

CLASSIFICATION OF CONTAINER PORTS ON THE BASIS OF NETWORKS

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1. INTRODUCTION

Ports have always functioned as loading centres for cargo, and although historically many ports were pivotal to international trade, many others also failed to sustain their role over time. Hub ports such as the ports of London after the era of the Industrial Revolution, the New York port and the port of Kobe in Japan each experienced a downturn of their status after an impressive debut in international trade. However, to determine the factors which raise the profiles of ports as centres of international trade and as hubs is not a straightforward analytical exercise. A major challenge for researchers nowadays is to pinpoint and analyze the relationship between a port and its region in view of economic activity. From this perspective, our particular concern in this work is to explore the function and classification of container ports and port cities in relation to the networks that connect them inland and outward.

The literature on ports from historical, archaeological, geographical, economic, and even anthropological perspectives is plentiful. Various studies have focused on the hierarchy definition among ports in the shipping network (UNCTAD, 1990; Zeng and Yang, 2002). But others have examined the development and impacts of port growth, in particular how a port evolves in response to changes in its environment (UNCTAD, 1992; Hoyle, 2000; Lee et al., 2008), and how a port impacts on its region, from positive agglomeration effects (Fujita and Mori, 1996) to specific economic obstructions in developing countries (Naude, 2009).

After the Industrial Revolution the port as a transport centre for international trade began facing challenges to its predominant status. Other transport modes, particularly air and rail were used increasingly for long distance trade (Porter, 1998). For instance, high value goods as well as small and light manufactured products are usually transported by air. Hence, in some regions logistic activity has tended to shift from its traditional location around central areas within port and rail linkages, to peripheral locations where airport and road linkages were easier (Rodrigue, 2004). We then observe that the relationship between a port and its region has been characterized by many changes. The standardized iron container, used increasingly since the 1960s, is a maritime innovation that has been able to handle the burgeoning growth in the shipping industry, using less human labor (Hoyle and Hilling, 1984; Martin et al. 2001). However, the port with a larger volume of containers whose contents is

composed mainly of transshipment cargo, may bring less employment and income to its region than a smaller port, whose volume is composed mainly of export and import general cargo of the region. In addition, the business activity of international interchange or trade can be handled away from ports. Consequently, the centrality of ports for international trade and international culture exchange has decreased gradually over time (Murphy, 1989; Moore, 2001).

The existing classifications of ports do not account for the relatively recent changes in shipping and inland transport networks (containerization, globalization and regionalization), nor as Martin et al. (2001) observe do they reflect the current diverse trends of economic activity of the maritime and logistic industry. Given these influential trends in port development and in light of the recent economic downturn, the aim of this paper is to attest that the essential role of a port is to act as the bridge between shipping activity and inland transport network, to compare different port classifications and finally to suggest a new category for container ports in order to clarify their economic effects on the regions or cities where they operate. We focus specifically on the characteristics of cargo transport networks. The port as a transport node plays a number of crucial roles in moving cargo and connecting different regions and countries into single economic networks. With this extended perspective ports can be interpreted as a player and a competitor in foreign trade and regional economies through their transport networks in relation to other ports, backward areas and hinterlands.

The paper is structured such that in the next sections we review the standard port classifications and briefly discuss their drawbacks. We argue that the existing classification for ports: hierarchical, generation and functional, does not allow for a simultaneous analysis of shipping networks and inland networks. Therefore, we introduce in section three our network classification for the maritime industry and, based on this network classification, in section four we identify the nine new categories of container ports. We conclude with a discussion of the main policy that may be implemented on the basis of our new classification.

2. LITERATURE REVIEW OF PORT DEFINITION

In this section different classifications of ports based on their characteristics and functions will be examined in order to identify a new definition of port. In the literature we observe three main types of definition of ports: hierarchical, generation and functional. The *hierarchical* classification refers to the role of ports in the shipping network and partially includes their role as an intermodal linkage, but it neither clarifies the inland network at ports, nor includes the explanation for logistics services and relationships with the region. The *generation* classification divides ports according to their development or evolutionary stage, and assumes that ports develop from a primitive harbour to a global hub port. The third classification of ports, that of *functional*, asserts that globalization and regionalization in the world economy promote ports to develop as transshipment hubs or regional load centres in the global logistics chain. The functional approach emphasizes the role of intermodal

transport of ports in the supply chain. In table 1 we summarize the main factors that characterize a port in relation to the three port classifications.

Table 1. Comparison of Port Classifications

Definition /Factors	Intermodal Transport	Shipping Network	Inland Network	Logistics Service	Relationship with Region	Definition of Shipping Line	Basic Function
Hierarchical Classification	△	○	-	-	-	△	-
Generation Classification	△	-	-	○	○	-	-
Functional Classification	○	△	△	○	△	-	-

○ : including, △ : partially including or unclear, - : not including.

2.1 Hierarchical Classification

Shipping and air transport companies have developed the hub-and-spoke system in order to concentrate capacity at a few major nodes connected by many spokes and to benefit from economies of scale. The hierarchical definition of ports focuses on the shipping network and relies on the concept of the shipping route. It is mainly based on the hub-and-spoke system, but does not address the interaction between a port and its region. It is therefore a one-sided view of ports, for instance, the shipping trunk line can easily be altered, according to port throughput in each region and each port.

A formalized concept of hub port and port classification was suggested by UNCTAD (1990) after the generalization of the container system in world trade during the 1980s. However, many changes have since occurred in the container shipping business, in which traditional routes have become obsolete, and new routes play a more significant role, as in the case of ship calls in Chinese and Korean ports (Yeo et al., 2008). Very rapid growth of Northeast Asian container ports which benefitted from the enormous economic growth of the 1990s, meant that feeder ports developed into regional hub ports or into global hub ports (Todd, 1993; Zeng and Yang, 2002; Cullinane. et al., 2004). Even though this hierarchical classification of ports can explain the shipping network after containerization, it lacks in its definition an integrated logistics vantage point, that is, a port plays the role of joint operator, and the effects of inland networks on ports may be a decisive factor for the positioning of ports in the shipping network.

2.2 Generation Classification

The generation classification defines a port's linear development in view of its functional and evolutionary change, for example, from primitive fishing village to developed facility, such as a global logistics centre (Hoyle, 1978; UNCTAD, 1992; Fujita and Mori, 1996; Hoyle, 2000; Lee et al., 2008). This classification, which is widely accepted in the maritime industry,

identifies ports on the basis of development generation or as having undergone evolutionary stages (UNCTAD, 1992). Nevertheless, different types of ports and diversified ports carry out numerous functions simultaneously so we can surmise that a port does not always evolve in one direction or through a predictable pattern.

Thus the evolutionary stage of a port can be interpreted as the development of spatial and functional relationships between a port and its corresponding city (Hoyle, 2000). This view emphasizes waterfront revitalization as the final stage of evolution and mixed-use operations as a more advanced stage than the containerization and the RO/RO system stage. Even if there is connectivity between globalization and renewal of the port city, it is arguable that every port city renews its function and also enhances its port-city integration. Moreover, Hoyle's model may not be applicable to Asian port development, since an Asian evolutionary model may only be able to explain the development of Hong Kong and Singapore (Lee et al., 2008). Lee et al. (2008) states that the development and advancement of ports moves in only one direction, towards a global hub port city.

A similar classification based on the belief that underdeveloped ports grow in a linear progression towards developed ports also helps to explain the advent of the colonial city and port after the Industrial Revolution (Todd, 1993; Fujita and Mori, 1996). This generation classification is appropriate for justifying the advancement of technology, particularly when we examine the development of container vessels and oil tankers.

2.3 Functional Classification

Ports may, in accordance with globalization and regionalization, integrate their functions as transshipment hubs or regional load centres in order to improve their competitiveness (East, 1931; Hayuth, 1981). The privatization of port functions has also been estimated to improve productivity and competitiveness (East, 1931; Hayuth, 1981; World Bank, 1999; Tongzon and Heng, 2005). Within this perspective ports can be divided by means of different functions.

The functional classification of a port from the perspective of integrated logistics systems and inland transport networks focuses on the regionalization of a port system through a number of stages (Notteboom and Rodrigue, 2005), and on the integration of shipping and land based logistics networks (Robinson, 2002). This functional approach analyses the emergence of transshipment ports and the competition of logistics chains but nevertheless ignores the diversity inherent in port development from a simple function to advanced transport networks and instead regards port logistics integration as the last step of port development.

The port has also been classified as a combined channel system of trade, supply and logistics (Bichou and Gray, 2005). This interpretation not only defines the content of traditional port services into the simple services of loading and unloading cargo, but also argues that a port can supply shippers with value-added logistics services as well as related services, including trade, financial, leisure, and property development. However, this does not define multiple types of combination among trade, supply and logistics channels.

The functional approach as the generation classification assumes a linear evolution of a port from simple functions to advanced and integrated networks. From this perspective it is difficult to interpret dynamic and diverse developments of shipping and inland transport networks around a port.

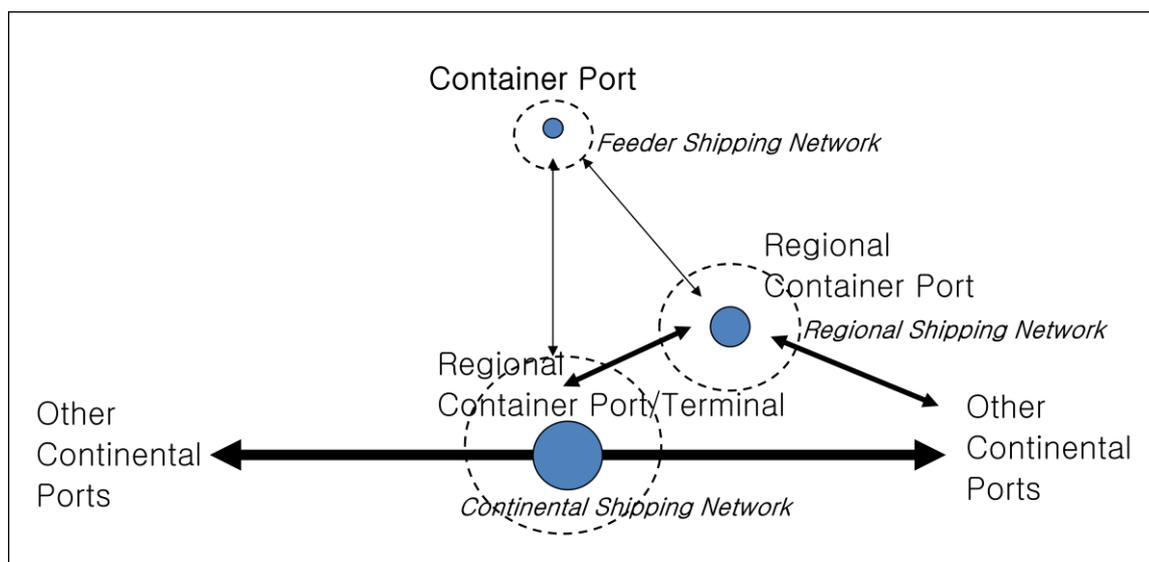
3. NEW CLASSIFICATION: SHIPPING AND INLAND NETWORKS

Existing classifications are based on the idea that changes in technology, size of ship and equipment, logistics integration, and ownership around a port may fundamentally affect the function and role of a port. In this section we examine the container port and the structural relationship between the container port network and its region. We distinguish between the shipping networks constructed on the connection between container ports and the inland networks, i.e., networks based on container ports and their backward urban and regional areas. A container port as an element of logistics chain and value chain is exposed to severe competition directly from other container ports. However we consider only the analysis of container port networks.

3.1 Shipping Networks

The port as gateway or transit point needs shipping networks that connect to other ports in other regions and other countries. Major ports in general are connected not only with other ports but with other transport networks such as railway and air transport. While a port cannot decide its shipping networks with other ports, a port coaxes shipping companies to deploy vessels at its terminals. Those shipping networks could be classified into three types according to the position of a container port in shipping networks.

Figure 1. Three Types of Shipping Networks



3.1.1 Continental Shipping Network

We will examine here a continental shipping network where container ports connect with container ports in other continents through scheduled shipping routes and supply direct global services to shippers (see Fig. 1). For example, prior to 1990, as we can see in Fig. 2, the main trunk route in Asia was comprised by a shipping service calling at Singapore, Hong Kong, Busan, and Japanese container ports, which then connected directly with European and American container ports. Since the late 1990s, however, Chinese container ports have emerged as the core of the shipping market and now handle significant trade volumes, thus we can observe that even a regional Chinese container port may operate a direct shipping route with other continental container ports in Europe or America (Yap and Lam, 2006 ; Yap, Lam, and Notteboom, 2006).

Figure 2. Major Ports in Asia



In continental shipping activity the trend has been to develop strategic alliances among shipping companies and joint calling in order to broaden service networks and also reduce vessel operation costs. The construction of increasingly larger container vessels has also compelled shipping companies to favour the hub-and-spoke transport strategy (Imai et al., 2006).

3.1.2 Regional Shipping Network

Whereas a continental shipping network connects container ports in different countries, in a regional shipping network, a container port links with other ports in the same region, mainly by direct routes – and to other continents – mainly by indirect routes or a few direct routes. Due to the sustained growth in the shipping trade, larger vessels carrying approximately 4500TEU, such as the Panamax sized container vessel, can now be deployed within the

regional shipping network, and in so doing, container ports and terminals are spurred to develop large and high-speed logistics infrastructures to handle container vessels (Cullinane and Khanna, 2000).

In some cases gateway container ports may also be classified as part of regional shipping networks. St. Petersburg in Russia, the port of Incheon in Korea, and the port of Haiphong in Vietnam are characteristic of this type of port, which partially connects with other continental hub container ports, but is committed to the development of a regional shipping network.

3.1.3 Feeder Shipping Network

Similar to the regional network, a feeder network connects a container port with other container ports in the same region and with other continental container ports, but it does so mainly through indirect routes. Feeder shipping companies supply transshipment services to global service shippers, and ports are connected by means of branch shipping routes. Shipping networks of Shanghai in China and Busan in Korea with Dandong, Yingkou, Shidao and Weihai in China, and Jeju and Mokpo in Korea, would belong to a feeder network.

3.2 Inland Network

Container Ports also connect with their backward areas and hinterlands through what is known as inland networks. In the current era of containerization, container ports can have access to shippers and logistics providers through a variety of different types of inland networks; container ports with their own vast backward areas supply shippers with diverse logistics services; other container ports with smaller backward areas and underdeveloped inland networks can handle mainly foreign countries' transshipment cargo.

However, similarly in the case of shipping networks, a port cannot decide inland transport networks, but can advise shippers and logistics providers to use its facilities and terminals.

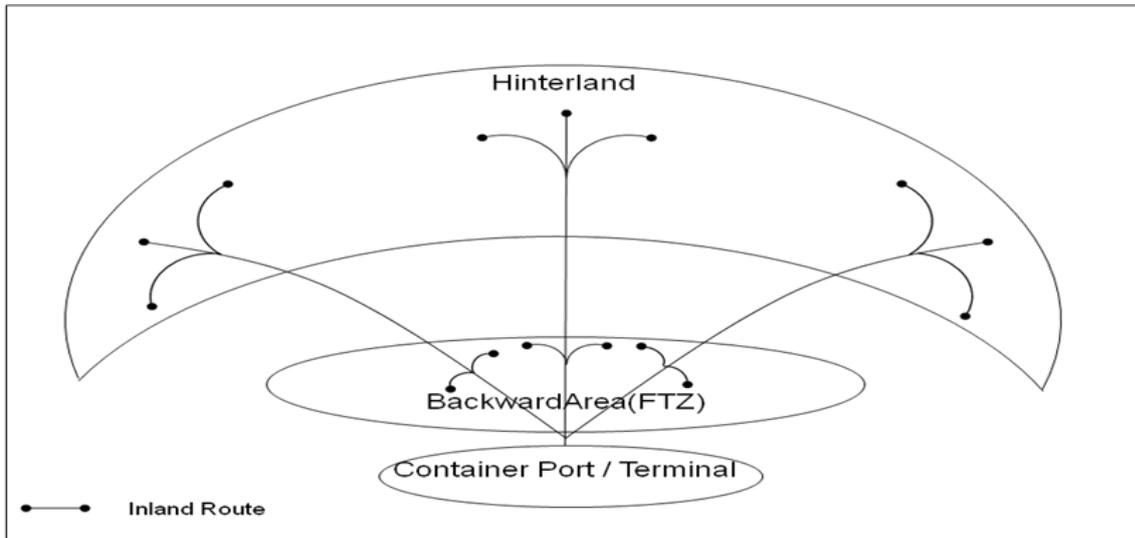
3.2.1 Multifunctional Inland Network

A multifunctional inland network has backward areas, hinterland and in some cases foreign hinterland, and is therefore characterized by multiple transport modes including airport, roadway, railway, inland waterway, domestic short sea shipping, and sea and rail intermodal routes. A multifunctional network supplies diverse services such as storage, sorting, resorting, processing, consolidation, forwarding, financing, and consulting.

The backward area, in which various economic activities are organized by logistics providers, may also be known as a free trade zone (FTZ), such as at Shanghai and Shenzhen, or as a Free Zone, Logistics Park or Distripark, such as Rotterdam and Hamburg, in accordance with the legal system of each country. Backward areas interface between local and global networks (Wang and Oliver, 2006); moreover, a container port in this network may connect Inland Container Depot (ICD) in hinterland and have exclusive road and rail access, thus

improving connectivity between port facilities and inland areas, such as the Alameda corridor at Los Angeles and Long Beach in the USA (Roso et al., 2008).

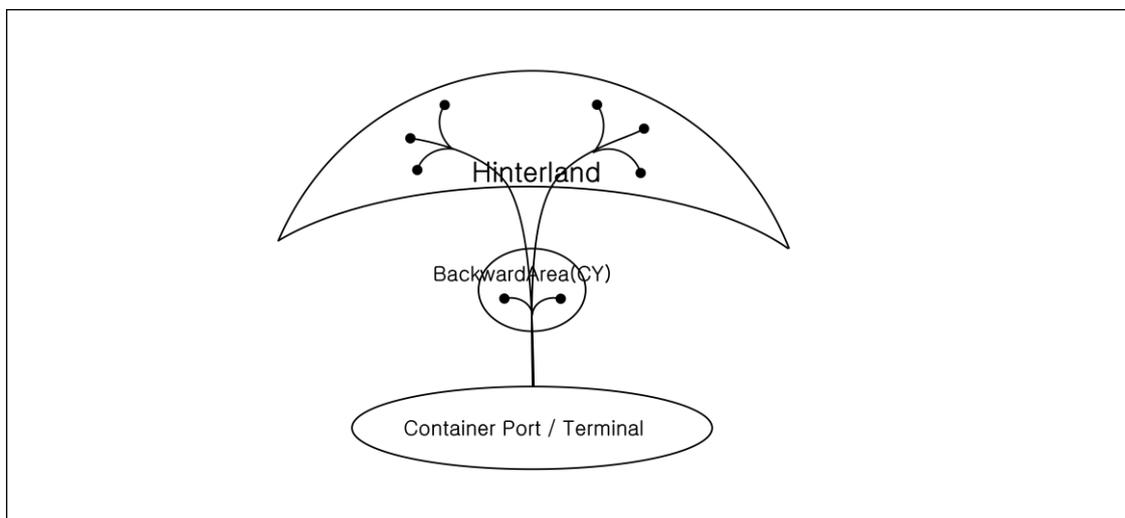
Figure 3. Multifunctional Inland Network



3.2.2 Intermodal Inland Network

In comparison with the multifunctional inland network, an intermodal inland network has a small backward area and hinterland, both of which connect to inland transport modes, mainly truck and rail, and in some cases, inland waterways and domestic short sea shipping. An intermodal inland network has backward areas near container ports, which act as container yard (CY) and warehouse; for example, the UK port Felixstowe has a small container yard (Baird, 1999). Nevertheless, it is the case that a container port, its backward area, and its hinterland have little interaction with each other in the production process through input and output, with the exception of a functional connection through container yards and warehouses.

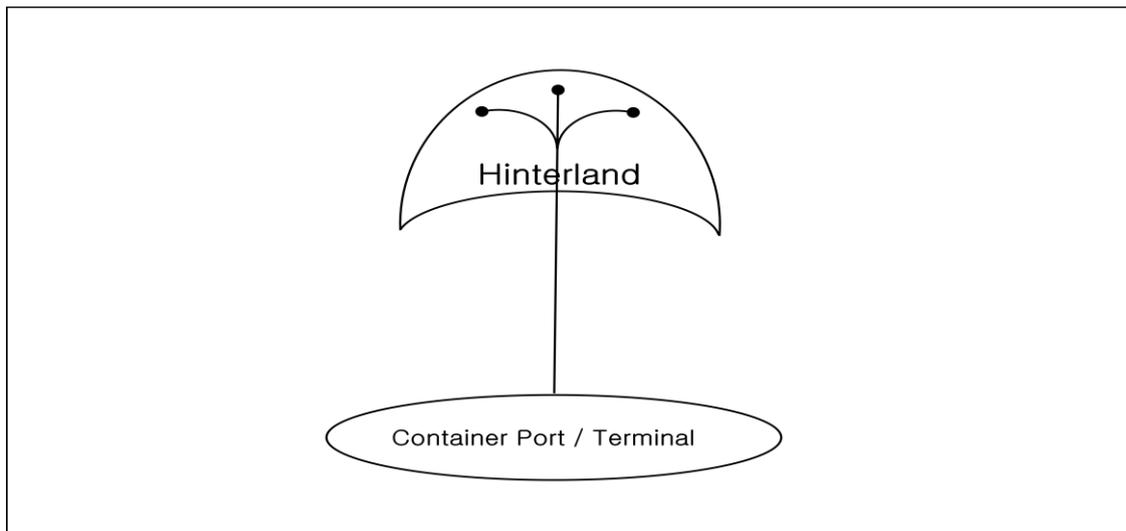
Figure 4. Intermodal Inland Network



3.2.3 Simple Inland Network

The third type of inland network connects a container port to its hinterland via inland transport modes, mainly by truck and rail, but rarely by inland waterway and domestic short sea shipping. In a simple network backward areas are combined with the hinterland where cargo originates and terminates. Container ports in this network may be domestic feeder ports or regional feeder ports; they mainly supply loading and unloading services to shippers.

Figure 5. Simple Inland Network



In addition to shipping and inland network operations, transport technology and the introduction of new equipment also affect the status of container ports in the economy. The shipping industry and ports have encountered challenges from other transport modes (Hayut, 1983; Porter, 1998; Miller, 2003) as well as technology (Albion, 1984). The ubiquity of the container means that container ports can handle transshipment cargo in iron boxes without requiring an economic relationship with its region (UNCTAD, 1990; Slack and Wang, 2002; Baird, 2006). In the next section we will elaborate on specific container ports in shipping and inland networks in order to analyze the economic relationship between a container port and its region.

4. CLASSIFICATION OF PORTS

Differently from the conventional port mainly serving bulk cargoes and general cargoes, a container port is built usually in accordance with the planning on transport networks by governmental authorities such as Port Basic Planning in Korea and Super-hub Port Planning in Japan. In addition, the demand and the supply of shipping and inland transport networks around a container port would be harmonized by bargaining on port tariff between terminal operators and logistics providers, such as shipping companies, hauliers and freight forwarders, agreement on port planning between central government and local government, collaboration among logistics providers and policy makers and strategic behaviour of logistics

providers. Different choice behavior by participants in transport networks will decide each type of shipping and inland transport networks around a container port. Hence there could be different combination by each shipping networks. Decisions on shipping networks by shipping companies could be sometimes suitable for multifunctional inland network by hauliers and railway companies or suitable with simple inland network. Even under immature inland networks shipping companies use a container port as a transshipment hub in continental shipping routes.

Now that we have outlined the six types of shipping networks, we can now develop a new classification for container ports through the combination of the definitions of shipping and inland network. Conceptually, we know that ports may develop different functions and impact differently on their regional economies, in accordance with their network characteristics.

We show in Fig. 6 that container ports can be classified into nine different networking concepts based on a mix of shipping and inland network: dominant, superior, intermediary, versatile, ordinary, developing, specialized, industrial, and peripheral. We notice in Table 2, row two that type 1s have a wide intercontinental shipping route and can be subdivided into different types by inland networks. Whereas Type 2s have a narrow regional shipping network and Type 3s connect to intercontinental shipping routes only via other ports.

Table 2. Classification of container ports by inland and shipping networks

Inland Network/Shipping Network	Continental Network (Type 1s)	Regional Network (Type 2s)	Feeder Network (Type 3s)
Multifunctional Network	Dominant Port	Versatile Port	Specialized Port
Intermodal Network	Superior Port	Ordinary Port	Industrial Port
Simple Network	Intermediary Port	Developing Port	Peripheral Port

The classification in Fig. 6 below portrays the nine types of container ports, ranging from a *dominant* port in intercontinental shipping routes and multifunctional inland links on the upper left side, to a *peripheral* port in feeder shipping routes and simple inland links on the bottom right side. Each type of container port is described in the following sections.

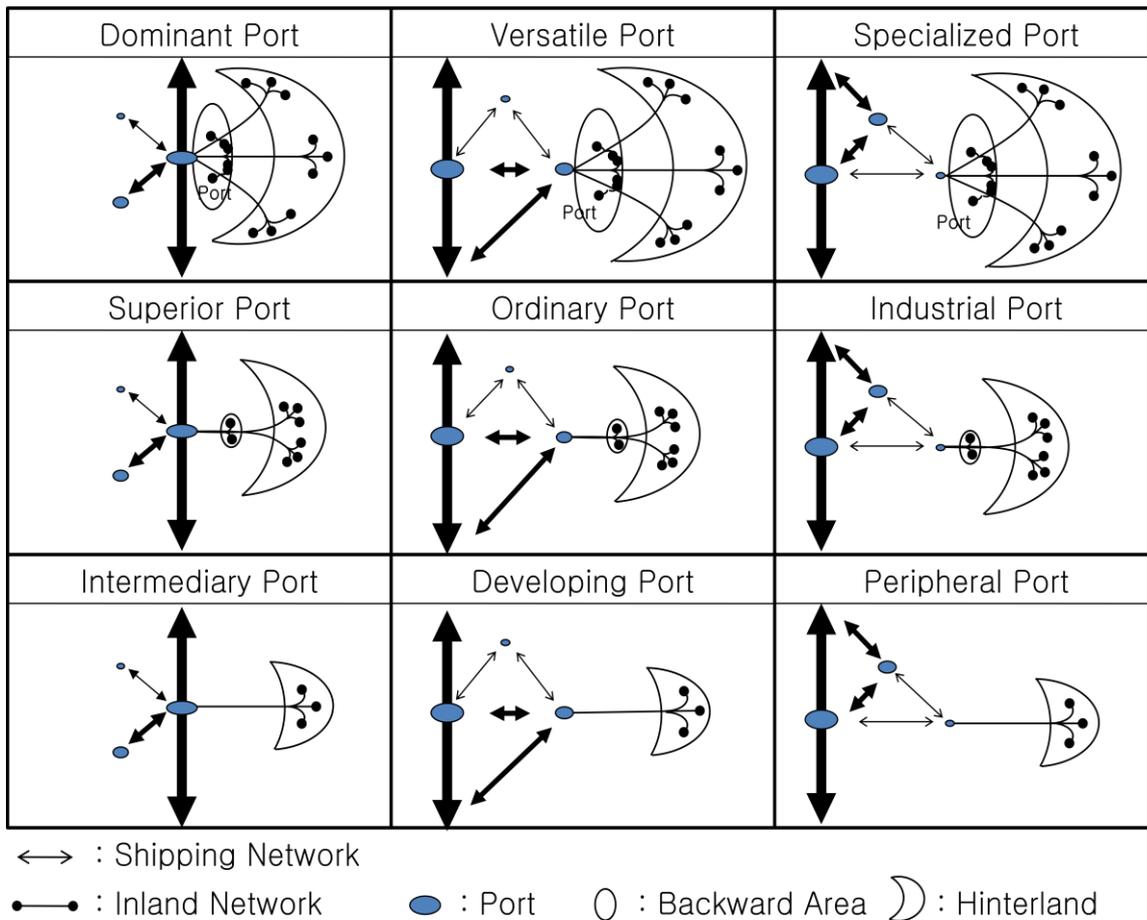
4.1 Dominant Port

Dominant ports have a global shipping network and a multifunctional inland network that gives accessibility to regional markets or mega-markets (Sujatha, 2002). Most leading shipping companies have a calling schedule in dominant ports. A multifunctional inland network allows a container port to dominate the world logistics market and connect with foreign inland regions. As leaders of new systems and technologies, dominant ports can

produce their own movement by activating the economy in their backward areas and hinterlands, where diversified value-added services can be supplied to shippers. By establishing their base for business activity around these container ports, shippers such as manufacturing companies and logistics providers can approach regional markets with abundant human resources and distribution networks.

The growth and development of dominant ports is evident in the port of Rotterdam, as a gateway to European countries (Klink, 1995; Ireland, Graveland and Huib, 2000; Weigend, 1958), the port of Hong Kong as a hub in Asia (Chiu, 1973), and Shanghai as a maritime hub in China (Eng, 1989; Ministry of Communication of China, 2006).

Figure 6. Classification of container ports by inland and shipping networks



4.2 Superior Port

Superior ports have a global shipping network but a restricted inland network. Most leading shipping companies have a calling schedule to a superior port. In the case of superior port, the weakness of legal schemes for backward areas indicates that only limited logistics services can be supplied. Backward areas of superior ports are small and generally unable to afford warehouse and logistics facilities for value-added service to shippers. The majority of the cargo of these container ports is produced in its hinterland.

As a gateway to England for container vessels, the port of Felixstowe, has diverse shipping routes with 365 ports of 45 shipping companies (Port of Felixstowe, 2008) and intermodal networks of rail connections with main cities and feeder routes with regional UK ports (Baird, 1999). Its backward area supplies small areas of container yard for container storage only; the commercial distribution of commodities by container is therefore carried out by companies in other regions in England.

4.3 Intermediary Port

Intermediary ports have a global shipping network as well as simple inland networks to their hinterlands. The major cargo of these container ports is the transshipment cargo of other container ports, but its industrial relations with its backward areas is weak. Intermediary ports are generally used exclusively by one or a few shipping companies. The intermediary port of Algeciras relies mainly on transshipment cargo from other countries and is situated at the crossroads of the shipping routes from Northern Europe, West Africa and Asia. The commercial relationship with its municipalities in Spain, with the exception of cargo handling services, is very weak.

4.4 Versatile Port

Versatile ports have a regional shipping network but their inland networks are multifunctional. The backward area is well-established and often has a good legal scheme for its logistics service. The major cargo is produced in the backward area and hinterland of the country; value-added logistics services can also be supplied to shippers. At versatile ports shippers can be supplied with strong activity in commercial distribution and may access the regional market through the existing distribution system. .

The port of Incheon in Korea, which carries out regional shipping primarily with Chinese container ports and supplies a wide air cargo network, is an example of a versatile port (Ha et al., 2005). As a gateway to the Seoul metropolitan area, the port of Incheon has advantages in the distribution industry. Other examples of versatile port are Liverpool and Thamesport in England, Hochimin in Vietnam, and Miami in the U.S., all of which have good accessibility to large markets.

4.5 Ordinary Port

Ordinary ports have a regional shipping network and an intermodal inland network. The majority of container ports belong to this category, which generally have slow-growing backward areas and are only partially developed and operational. The major source of cargo for these ports is the hinterland, and only limited logistics services can be supplied, due to the weakness of legal schemes for the backward areas.

An ordinary port is Gwangyang in Korea. The Gwangyang container terminal opened in 1996 and has expanded its port sites and backward area. However, major hindrances of Gwangyang Port include its underdeveloped logistics facilities and system in its backward area (So et al., 2007), fierce competition with the port of Busan, and its distant location from large domestic markets such as Seoul.

4.6 Developing Port

Developing ports have a regional shipping network and a simple inland network. Through the shipping network developing ports can connect with regional container ports and other container ports in other continents. Their major movements are domestic cargo and their logistic relations with backward areas are weak, which may be due to their being in the early stages of development, partially built and operational. In smaller backward areas, where present, only limited logistics services can be supplied due to weak legal and aids schemes for backward areas.

The Pyeongtaek Port in Korea is a developing port in a regional shipping network and has a hinterland nearby. Pyeongtaek has a small number of intercontinental shipping routes with many regional shipping services (Gyeonggi Province Government, 2002), however, it connects with its hinterland only by lorry, and its backward area is under construction.

4.7 Specialized Port

Specialized ports have branch or feeder routes in the shipping lane and a multifunctional inland network. Their major movements encompass cargo from its region to multiple countries, and the logistics relation with its backward area is strong because the region is accustomed to specialization: motor manufacturing, oil refinery, steel, and food industries. An example of a specialized port is Ulsan in Korea, which has well-developed backward areas where Hyundai Motors Manufacturing Co., Hyundai Heavy Industry Co., Hyundai Oil Refinery Co., and their subsidiary companies and subcontractors are located. The port has car-carrier feeder networks with Northeast Asian ports through the global network for automobiles.

4.8 Industrial Port

Industrial ports have branch or feeder shipping routes in the shipping lane and intermodal inland networks. Their major haulage includes cargo from regions within the same country, and their relation with backward areas, which may be industrial complexes, is weak. These container ports resemble specialized ports with regard to their type of backward area. Kitakyushu in Japan is an example of an industrial port (Shibaski et al., 2005) with four container terminals: Moji, Tachinoura, Gokura, New Moji, and Hibikinada. Kitakyushu port's backward areas for container terminals are composed of different industrial complexes scattered across a wide area. The port has shipping services with Northeast Asian ports and domestic short sea shipping lanes.

4.9 Peripheral Port

Peripheral ports have branch or feeder shipping routes and simple inland networks. Through the branch and feeder route peripheral ports connect indirectly with the intercontinental shipping service. Cargo generally comes from the same region in the same country, and their hinterland is restricted to smaller areas in the same region of the port. Examples of a peripheral port are Jeju in Korea and the port of Dandong at Liaoning Province in China. This type of container port only has feeder routes with regional hub container ports and sometimes underdeveloped hinterland. Their relationship with their hinterland is restricted to the transport of cargo. .

5. CONCLUSION

Major technological advances such as car, train, airplane, and communication inventions have weakened the traditional function of ports. However, the improvement of transport systems over the years has stimulated the shipping industry to diversify markedly. Furthermore, the internationally standardized iron container, used gradually since the 1960s, has enabled ports to adopt a nearly universal system. A cargo container can be transported in the same form along a chain of transport modes: ship, railway, lorry and inland waterway. Nowadays ports can also handle foreign transshipment cargo without interacting with backward regions. In addition, due to globalized business activity and continual economic growth since the 1990s, China has emerged as a major market in the international logistics business, and major shipping companies have been increasingly eager to call at Chinese ports. Although technological changes in transport and international trade are ongoing, ports will nevertheless maintain their fundamental function as the bridge between land and sea.

We have discussed how the classification of ports from the view of hierarchy, generation and function is useful to analyze and clarify changes in the port industry and the areas around ports. However, as we have also highlighted, there are limitations to the existing classification due to the increasing necessity to analyze the economic relationships between ports and regions, examine the diverse types of port, and define the integrated networks of shipping and inland transport around ports.

In this work we have defined a new classification of port on the basis of shipping and inland transport networks which can provide us with the foundation to analyze the relationships between the port and its region, among ports, airports and inland terminals, and between port's activities and information technology. The classification defined in the present paper has examined different functions and impacts of ports on regional economies to which they belong, and in accordance with their networks. The nine types of port, from the port in direct intercontinental shipping routes and multifunctional inland routes, to the port in feeder routes and simple inland routes, summarizes the essential characteristics of container ports or terminals. The nine types are dominant, superior, intermediary, versatile, ordinary, developing, specialized, industrial, and peripheral. A new definition of ports adopts both hierarchical and functional approaches, and partially segregates shipping and inland

networks into three types in order to highlight the functional relationship between a port and its region. We observe that a container port can balance transport networks between sea and inland by mixing different types of networks according to decisions of shipping companies, shippers and logistics providers.

When we consider how international hub ports have risen to prominence or faded to obscurity since the ancient era, we understand ports as economic entities that respond continuously to internal and external changes and have dynamic relationships with their regions. In so doing, we acknowledge that the economic effect of a port to its region can be differentiated based on its unique characteristics.

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