsuruga Port, Maizuru Port, Hiroshima Port, Mizushima Port, Kanmon Port, and the Port of Hakata

Step 3: Integration of Port Management Corporations

In order to bring out the strengths of the port management corporations, as the final step, the National government needs to accelerate the integration of invested management and develop structures where a single port management corporation manages the entire port management operations across Japan, with the expansion of port management overseas being achieved.

Table 9.3 Items for Quantitative Analysis to Establish the Time Period Required for the Implementation of Solution Policies

1. Understanding of the Current Situation and Future Predictions a. The current situation and future predictions for shipping companies and domestic shipping companies. b. The number, ownership, age, and operating status of loading equipment . c. Management bodies and the status of container terminals across Japan. d. The current situation and future predictions for supply and demand of port operators, including port transport business providers and domestic sailors. e. Predictions of supply and demand for workers at port transport businesses, related to the electric motorization and automation of loading equipment.
2. Discussion of Methods for the Introduction of Electric Motorization and Automation a. Processes and methods for the improvement of existing terminals with the electric motorization and automation of loading equipment. b. Effect of cooperation and unification of port transport businesses.
3. Feasibility Study on the Putting the Port Operation Supporting Businesses a. Examination of the amount of bulk orders for loading equipment, lease charges, and administrative and maintenance costs at Japan's three largest ports and main local ports. b. Surveys Related to Implementing Business Operations by the Separating Possession of Equipment and Management.
4. Examination of Involvement in the Management of Main Local Ports a. Examination of investment in the management of main local ports. b. Surveys related to implementing business operations by integrating the management of port management corporations.
5. Examination of the Relaxation of Cabotage Restrictions (including the introduction of tag-end cabotage) a. Predictions for the future and effectiveness for a domestic shipping route network. b. Predictions of the effectiveness for management of port management corporations.

10. Conclusion

The National government and stakeholders involved in port management have great expectations for port management corporations. At first, the author considered that the issues of stakeholders involved in port management need to be addressed in order to assist the drawing up of a management policy for the future of port management corporations when launching port management corporations. However, even after the port management corporation was established, the author realized that it had not progressed toward any solutions of the issues, resulting in a decision to survey the issue of port management corporations.

What was revealed in the addressing of the issues with port management corporations was lack of individuals willing to take responsibility. As port management corporations are private companies, corporation directors have management responsibility. Although the National government and port management bodies have the strong rights as stockholders to express their opinions on companies' policies, the fact that the stockholders themselves do not have a clear policy makes this problem more profound.

On the other hand, there has been no previous research dealing with port transport businesses, providing a gap in the research. Because of this, the author has clarified those who hold responsibility, and indicated which scenario and process to take going forward.

The conclusion of this report is summarized as follows:

The objective of establishing port management corporations for container terminals is to improve a rigid port management system by the local governments, and develop a port management system, which can rapidly adapt to global economic changes, and the intentions of shippers and shipping companies. The author has analyzed the current system of port management bodies theoretically in a previously published research paper, and has pointed out that there exist diverse problems in the system.

a. The need to integrate facilities for container terminals by reducing surplus facilities, in accordance with Japan's geographic characteristics from the perspective of physical geography, in order to improve the productivity of container terminals in Japan (**Chapter 2**)

b. The fiscal conditions of local governments as port management bodies had been deteriorating due to an increase in the capital costs and administrative and maintenance expenses of the ports to be reduced and integrated (**Chapter 3**)

c. A rise in the capital costs and administrative and maintenance expenses should be compensated by injecting local taxes (**Chapter 4**)

d. The current port management system operated by local governments has the objective of Japan's legal system and the situation of a global port operation is constrained by the Local Autonomy Act of Japan (**Chapter 5)**

e. An integrated operation of container terminals throughout Japan is necessary, in order to build the sustainability in port management, which is resistance to large-scale natural disasters expected to occur in the future (**Chapter 6**)

f. What is inevitable to implement solutions for the issues is not leaving it to the initiative of local governments but the powerful leadership of the national government (**Chapter 7**)

However, as stakeholders involved in port management face various issues, the management of port management corporations has not proceeded smoothly. Thus, the author has decided to find out what issues are hurdles to the process by rigorously examining the actual conditions of organizations and trade practices, among other factors.

As mentioned in **Chapter 8**, by carrying out a rigorous survey of stakeholders involved in port management, and analyzing issues requiring measures for port management to achieve their initial objectives and adapt to changes in social economy, the following trends detailed below by stakeholders have been found:

a. The improvement of the National government, port management bodies and port transport business providers cannot be expected simply through their own efforts.

b. The issues for shippers and port management corporations require solutions made by other than themselves.

c. These issues all share the attribute of requiring solutions from third party organizations.

Next, with respect to these issues, solution policies utilizing the strengths to be expected from port management corporations, which are private companies, are indicated. These solution policies, in comparison with the policy of the International Container Strategy Port, have been shown the need for the following management strategies:

a. The national government will need to shelve the objective of the Policy of International Container Strategy Ports, which is a reduction in the rate of a foreign transshipment, and ask port management corporations to aim for management to maximize their profits as private companies.

b. In order to pursue economies of scale as private companies, port management corporations will need to undertake port management to maximize their profits according to market trends and invest in foreign port management in consideration of the economic rise of Asia.

Further, based on these management strategies, to solve the problems of port management, the author has suggested the need for the involvement of neutral and expert third party organizations to form public opinion, and provide authority. The author has also proposed three scenarios, namely the scenario carried out with the minimum coordination with stakeholders, the middle scenario, and the future scenario requiring a great deal of coordination with stakeholders, and the processes for implementing these scenarios.

This report, in combination with the author's existing research based on seven fields of geographic, engineering, finance, administrative law, business administration, risk management and politics, is considered to have the achievement of the first systematic research on port management system as well as a groundbreaking one in the research history of port management.

Lastly, the author is hopeful for positive developments in the future, leading to concrete solutions for the issues. In addition, the author will be also delighted if this report contributes to opening the door to a bright future for Japan.

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Afterword

The author showed the copies of this report to those who participated in International Conferences of the world. This report has been standing high in public estimation.

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発　行　所　港　湾　空　港　技　術　研　究　所
横須賀市長瀬３丁目１番１号
TEL. 046(844)5040　URL. http://www.pari.go.jp/

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