PORT PLACEMENT WITH CONSIDERATION FOR GEOGRAPHICAL CHARACTERISTICS OF THE WORLD

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***ABSTRACT*:** Basic matters to be considered in setting the international main route for container ships are "geographical factors" and "transportation means factors." The authors analyzed the density of economic activities and depth of the port hinterland, which were categorized as geographical characteristics, and also analyzed the characteristics of the port placement by using a model of topography properties.

The authors classified the characteristics of ports of the world into three kinds based on the density of economic activities and depth of the port hinterland. The first type is 'the Continental Hub Port Type', which it is located in the continent and has the large economic hinterland. Typical ports of this type are Melbourne, LA, Rotterdam and Shanghai. The second type is 'the Marine Hub Port Type', which is located in the ocean space where geographical predominance is high. This type forms route hubs. Typical ports of this type are Singapore, Freeport and Malta. The third type is 'the Narrow-area, extra-high-density Port Type', which is located in an island and has the highest density of economic activities and the lowest depth worldwide. This type has characteristics that the distance between the ports is short and there are a lot of numbers of ports, which is unique and special in the world.

Japan's ports are classified in the third type. Furthermore, Japan has a characteristic that there are many large-scale earthquakes and has to consider earthquake measures to reduce disaster risks. The authors will suggest that what are required for the third type are a bold reorganization of international hub port functions and a drastic reformation of the structure of collecting domestic cargoes at major ports.

KEYWORDS: Port Placement, Geographical Characteristics, Depth

1. INTRODUCTION

Container ships taking world-known arterial sea routes, which have directly assisted in establishing recent global logistics, are now becoming larger at a rapid pace. Moreover, given the more efficient use of the marine container transportation network that has become the universal logistical tool as an open network, reorganization of the network structure seems to be advancing in conjunction with a further increase in container ship size. More specifically, the positive introduction of transshipments, which are not seen in most marine transportation systems other than container transportation, has occurred in some ports as a matter of course not just for loading and unloading to connect marine and land transportation but also for the efficient operation of the entire network. As a result, hub ports in the global network at which large container ships call using trunk lines differ from general ports at which they do not call. Moreover, because hub ports for marine container transportation are believed necessary to revitalize economic activities in an international competitive environment, many countries are making strenuous efforts to establish these ports in their own countries through their own national policies.

Although these efforts are diverse, the ultimate target is almost the same, which is to expand the scale of ports by increasing the number of containers to be handled. With the expansion of the scale of ports, the calling of trunk lines at their ports will increase accordingly and, as such, the significance in using the ports will be enhanced for both shippers and shipping companies, resulting in the ports having a greater possibility of becoming base ports. However, not all ports necessarily have a greater opportunity to become a base port because of such efforts; whether they become base ports is determined by the relative relationship of the scales of various ports. The authors consider the causes of different results. Previous engagement in the expansion of the scale of some ports may help them become base ports instead of others, but the authors believe that the geographical characteristics of port placement have a far stronger influence on whether or not a port can be a base port.

Of course, many people concerned with shipping and port services recognized this matter; nevertheless, few studies discussed it objectively and clearly. Having analyzed the geographical characteristics of ports worldwide that handle containers and by focusing in particular on their spatial data, the authors attempt to discuss the baseness of ports in the context of international container transportation.

2. CURRENT STATUS OF THE PLACEMENT OF CONTAINER PORTS THROUGHOUT THE WORLD

In this discussion, from the recognition that grasping the current placement of container ports all over the world is inevitable, the authors checked the types of ports that are actually handling containers. As a result, the authors confirmed that mooring facilities dedicated to containers exist in more than 435 ports in 125 countries around the world. Fig. 1 shows the locations of the ports confirmed to hold container facilities.

Fig. 1 Locations of Ports Holding Mooring Facilities Dedicated to Containers (Top 100 Ports by Handling Volume)

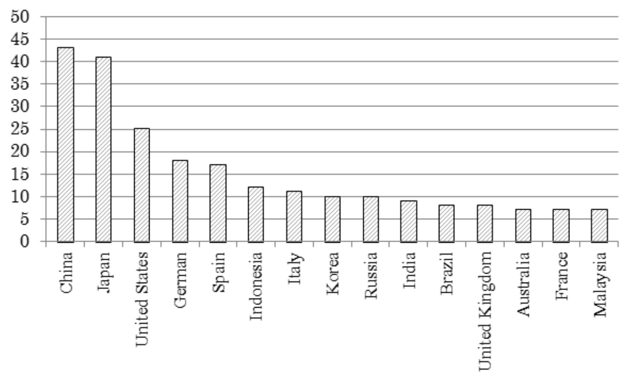

Fig. 2 Number of Ports Holding Mooring Facilities Dedicated to Containers by Country

Note: The number of ports in France includes only ports on the mainland of France.

Fig. 2 indicates the number of ports that have mooring facilities dedicated to containers by country, particularly in the 15 countries with a relatively larger number of ports. China has the largest number of ports, followed by Japan, America, Germany, and Spain. As for China at the top and America in third place, the number of ports that these countries possess is reasonable because their land areas and trading volumes are huge. In Germany, the number of inland-river ports alongside the Rhine water system is very large, but only four ports at which large container ships can call are in direct contact with the open sea. Spain has mooring facilities for containers at many ports on the Canary Islands, resulting in a relatively high number of ports. Relative to these countries, the number of ports in Japan is extraordinarily high given its land area. The authors subsequently discuss the reasons for this phenomenon.

Fig. 3 shows the status of ports holding mooring facilities dedicated to containers in each region of the world. In 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. The authors also review large-scale ports with very large volumes of container cargo. As of 2010, the East Asian regions including China had the largest proportion of the approximately 100 ports that handled 1 min. TEU or more per year, followed by European regions, North American regions including the Atlantic and Pacific regions, and Southeast Asian regions. The current positions of the three major regions of East Asia, Europe, and North America—whose market sizes are large in terms of world trade—are understood to be reflected in such figures. Likewise, the East Asian region including China, Japan, South Korea, and Taiwan has the largest number of the approximately 20 ports in the world that handle 5,000,000 TEU, followed by Southeast Asia, and then the Atlantic coast region of Europe. A review of America shows that large-scale container ports exist on both the Pacific Ocean side and the Atlantic Ocean side. The Middle East region's 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, arguably, they enjoy significant economic growth and their positional relationships with other areas and their geographical characteristics contributed to their emergence. Moreover, these ports handle not only import and export cargoes generated from their hinterlands, but also many transshipment cargoes. The authors also inquire into this matter from a geographical point of view.

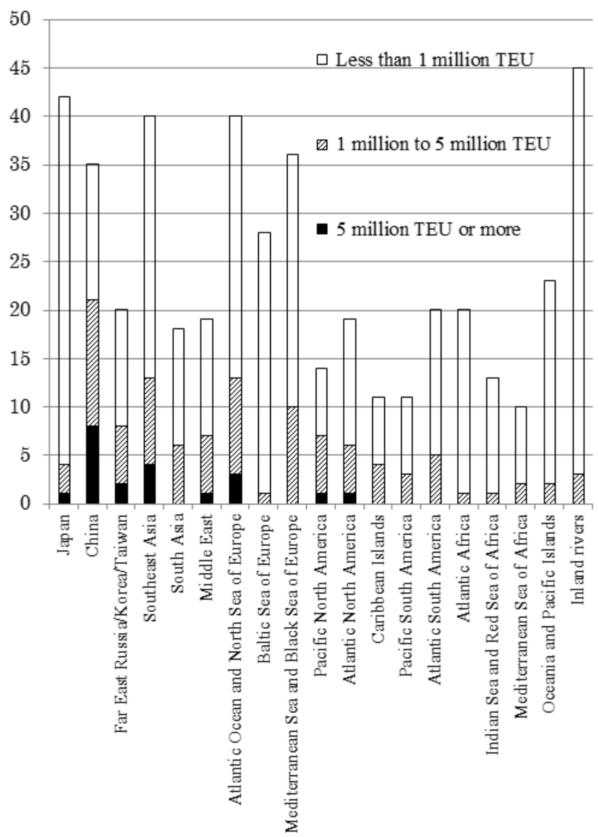

Fig. 3 Number of Ports Holding Mooring Facilities Dedicated to Containers by Region

(Containerization International Yearbook 2012)

Moreover, importantly, note that in relation to container ports even in areas in which no large islands of economic activity or cargo generation could be expected because of a sluggish economy, relatively large-scale container ports are economically viable. These ports run smoothly only because of transshipments among container ship routes. Before the prevalence of container transportation, ports of this type were unthinkable. In addition, unexpectedly, many inland river ports are seen handling containers. Many such ports exist particularly alongside the Rhine water system and the Yangtze River water system, and some exist on the Danube River, the Amazon River, 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 hinterlands, and they can be reasonably regarded as complementing and replacing land transportation.

3. CLASSIFICATION OF INTERNATIONAL CONTAINER PORTS

With respect to classifying the world's leading international container ports by whether they depend primarily on land transportation or marine transportation for the collection of cargo at their ports, representative ports depending on land transportation include various ports along the Atlantic coast such as Amsterdam and Antwerp in the EU; almost all major ports such as Long Beach, Los Angeles, New Jersey, and New York in America; and major ports such as Shanghai and Dalian in China. The same can be said of major ports such as Keihin and Hanshin in Japan, and Melbourne and Sydney in Australia. For any of these ports, the ratio of transshipment is low for the volume of containers handled. This feature is primarily the result of the sizable scale of economic activity in the hinterland. However, the maintenance of such a large-scale economy in the hinterland presupposes either the wider area of the hinterland or the higher density of economic activity, or both.

In contrast, representative ports that depend significantly on marine transportation are Singapore and Malta; Rasasa and Freeport are similar. Any of these ports belong either to one group of ports with geographical features of land area, such as straits, canals, or protruding land terrain, that converge shipping routes through obstructing geographic features to constrain the cruising of ships or to 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: one is the continental hub port that has a hinterland, is located on a continent, and engages in large-scale economic activity, and the other is the marine-hub port that forms a shipping route hub located in the sea area of high geographical advantage. Busan Port, which has a large-sized hinterland and the geographical advantage of facing the Tsushima Strait, represents both types of parts and accepts numerous transshipments.

In addition, regarding small ports that handle a relatively small number of containers, because the volume is minimal in response to the hinterland's demand for marine transportation, if the authors dare to classify these small ports, they and island ports can be classified as continental hub ports.

Table 1 shows the respective number of ports around the world that are classified into the listed groups. Broadly, the number of continental hub ports is the largest, with many of them having a wide-area, low-density hinterland structured to collect cargo generated in that area. Ports in Japan are extremely opposite of these continental hub ports. Although the hinterland area is very narrow, economic activity is extremely high and many container-handling ports are placed there. The hinterlands of the ports in Europe are classified into an intermediate position between the two extremes.

Table 1 Number of Container Handling Ports by Classification

Classification		Representative Ports	No.
Continental hub port			75
Wide-area, low-density type		Long Beach, Los Angeles, Melbourne, Shanghai	56
Wide-area, high-density type		Rotterdam, Hamburg, Felixstowe	15
Narrow-area, extra-high-density type		Keihin(Tokyo, Kawasaki, Yokohama), Hanshin(Osaka, Kobe), Isewan(Nagoya, Yokkaichi) Kitakyushu	4
Marine hub port			31
Obstructing -terrain type	Narrow -terrain type	Singapore, Dubai, Tanger, Balboa, Port Said.	12
	Protruding -terrain type	Rasasa, Port Elizabeth, Casablanca, Gwangyang	10
Remote isolated-island type		Marsaxlokk, Freeport, Las Palmas.	9
Continental/Marine hub		Busan	1
Locally demanded		(small-scale)	328
Total			435

Note: Hub type refers to port-holding facilities dedicated to containers larger than a quay.

4. JAPAN'S GEOGRAPHICAL CHARACTERISTICS

Fig. 4 shows the nominal GDP values per inhabitable land area in 15 top countries with FY2012 GDP of more than US$1 trillion. The GDP per inhabitable land area in Japan is found to be prominently high among these values.

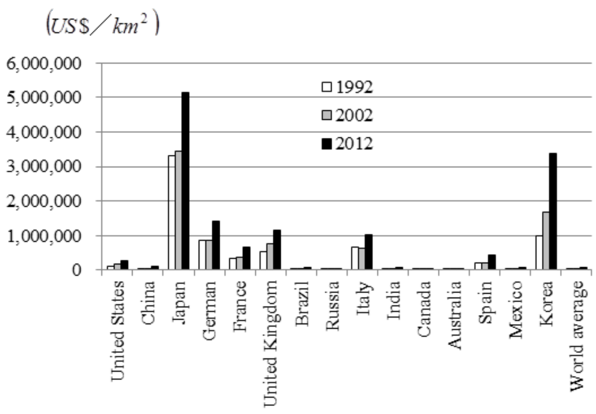

Fig. 4 GDP per Inhabitable Land Area (Nominal Value)

(World Economic Outlook Database 2013, IMF)

(THE WORLD FACT BOOK, CIA, http://cia.gov/library/publications/)

(State of the World's Forest 2009.FAO)

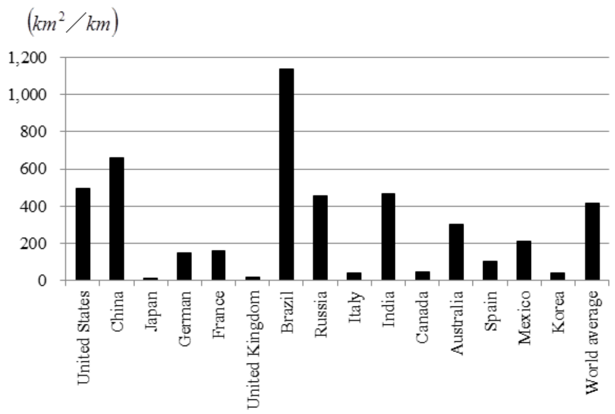

Fig. 5 National Land Area per Shoreline

(THE WORLD FACT BOOK, CIA, https://www.cia.go_v/library/pubilcations/the-world-factbook/)

Furthermore, Fig. 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 Fig. 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.

5. GROWTH SCENARIO 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 authors consider the type of growth scenario of the ports that have established themselves as international container hub ports. The authors argue 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 (1).

$$Qp = Qg + Qt \geq Qpc \quad (1)$$

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 (1) is assumed, the 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 scenario to improve the cargo booking structure for land transportation aims primarily at increasing Qg, and the scenario to improve the cargo booking structure for marine transportation aims primarily at increasing Qt.

(1) Scenario to improve the structure of cargo collection for land transportation

As a whole, the 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 scenario.

(2) 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 scenario is seen in the Singapore port and the Dubai port.

(3) Scenario to improve the structure of cargo collection for land and marine transportation

Scenarios (1) and (2) are to be promoted in parallel. The corresponding case is Busan port.

Qp is represented in the following equation:

$$Qg = \int_A q dA = A \cdot \overline{q} \qquad (2)$$

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

According to Equations (1) and (2), for Qp to exceed Qpc in the scenario to improve cargo collection for land transportation, attempting to increase any one or more of Qt, A and $\overline{q}$ is necessary.

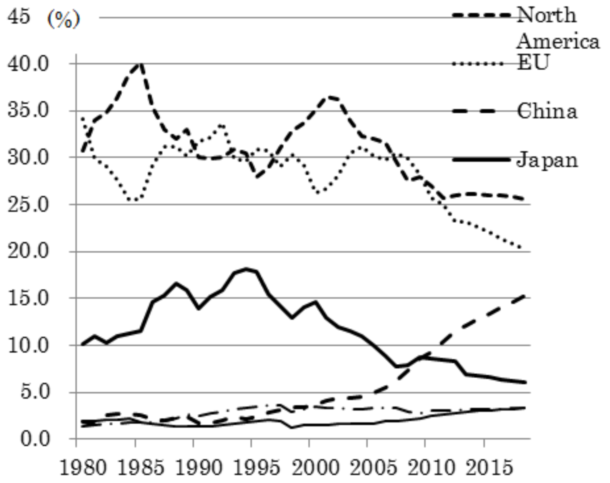

Fig. 6 Trends in GDPs by Regions of the World

(World Economic Outlook Database 2013, IMF)

Fig. 6 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 cargoes coming from and going to Japan through other countries in East

Asia.

6. CHARACTERISTICS OF INTERNATIONAL MARINE ROUTE

Fig. 7, Fig. 8, and Fig. 9 show the numbers of container ports at every 500 km within a total distance of 5,000 km in the three regions of the Atlantic coasts of Western Europe, Southeast Asia, and East Asia. These numbers are regarded as showing in what distance distributions the targeted major ports have their own centeredness.

The distribution patterns of the distance range of major ports in Europe as shown in Fig. 7 and of those in Southeast Asia as shown in Fig. 8 are relatively uniform and not significantly different. Almost no geographical advantage with respect to distance to container ports exists among the major ports in Europe; therefore, their current relationships are deemed likely to be maintained.

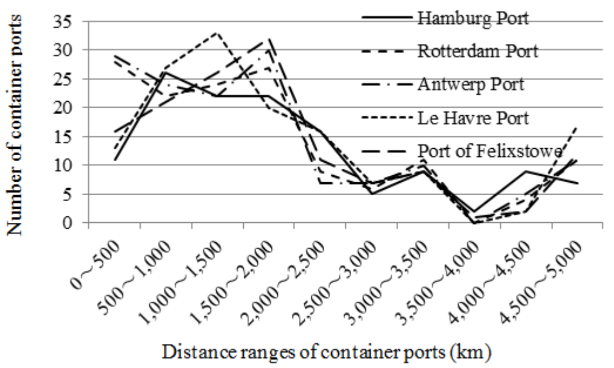

Fig. 7 Distance to Container Handling Port from Major Ports (Atlantic Coast of Western Europe)

To the extent that the geographical advantage of distance to container ports can be seen in the figures, Fig. 8 indicates no such conspicuous advantage for Southeast Asia. In fact, Singapore Port is far advanced in expansion of scale, and is followed by other ports. These four ports are far from one another relative to the distances between ports in Europe. Nevertheless, the two groups of ports show no difference in geographical advantage because few ports exist in Southeast Asia and many of them are larger in scale and, therefore, distributed at long distances rather than at short distances. Regarding future competition among ports, a good possibility exists that ports in this region will compete with those in East Asia, Europe, and North America, among others; given the distance, the ports in this region will attempt to acquire hub port positions in the global network.

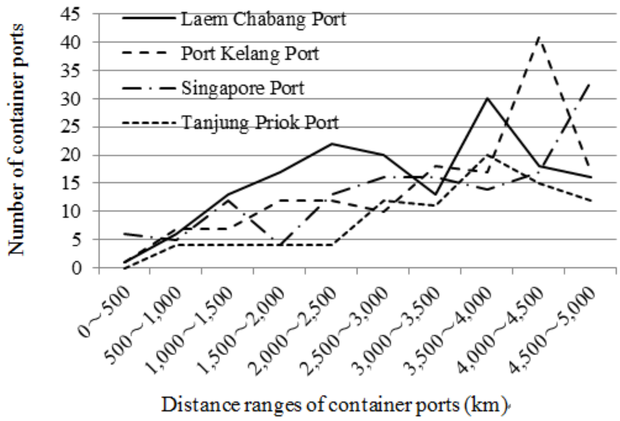

Fig. 8 Distance to Container Handling Port from Major Ports (Southeast Asia)

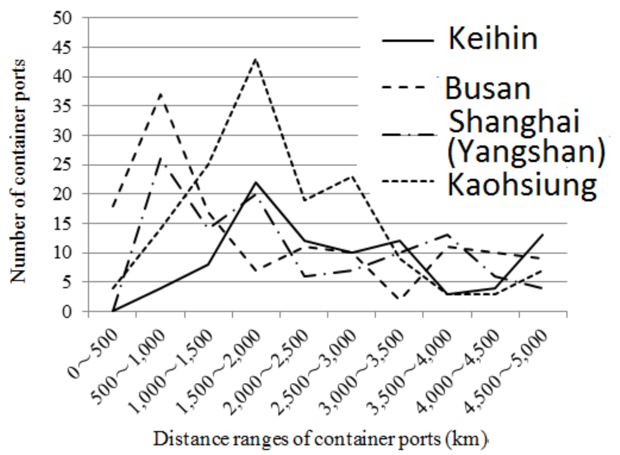

Fig. 9 Distance to Container Handling Port from Major Ports (East Asia)

As shown in Fig. 9, the major ports in East Asia each have different geographical advantages, in contrast to the ports in Europe and Southeast Asia. To compare Busan Port in Korea and Keihin Port in Japan, Busan Port is within 1,000 km of a number of ports in the eastern part of China and Japan, making it clearly able to collect cargoes using short-distance feeder transport. In addition, Busan Port also faces the Tsushima Traits, where shipping routes converge. Fig. 9 clearly shows that Busan Port is in a more advantageous position to practice the scenario to improve the structure of cargo collection for marine transportation than is Keihin Port in Japan. Therefore, under the present circumstances, attracting—as part of a transshipment policy—cargoes handled by foreign ports such as Busan Port to ports in Japan will be difficult.

7. STRUCTURE OF CARGO COLLECTION FOR LAND TRANSPORTATION

Fig. 10 shows GDP values per inhabitable land area in Fig. 4, indexed to a world average of 1. Thus, Japan's density of economic activity is still one of the highest in the world but, relatively, is on a declining trend.

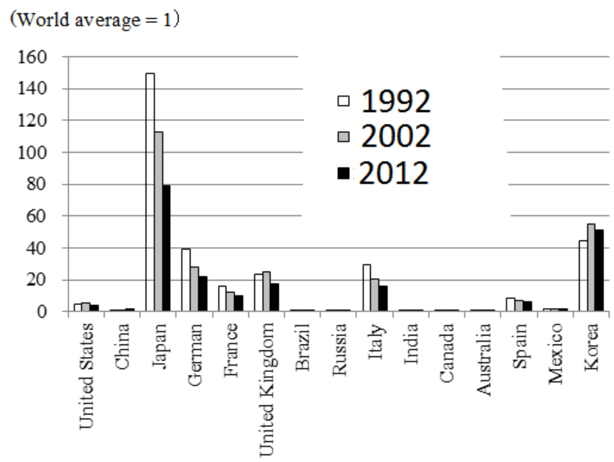

Fig. 10 GDP per Inhabitable Land Area

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 Fig. 10, Japan’s density of economic activity is on a relatively declining trend. Therefore, no other way exists to realize a 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 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 authors 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 authors then consider the effects of integrating the hinterlands in the directions of the coastline. Fig.

11 graphically represents all of these prerequisites.

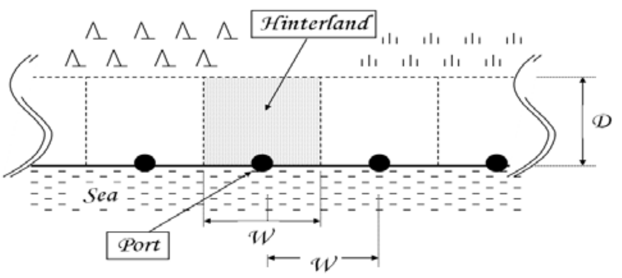

Fig. 11 Simplified Image of Hinterland

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:

$$ct = cl + cp = \alpha \cdot r \cdot q + \beta \cdot q = (\alpha \cdot r + \beta) \cdot q \quad (3)$$

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:

$$Cl = \int_A \alpha \cdot r \cdot q dA = \alpha \cdot q \int_A r dA = \alpha \cdot q \cdot S \quad (4)$$

$$Cp = \int_A \beta \cdot q dA = \beta \cdot q \int_A dA = \beta \cdot q \cdot A \quad (5)$$

In Equation (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 Fig. 12.

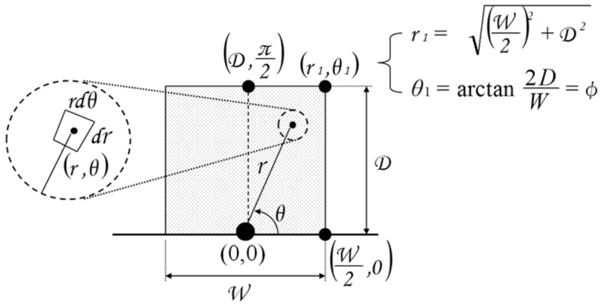

Fig. 12 Definition of Coordinates

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

$$\bar{\delta} = \frac{\bar{r}}{D} \quad (6)$$

$$\delta p = \frac{\beta}{\alpha \cdot D} \quad (7)$$

Then, Equation (3) can be expressed as follows:

$$\frac{\overline{ct}}{\alpha \cdot q \cdot D} = \bar{\delta} + \delta p \quad (8)$$

In addition, if equations are set up as follows:

$$\eta = \frac{W}{D} \quad (9)$$

$$\phi = Tan^{-1}\left(\frac{2}{\eta}\right) \quad (10)$$

and if the definite integral of *S* in Equation (4) is calculated and the result is applied to $\bar{\delta}$, $\bar{\delta}$ is calculated in the following equation:

$$\bar{\delta} = \frac{2}{3 \cdot \eta}\left[\frac{\eta^3}{8}\left\{\frac{1}{2} \cdot \frac{\sin\phi}{\cos^2\phi} + \frac{1}{4} \cdot \ln\left(\frac{1+\sin\phi}{1-\sin\phi}\right)\right\} + \left\{\frac{1}{2} \cdot \frac{\cos\phi}{\sin^2\phi} + \frac{1}{4} \cdot \ln\left(\frac{1+\cos\phi}{1-\cos\phi}\right)\right\}\right] \quad (11)$$

Equation (11) makes it possible to determine the dimensionless amount of average transportation distance $\bar{\delta}$ 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 $\bar{c}t/\alpha \cdot q \cdot D$ of the average cargo transportation cost in the hinterland of the port using Equation (8).

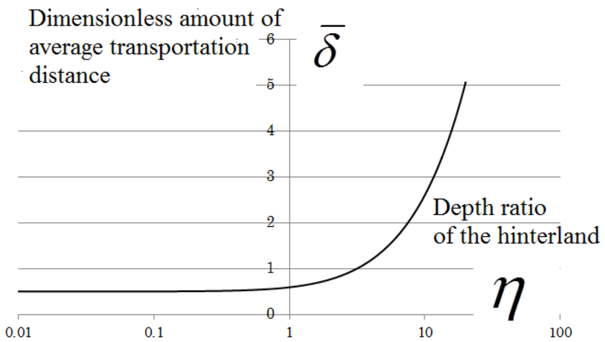

Fig. 13 Relationship between Horizontal to Depth Ratio η and Average Transportation Distance $\bar{\delta}$

Fig. 13 graphically represents the relationship between η and $\bar{\delta}$ in Equation (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 $\bar{\delta}$. In contrast, if the depth of the hinterland η exceeds 1, the port placement interval *W* becomes a dominant factor and $\bar{\delta}$ 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 depths of the hinterlands of Japanese ports are 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.

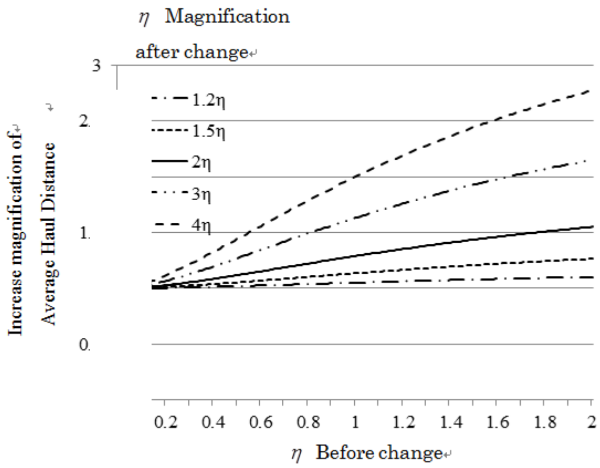

Fig. 14 Effect of the Change of Horizontal to Depth Ratio of Hinterland

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. Fig. 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 (11) and these figures for η or using Fig. 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.

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.

8. CONCLUSION

As a result of our attempt to typify almost all of the container ports in the world, the authors recognized that container hub ports can be divided into a group of continental hub ports whose mission is to collect cargoes primarily from the hinterlands and a group of marine hub ports whose mission is to handle transshipment cargoes as the mode characteristic of container transportation. From this viewpoint, the authors 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 cargoes based on the recognition that the acquisition of more transshipment cargoes than other ports is a priority in the competition among international container ports. Japan has a characteristic that there are many large-scale earthquakes and has to consider earthquake measures to reduce disaster risks. The authors believe that prioritizing the recognition of international competition with foreign ports 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 cargoes at major ports.

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

The authors suggest 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.

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