A concentration pattern analysis of port systems in South East Asia

Viet Linh Dang*
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목 차

〈초 록〉

지난 수세기 동안 아시안 5개국, 인도네시아, 말레이지아, 필리핀, 태국, 베트남 등의 항만을 통해 처리된 컨테이너 물동량은 빠른 속도로 증가하고 있다. 특히 아시안 5개국 컨테이너 항만은 집약화된 발전을 보이고 있다. 이러한 측면에서 본 연구는 컨테이너 항만의 공간변화도를 측정하기 위하여 HHI, CR3, SSA 지수를 사용하였다. 연구결과, 베트남과 인도네시아 컨테이너 항만은 탈집중화 현상을 보이고 있으며, 이는 타 아시안 5개국과는 반대의 현상이다. 또한 항만내에서 경쟁에 따른 컨테이너 이동이 확인되며, 항만의 거버넌스 형태에 따라 집중화 현상에 차이를 나타낸다.

키워드: 아시안 5개국, 집중화, 탈집중, 컨테이너항만, 동남아시아.

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Abstract

During the past few decades, Southeast Asia has experienced rapid growth in the number of containerized cargo transported through the port systems, particularly in the ASEAN-5 group, which includes Indonesia, Malaysia, the Philippines, Thailand, and Vietnam. As a result, container ports in the ASEAN-5 nations have experienced intensive development. This paper aims to clarify the spatial evolution process of these container ports through estimating degrees as well as the trends concentration by applying the Hirshmann-Herfindahl Index (HHI), a concentration ratio (CR3), and shift-share analysis (SSA). The results of this analysis reveal that a tendency toward deconcentration has been occurring in the container ports of Vietnam and Indonesia, a trend that is in contrast to the systems of other ASEAN-5 nations, all of which have experienced a concentration trend. The numbers of containers have also beed shifted significantly within intra-port systems. Moreover, the differences of concentration patterns are clarified through port governance's development policies.

Keywords: ASEAN-5, concentration, deconcetration, container ports, Southeast Asia.

Ⅰ. Introduction

The Association of Southeast Asian Nations (ASEAN) is an organization of 10 countries in Southeast Asia established to promote cultural, economic, and political development in the region and comprises the nations of Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam. However, this study will focus only on ASEAN-5 (i.e., Indonesia, Malaysia, the Philippines, Thailand, and Vietnam). The ASEAN-5 concept was previously used in an International Monetary Fund (IMF) organization working paper written by Alexandros Mourmouras (2013) and in the Asian Development Bank's Asian Economic Integration Report 2015 in order to analyze the economic growth of these nations before and after the global financial crisis of 2008. Along with Singapore, the ASEAN-5 countries represent the major ASEAN economies; however, in contrast with the context of ASEAN nation members are developing countries advancing to the status of "developed countries", Singapore is viewed as a developed country. Therefore, the port of Singapore is not included in this study. Besides, Singapore, an island city-state, owns only one main seaport thus port of Singapore is not suitable for this study, which requires studied countries to have many seaports.

The ASEAN community (AEC), established at the end of 2015 with free goods and services comprising its major principles, has urged ASEAN-5 nations to rapidly enhance their national infrastructures in order to cope with rapid trade growth. In addition, the large volume of foreign direct investment (FDI) flowing into the ASEAN infrastructure has recently experienced a rising trend throughout the world, the largest occurring in developing countries, despite the decline in global FDI flows (ASEAN Investment Report, 2015).

It is, therefore, apparent that due to their importance with respect to economic growth, ASEAN-5 port systems and transportation networks have been of special concern in recent years.

In conjunction with a strong tendency toward containerization and the mega-vessel utilization of new alliances of major shipping companies as well as having an important geographical location in terms of global shipping routes, ASEAN-5 container ports have indeed witnessed many significant variations in national infrastructure enhancement plans. A number of international expansionary deep-sea hub projects, such as the Ports of Cai Mep-Thi Vai and Lach Huyen in Vietnam and the Port of Kuala Tanjung in Indonesia, have recently been implemented in the ASEAN-5 region. In addition to these new projects, expansionary projects include the Port of Tanjung Priok in Indonesia, the upgrading of the Port of Manila, and the $422 million enhancement of Davao Sasa Port in the Philippines, Port Klang in Malaysia, and the Port of Leam Chabang in Thailand.

Many scholars have researched port systems in Southeast Asia (Syafi'I and Kuroda, 2003; Yap *et al*., 2006; Yap and Lam, 2007; Notteboom and Yap, 2012; Rimmer, 2014). However, these studies have focused on competitive dynamics within regional main ports or the port systems of nations located along the Strait of Malacca (i.e., Singapore, Malaysia, and Indonesia) and therefore lack a Southeast Asia-wide dimension. While concentration indices are widely used by scholars to evaluate port systems throughout the world, a limited number of studies have used concentration indices to explore the dynamic changes that have occurred in the intra-port systems of these nations. Therefore, this study aims to offer the insight into spatial development patterns of the container ports in ASEAN-5 countries during 2010–2014 via examining the concentration indices. The container throughputs of 49 selected ports in

ASEAN-5 nations were involved in estimating concentration ratios via the following methods: The Hirshmann-Herfindahl Index (HHI), a concentration ratio (CR3), and shift-share analysis (SSA). This paper also provides comparisons in terms of container port concentration indices for researchers who are interested in the spatial development of ASEAN-5 container port systems and offers several suggestions for related organizations.

During the past decade, no research has traced the concentration of the container port system in Southeast Asia. This timeframe was very important with respect to the development of the container port systems situated in this region, as it was a period of high-speed economic development. Additionally, because port systems have undergone many significant changes, a comparison of the concentration index of ASEAN-5 port systems might be helpful for the governments and port authorities in this region so that they can get a firm grasp of variations in port system trends and thus develop proper solutions and strategies for their own port systems. Potential international investors may also gain a better insight of the Southeast Asian port systems as a whole before deciding to invest in a specific port in this region. In addition, it is interesting to examine the validity of some previous models of port system development in the Southeast Asian context, such as those offered by Taaffe *et al*. (1963), Barke (1986), and Hayuth (1988). In light of these models, the following research questions require further investigation:

Research question 1: Do ASEAN-5 port systems follow the phases indicated by Taaffe *et al*. (1963), Barke (1986), or Hayuth (1988)?

Research question 2: If ASEAN-5 port systems do follow a common trend, which phases have they experienced to date?

Research question 3: Are the ASEAN-5 container port systems becoming more concentrated or more deconcentrated, and to what extent?

The following sections present a literature review of previous studies related to concentration patterns of port systems throughout the world and the research questions addressed in the study. A case study featuring an overview of ASEAN-5 container ports is followed by an explanation of the methodologies applied and the calculated results in estimating the concentration levels of ASEAN-5 container ports. An in-depth discussion regarding tendencies, degrees and reasons of concentration in ASEAN-5 container ports are then provided. Conclusions of the study are delineated in the final section.

Ⅱ. Literature review

The port system, a set of ports that collaborate or are in competition with each other in a region, was a concept initially used by Rimmer (1967) in descriptions of port system the spatial development of Australian ports. Before the 1970s, the majority of research on port systems examined forelands, hinterlands (Weigend, 1956), rivalry among terminal operators (Thomas and Benjamin, 1957), and the impact of externality, monopolies, and the economies of scale on port competition (Robinson and Ross, 1976). Nonetheless, because of the advanced technological development of multimodal transportation and the hinterlands' enhanced transportation infrastructure, the emergence of containerization profoundly influenced the perspectives of port competition, forelands, and port hinterlands. Notteboom *et al*. (2005) indicated that recent studies focus more on port clusters and port systems rather than a single port.

The development of container ports due to containerization has prompted many scholars to investigate models addressing (de)concentrations patterns within port systems. Taaffe *et al*. (1963) presented an idealized model on the network development of port systems that consists of six phases. The model indicates an upward trend in the degree of port concentration since the dynamic development of hinterland routes in the port network. As a result, this port concentration trend poses a decline, or even the disappearance of, small ports in the network. Two decades later, a model developed by Barke (1986) offered many features that are similar to the Taaffe *et al*. (1963) model. However, in the last stage of his five-phase model, Barke (1986) introduced a process of deconcentration. The justification for this process is excessive congestion in rapidly growing port regions. Port activities are thus recommended to shift to less-congested suburban port sites, causing infrastructural extensions to occur in areas that are less urban than those in which core ports are located, which is reflected in a decreased volume of investments in terminal infrastructures in many European ports. Hayuth's (1988) five-stage model was used in a study of the U.S. container port system during 1970–1985; the final phase describes a tendency toward deconcentration. However, deconcentration arose as a consequence of "the peripheral port challenge" (Hayuth, 1981). Because of restricted approachability to the hinterlands and a deficit in geographical spaces for expansion, several load centers no longer retain economies of scale as conditions of port system development, thus providing an incentive for minor ports to draw sea transporters operating in their ports. Deconcentration, therefore, occurs when shipping activities are moved to smaller ports. Notteboom (1997), who examined the load-center development and the dynamics of deconcentration and concentration trends in the European container port system during 1980–1994, maintained that the belief that "containerization would lead to further port concentration" was an incorrect assumption. Notteboom (1997) concluded that concentration eventually reaches a limit and might even develop into deconcentration, which is similar to the models developed by Barke (1986) and Hayuth (1988).

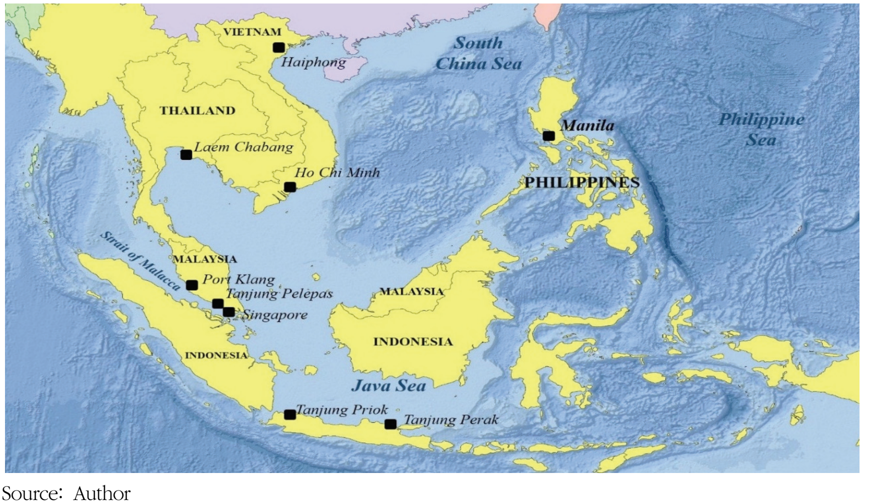
In addition to the main body of articles describing studies on the development of port systems, the literature contains analyses by many scholars who have examined cargo concentration in ports or in port systems in various regions. For example, Liu *et al*. (2011) completed a comparative analysis of two main ports in the Shanghai International Shipping Hub (Port of Shanghai and Port of Ningbo) in terms of competition and concentration and found the competitiveness and the extent of concentration of port system relies on both the development of hinterland and natural conditions. Notteboom (2012) continuously studied the position of the dynamics in port competition in Europe and discovered that the container-handling market is more concentrated than other cargo-handling services.

The most preferred methodologies for the measurement of concentration and competition are the HHI, the SSA, and the Gini coefficient. The Gini indices were utilized by Hayuth (1988) and Kuby (1992) to evaluate the tendency of market concentration in the U.S. port system during 1977–1987 and from 1970–1988, respectively. However, Scherer (1980) and Fageda (2000) found some shortcomings in the use of the Gini coefficient. Aside from the studies on the U.S. port system, Notteboom (1997, 2010) evaluated the development of European container ports using the HHI and SSA. Pan *et al*. (2014) also used the HHI to shed light on the container port system trend in China during 1998–2010.

Ⅲ. Case study

An overview of ASEAN-5 maritime landscapes and economic environments

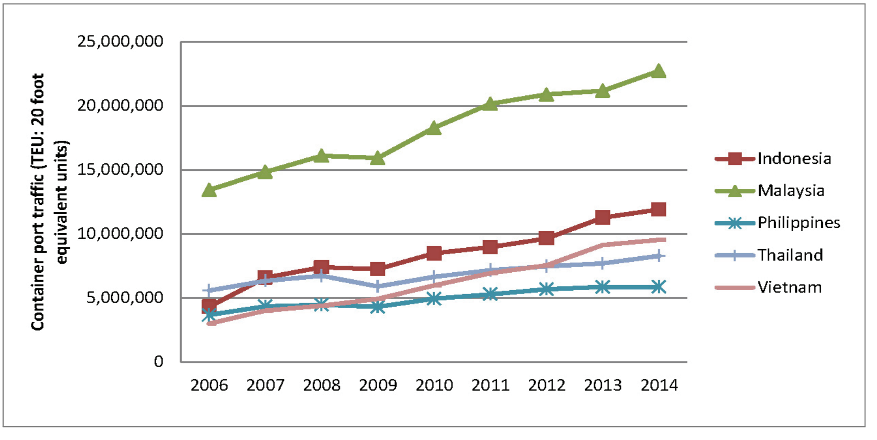
In 2014, nine of the world's top 50 container ports, in terms of throughput, were located in Southeast Asia (Figure 1). Since most of these ports were designed to deal not only with container cargoes but also with various other types of cargoes, which has caused their government's significant concern regarding the potential for expansionary development, they are characteristic of the Southeast Asian maritime landscape. The ports listed in Figure 1 are situated centrally among both intra-Asian and global shipping routes. This region has been viewed as a strategic and critical area, particularly for European-Asian shipping traffic flow; to the east are the Java Sea and the South China Sea, to the west is the Strait of Malacca, and in the south of peninsular Malaysia is the trading hub of Singapore, which was established as a global shipping port decades ago.



Source: Author

‖ Figure-1. Map of Southeast Asia highlighting key ports ‖

The current economic environment and trends impact Southeast Asia port systems both domestically and regionally, since the ASEAN-5 group includes middle-income nations that have been in the process of moving from developing-country status to developed-country status (Schwab and Martin, 2013) and benefit from the rapidly-growing intra-Asia trade. Seaborne cargo volumes for Southeast Asia are forecasted to increase, with average port terminal utilization increasing from 70.9% in 2011 to 86.1% by 2017, according to Drewry Maritime Research (Global Container Terminal Operators 2012).



Source: World Bank

❙ Figure-2. Container throughput volumes of Southeast Asia container terminals, 2006-2014 ❙

Figure 2 shows considerable growth in container traffic through the container ports of ASEAN-5 countries during 2006-2014. As Figure 2 illustrates, at the beginning of the designated period, the container traffic of the container ports was equal. Afterward, however, the container throughput rises quickly, particularly in Malaysia, Vietnam, and Indonesia. This growth might be the consequence of developments in regional economics as well as in major port infrastructure, each of which is significantly supported by recent federal governmental policies aiming to establish regional hubs in terms of products and services. Moreover, GDP earnings per capita and the populations of Southeast Asian countries are consistently increasing, leading consumer demands to also increase. Therefore, the expansionary development of national port systems for purposes of enhancing competence and meeting expected demands is imperative (Low, 2010). Furthermore, ASEAN-5 port systems have merits in terms of geography, such as strategic positions, favorable climates, low labor costs, cheap, available land, and an increasingly trade-oriented culture (Sheffi, 2012). These trends signal a considerable advantage in a port system's race to become the regional hub, depending on whether ASEAN-5 nations can leverage their strengths to catch up to Singapore and become a part of the global port system.

Overview of ASEAN-5 container ports

Indonesia's seaport

Different from most regional countries with land-based hubs and spoke systems for the domestic flow of merchandise, Indonesia is an archipelago whose gateway ports serve as an entrance node. The country relies heavily upon its maritime-based logistics, which is the backbone of its transport (Meeuws and Bahagia, 2012). The operation of Indonesia's ports and harbors is managed by PT Pelabuhan Indonesia (Pelindo), state-owned organizations that are numbered based on a regional coverage of ports, ranging from 1—west (Sumatra) to 4—east (Papua). Indonesia has four major ports: Belawan Port (Pelindo I), Tanjung Priok Port (Pelindo II), Tanjung Perak Port (Pelindo III), and Makassar Port (Pelindo IV). Of these ports, Tanjung Priok, which includes Koja Container Terminal (IPC-Hutchison) and Jakarta International Container

Terminal (JICT), is the largest, handling more than half of Indonesia's container throughput. Tanjung Priok is located in the western Java Sea, the site of Indonesia's largest demand for cargoes. On a regional scale, these ports are identified as feeder ports for the Port of Singapore; on a national scale, they are key domestic hub ports.

Malaysia's seaport

Jeevan *et al*. (2015) maintained that the key container ports of Malaysia represent their respective regions: Port Klang (central region), PTP, and Johor Port (southern region), Penang Port (northern region), and Kuantan Port (Eastern region). In addition, Malaysia boasts two of the world's top 20 busiest container ports: Port Kelang ranked 12th in 2014, and PTP ranked 19th. These two ports are tactically situated alongside the Strait of Malacca, the world's busiest shipping route. Having trade connections with more than 500 ports in 120 countries throughout the world, Port Kelang has been considered one of the busiest ports in Malaysia. It serves not only as a domestic hub port but also as a regional transshipment hub. On the other hand, thanks to favorable policies and regulations in support of international trade, professionals, modern infrastructure, logistics-related advanced administration skills, and customs clearance competence, Malaysia currently has a leading port system in terms of efficiency when compared to other national port systems in the ASEAN-5 group.

The Philippines' seaport

The Philippines, a country with archipelagic topography (7,107 islands), initially was focused only on trading and fishing. Having no direct border with any country, the nation's population is spread out over thousands of islands. The Philippines currently owns a huge number of modern ports throughout the nation; maritime transport is considered the major means in this country, and virtually 98% of all materials and products are traded via shipping. The Philippines has therefore gained maximum importance in terms of developing an efficient maritime transport system and utilizing the contributions of shipping and ports to foster economic integration and growth. Major gateways of Philippine trade comprise large, privatized ports, such as MICT, Manila South Harbor, Manila North Harbor, Batangas, and state ports, such as Iloilo, Cagayan de Oro, Davao, General Santos, and Zamboanga. The busiest Philippine port is the Port of Manila, which lies at the mouth of the Pasig River in western Luzon Island and stretches along Manila Bay's eastern shores. Manila is considered the primary political, cultural, and economic center of the Philippines.

Thailand's seaport

Thailand has a coastline of 3,219 km and over 4,000 km of waterways. Main ports include Bangkok, Laem Chabang, Songkhla, Penang, Map Ta Phut, Phuket, Sattahip, and Si Racha. Laem Chabang and Bangkok, the two largest, handle almost all the national container throughput. Klong Toey, or Bangkok Port, located on the west side of the Chao Phraya River (8.5 meters) at the entrance to Prakanong Canal, can handle approximately 1.5 million TEU per year. Laem Chabang Port, the key container terminal (at around 2,536 acres), is situated in Chon Buri province, offers 12 meters of port depth, and can handle about 6.9 million TEU per year. Laem Chabang has been used by most of the main factories to bring in a large volume of consignments and exports.

Vietnam's seaport

Vietnam has approximately 45 seaports that are divided into six groups based on region. However, over 90% of total national throughputs mostly go to the two shipping centers: The Hai Phong area, belonging to Group 1 (30%) and the Ho Chi Minh area, belonging to group 5 (60%). In the Hai Phong area, container port activities are focused mainly in the ports of Hoang Dieu, Chua Ve Terminals (Hai Phong), Dinh Vu, Nam Hai Dinh Vu, Haian, and Green. Nonetheless, these ports are situated along the Cam River, which allows access only to ships under 30,000 DWT. The Hai Phong port system thus serves merely as feeder ports for regional hub ports, such as Shanghai, Hong Kong, Busan, and Singapore. Additionally, the competitiveness within the Hai Phong port system is quite high, as there are approximately 60 berths located along the Cam River (6 km), which are utilized by many different investors. Meanwhile, in the southern area, Cat Lai terminal of the Tan Cang Sai Gon Port is the busiest port in the region as well as in the country. Container traffic through this port is continuously increasing and reached the 4,200 thousand TEU mark in 2014, accounting for nearly 40% of container throughput in the country. Like the port of Hai Phong, the Cat Lai terminals act simply as a feeder port for hub ports in the region, due to the Dong Nai River flows, which are only 8.5 meters deep.

Ⅳ. Methodology

The Herfindahl-Hirschman index (HHI)

The Herfindahl-Hirschman Index (HHI) was originally used by Herfindahl (1950) in antitrust cases to estimate the levels of concentration and competition in a specific market. Notteboom (1997) used the HHI to successfully evaluate the level of (de)concentration in the European port system; many other researchers followed suit. In this paper, the HHI method is applied to the container ports of the ASEAN-5 nations. The calculation, based on the 49 largest container ports in terms of container traffic (15 Indonesian ports, 10 Malaysian ports, 10 Philippine ports, 4 Thai ports, and 10 Vietnamese ports), is presented in the following formula:

$$H = \frac{\sum_{i=1}^{n} TEU_i^2}{\left(\sum_{i=1}^{n} TEU_i\right)^2} \text{ and } \frac{1}{n} \leq H \leq 1 \quad (1)$$

In which

H represents the concentration index of a port system,

represents the container throughput of port i (TEUs), and

represents the number of ports in a port system.

In case, a particular port completely dominated the entire throughput of the port system, its index reaching a maximum value of 1 (the monopolist's market share). When ports equally share the total traffic structure within a port system, the index equals its minimum value of l/n, meaning that no port dominance exists (is perfectly balanced). In general, the HHI is larger than 0.1, which is synonymous with the presence of concentration in a port system; an HHI larger than 0.18 indicates that a port system is significantly concentrated (Liu *et al*. 2011).

The concentration ratio CR(k)

According to the concentration ration (CR[k]) method, a percentage of the market share of the largest ports in a port system are used to estimate the level of concentration, with k expressing the number of largest ports. The concentration ratio is a widely-used approach for concentration level analysis. In this study, the CR3 was applied to determine the three biggest ports of each of the ASEAN-5's container port systems. The concentration ratio is calculated as follows:

$$CR_{(k)} = CR_{(k)} = \sum_{i=1}^{k} S_i \quad (2)$$

In which

S_i represents the percentage port market shares of the ith largest ports (i = 1, 2⋯k).

Sys (2009) indicated that the market is considered monopolized if CR3 and CR1 are equal to or higher than 75% and 50%, respectively.

Shift-share analysis (SSA)

Shift-share analysis (SSA) has been widely used in economic growth analysis to figure out the distinctions between national and regional rates. Wilson *et al*. (2005) applied this method to variations such as productivity, employment, and export growth. In terms of seaport, SSA was applied in studies conducted by Notteboom (1997), Fageda (2000) and Liu *et al*. (2011) to offer a better valuation of port competition. In this study, SSA was used to analyze the container throughput of five Southeast Asian nations: Indonesia, Malaysia, Philippines, Thailand, and Vietnam. The major goal was to obtain insight into the competition between these ports in terms of container throughput volume.

The competitiveness indices of national port systems are illustrated via losses or gains in their market shares. The change of container throughputs in a system port is separated into two elements: *share effect* and s*hift effect*. The anticipated growth of a port's container throughput is reflected via the share effect. A particular port basically retains its market share with a growth rate similar to that of the region. The shift effect allows analysts to better valuate a port's competitive position without considering overall growth. The total shift is the total actual variation in the container throughput of a port in the same region, with the container throughput being used as a reference (share effect). A positive value of the total shift implies an enhancement in the competitiveness of port systems in the region, and vice versa. The formula is presented as follows:

$$\text{SHARE}_i = \left(\frac{\sum_{i=1}^{n} TEU_{it_1}}{\sum_{i=1}^{n} TEU_{it_0}} - 1\right) . TEU_{it_0} \tag{3}$$

$$\text{SHIFT}_i = TEU_{it_1} - \frac{\sum_{i=1}^{n} TEU_{it_1}}{\sum_{i=1}^{n} TEU_{it_0}} . TEU_{it_0} \tag{4}$$

$$\text{ABSGR}_i = TEU_{it_1} - TEU_{it_0} = \text{SHARE}_i + \text{SHIFT}_i \tag{5}$$

In which

TEU_i represents the throughput volume of nation i,

n represents the number of container terminals,

SHARE_i represents the “share” effect in the TEU of nation i for the period t_1-t_0,

SHIFT_i represents the “shift” effect in the TEU of nation i for the period t_1-t_0, and

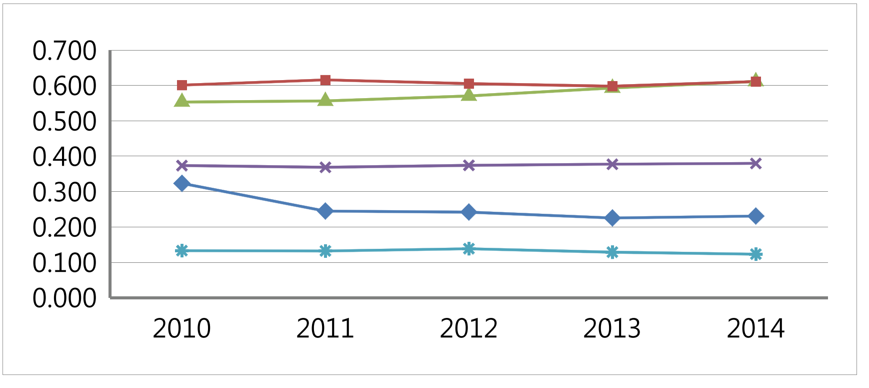
ABSGR_i represents absolute growth in the TEU of nation i for the period t_1-t_0.

Ⅴ. Data analysis

All data used in this study were collected from authentic sources, such as the World Bank, the Vietnam Seaport Association, the Bangkok Shipowners and Agents Association (BSAA), and the annual reports of the port authorities of the Philippines and Malaysia. The selected 49 container ports in the Southeast Asian region comprised 15 Indonesian ports, 10 Malaysian ports, 10

Philippine ports, 4 Thai ports, and 10 Vietnamese ports. The container throughput of these ports accounts for more than 80% of the container throughputs of their respective nations. They therefore could reflect the overall context of these national container port systems. Furthermore, the selected container ports have to meet following acquirements. Firstly, they need to be located in Southeast Asian area. Secondly, they are regional leading container ports. Lastly, the containerized cargo throughput data must be available during the researched time from 2010 to 2014.

The HHI results



❙ Figure-3. Hirschman-Herfindahl indices of ASEAN-5 container ports, 2010-2014 ❙

The graph shows that the container ports of all ASEAN-5 nations are undergoing the concentration stage. Nonetheless, the patterns of each of the national container port systems are rather distinctive as observed throughout the duration of the study. First, the result of the HHI follows a downward trend, or a deconcentration tendency, in the container ports of Vietnam and Indonesia during 2010-2014. The HHI descent is more obvious in Vietnam's port system, with the HHI being rather high (approximately 0.323) in 2010 and rapidly declining to 0.231 in 2014. The HHI of Indonesia's port system remains steady at 0.13 during 2010–2012 and negligibly decreases to 0.12 within the next 2 years.

In contrast, the container ports of the remaining countries (i.e., Thailand, the Philippines, and Malaysia) witness an increase in the degree of concentration. The HHI of Malaysia's port system remains at nearly 0.3, with a slight increase from 0.37 in 2010 to 0.38 in 2014, whereas Thailand's HHI indicates a fluctuation following an upward trend at a high degree of concentration in the port system, as the HHI remains at approximately 0.6 during the duration of the study. The reason for this might be that the container throughput of Thailand is focused on major container ports. In the Philippines, the concentration trend can be seen most clearly: Standing at 0.55 in 2010, the HHI escalated to 0.61 within 5 years.

The CR3 results

Table-1. CR3 indices for ASEAN-5 container port system, 2010-2014

	2010	2011	2012	2013	2014	De(con)
Vietnam	Tancang Saigon Hai Phong Sai Gon	Tancang Saigon Hai Phong Dinh Vu	Tancang Saigon Hai Phong TCIT	Tancang Saigon Hai Phong TCIT	Tancang Saigon Hai Phong TCIT	**Decon**
	0.845	**0.686**	**0.671**	**0.644**	**0.653**	
Indonesia	Tanjung Priok JICT Petikemas Surabaya	Tanjung Priok JICT Petikemas Surabaya	Tanjung Priok JICT Petikemas Surabaya	Tanjung Priok JICT Petikemas Surabaya	Tanjung Priok JICT Petikemas Surabaya	**Decon**
	0.64	**0.55**	**0.562**	**0.535**	**0.515**	
Thailand	Laem Chabang Bangkok Port PrivateWharves	Laem Chabang Bangkok Port PrivateWharves	Laem Chabang Bangkok Port PrivateWharves	Laem Chabang Bangkok Port PrivateWharves	Laem Chabang Bangkok Port PrivateWharves	**Con**
	0.982	**0.983**	**0.981**	**0.98**	**0.983**	
Philippine	Manila Davao Cagayan de Oro	Manila Davao Cagayan de Oro	Manila Davao Cagayan de Oro	Manila Davao Cagayan de Oro	Manila Davao Cagayan de Oro	**Con**
	0.891	**0.889**	**0.883**	**0.883**	**0.874**	
Malaysia	Port Klang Tanjung Pelepas Penang	Port Klang Tanjung Pelepas Penang	Port Klang Tanjung Pelepas Penang	Port Klang Tanjung Pelepas Penang	Port Klang Tanjung Pelepas Penang	**Con**
	0.956	**0.948**	**0.947**	**0.947**	**0.936**	

Note: TCIT: Tan Cang - Cai Mep International Terminal, JICT: Jakarta International Container Terminal

The CR3 results presented in Table 1 confirms the HHI results indicating that the container ports in Vietnam and Indonesia witnessed deconcentration throughout the examined period. In Vietnam, during 2010–2011, the CR3 demonstrates a concentration in 2010, with the CR3 standing at 0.84 before dropping by nearly 23% to 0.65 during the remainder of the period. The ports of Tan Cang Sai Gon and Hai Phong dominate Vietnam's container volume during the researched period, while the ports of Saigon and Dinh Vu rank third in terms of container handling volume during 2010 and 2011, respectively. However, in the next 3 years, the emergence of the Tan Cang-Cai Mep International Terminal (TCIT) takes the third position, formerly held by the Sai Gon and Dinh Vu ports. In Indonesia, the CR3 results reveal a trend similar to that of Vietnam's CR3, with a high of 0.65 in 2010 and then dropping to 0.51 at the end of the period shown. Among all national container traffic, Tanjung Priok, Jakarta International Container Terminal (JICT), and Petikemas Surabaya, respectively, are observed to be the dominant container terminal ports, and these ranks remain throughout the duration of the study.

A comparison of the remaining three container ports with those of Vietnam and Indonesia reveals that they have been experiencing a concentration trend in terms of container traffic. The concentration is most apparent in the CR3 results of Thai Lan and Malaysia, which nearly reach the status of monopolies, at 0.98 in Thailand and 0.94 in Malaysia. Laem Chabang and Bangkok are the ports where most of Thailand's containerized cargos are gathered, while in Malaysia, the major container ports are Klang, Tanjung Pelepas, and Penang. Finally, the Philippine port system's CR3 shows a lower level of concentration than the other ports, staying at 0.8 throughout the observation period. Based on the CR3 results, Manila, Davao, and Cagayan de Oro are the largest container ports in the Philippines.

The shift share analysis results

In order to simplify the SSA, container ports in the ASEAN-5 group were divided into three port categories based on average container throughput during the period 2010–2014: small ports (less than 200,000 TEU), medium-sized ports (ranging from 200,000–700,000 TEU), and large ports (above 700,000 TEU). Based on these classifications, 49 selected ports in ASEAN-5 container port systems comprised 18 small, 16 medium-sized, and 15 large container ports. Table 2 shows that the large ports are located mainly in Indonesia (6/15 ports), followed by Malaysia (4/10 ports). Most of the small ports are located in the Philippines (8/10 ports), while the ASEAN-5 country having the most medium-sized ports is Vietnam (7/10 ports).

The results of the category-based SSA are presented in Table 3, in which the ports categories alone are represented. Please note, however, that the specific ports are illustrated in Table 4.

Table-2. The classification in ASEAN-5 container ports

Classification (Units:1000 TEU)		Philippine	Vietnam	Thailand	Indonesia	Malaysia	Total
>700	Large port	1	2	2	6	4	15
200-700	Medium Port	1	7	1	4	3	16
<200	Small port	8	1	1	5	3	18

Table-3. A shift analysis for the ASEAN-5 container ports

	PORT	10 - 11	%	11 - 12	%	12 - 13	%	13 - 14	%	10 - 14	%	SIZE
MALAY	Sabah	250,224	232.0%	4,448	1.2%	(8,669)	-2.3	(990)	-0.2	277,151	227.8%	Medium
	Tanjung Pelepas	181,672	2.6%	(58,155)	-0.8%	(219,051)	-2.9	283,821	3.6	190,719	2.4%	Large
	Port Klang	(230,349)	-2.4%	175,850	1.8%	228,857	2.3	(146,742)	-1.3	30,418	0.3%	Large
	Miri	288	0.9%	(1,428)	-4.3%	1,964	6.1	(3,609)	-9.9	(2,738)	-7.7%	Small
	Kuching	7,116	3.4%	9,666	4.4%	13,478	5.7	(39,933)	-14.9	(6,897)	-2.9%	Medium
	Rajang	1,177	1.3%	(2,200)	-2.4%	(10,138)	-11.1	(10,813)	-12.4	(22,750)	-23.0%	Small
	Bintulu	(58,323)	-21.3%	8,223	3.7%	14,947	6.3	2,191	0.8	(38,673)	-12.5%	Medium
	Kuantan	(22,000)	-14.2%	(1,232)	-0.9%	(12,128)	-8.7	(4,378)	-3.2	(43,565)	-24.9%	Small
	Penang	(5,452)	-0.5%	(77,520)	-6.2%	49,927	4.2	(60,747)	-4.6	(98,047)	-7.2%	Large
	Johor	(124,353)	-13.0%	(57,652)	-6.7%	(59,189)	-7.3	(18,801)	-2.3	(285,619)	-26.5%	Large
PHIL	Malina	10,327	0.3%	61,362	1.7%	85,005	2.3	69,319	1.8	225,745	6.3%	Large
	Bredco II	4,003	5.5%	15,602	19.3%	603	0.6	22,390	23.2	42,669	55.9%	Small
	Tefasco	15,549	32.2%	14,607	21.7%	2,682	3.3	(5,149)	-6.1	28,285	56.1%	Small
	Iloilo	(7,521)	-7.5%	3,142	3.2%	6,051	6.0	17,968	16.9	19,254	18.3%	Small
	Cagayan de Oro	(16,836)	-9.4%	11,856	6.9%	5,604	3.1	19,157	10.2	18,909	10.1%	Small
	Zamboanga	(2,276)	-3.1%	6,651	8.9%	(6,074)	-7.5	3,923	5.2	2,095	2.7%	Small
	General Santos	(1,915)	-1.3%	(3,013)	-1.9%	4,142	2.7	130	0.1	(738)	-0.5%	Small
	Ozamiz	1,225	4.0%	(1,676)	-5.0%	(4,147)	-13.2	3,416	12.6	(1,099)	-3.5%	Small
	Nasipit	(1,045)	-2.9%	(6,124)	-16.6%	(2,234)	-7.3	1,893	6.7	(7,506)	-19.8%	Small
	Davao	(1,511)	-0.3%	(102,409)	-17.0%	(91,631)	-18.4	(133,047)	-32.8	(327,613)	-54.6%	Medium
THAI	Private Wharves	174,450	104.1%	17,516	4.9%	(21,225)	-5.5	2,260	0.6	200,209	103.4%	Medium
	Laem Chambang	145,542	2.6%	(64,034)	-1.1%	(53,448)	-0.9	94,944	1.5	134,843	2.1%	Large
	Songkhla	(10,697)	-7.8%	13,592	10.3%	6,806	4.5	(16,978)	-10.1	(7,007)	-4.4%	Small
	Bangkok	(309,294)	-19.2%	32,926	2.4%	67,867	4.7	(80,226)	-5.0	(328,046)	-17.6%	Large
INDO	Bitung	104,866		9,172	7.8%	16,696	13.0	54,250	37.2	200,153		Small
	Tanjung Priok	218,653	10.9%	448,427	17.9%	(363,807)	-12.2	(170,279)	-6.5	168,510	7.3%	Large
	Tanjung Perak	153,414	36.8%	(29,950)	-4.7%	48,490	7.9	(67,561)	-10.1	126,086	26.5%	Medium
	Berlian Jasa	(152,605)	-16.1%	20,471	2.3%	66,373	7.2	165,568	16.7	78,833	7.3%	Large
	Petikemas Semarang	(10,830)	-2.5%	(23,977)	-5.0%	38,472	8.3	72,992	14.5	75,004	15.0%	Medium
	Pontianak	1,784	1.0%	(9,999)	-5.1%	15,395	8.3	24,291	12.0	31,674	16.2%	Small
	Banjarmasin	29,611	8.8%	7,782	1.9%	3,320	0.8	(17,531)	-4.1	27,535	7.1%	Medium
	Palembang	13,323	13.3%	(13,374)	-10.5%	6,699	5.8	14,735	12.0	23,120	20.2%	Small
	Teluk Bayur	369	0.7%	(2,015)	-3.2%	6,366	10.2	(2,206)	-3.2	2,577	4.0%	Small
	BICT	(47,273)	-6.0%	3,459	0.4%	57,879	6.9	(5,862)	-0.6	1,904	0.2%	Large
	UTPM	(53,878)	-10.7%	22,371	4.4%	17,003	3.2	7,543	1.4	(14,180)	-2.5%	Medium
	Panjang Port	(7,171)	-6.3%	(12,283)	-10.2%	15,522	14.3	(17,427)	-13.9	(22,465)	-17.3%	Small
	Koja	(35,700)	-4.2%	(106,218)	-11.5%	24,152	2.9	15,079	1.8	(109,213)	-11.1%	Large
	Petikemas Surabaya	(121,824)	-8.8%	(77,892)	-5.5%	(9,863)	-0.7	(7,048)	-0.5	(235,204)	-14.9%	Large
	JICT	(92,738)	-3.9%	(235,974)	-9.1%	57,306	2.4	(66,544)	-2.7	(354,336)	-13.0%	Large
VN	TCIT	279,439		229,115	72.9%	16,975	2.7	183,210	24.8	922,885		Medium
	CMIT	94,525		199,885	187.9%	255,893	72.4	(296,804)	-42.4	402,714		Medium
	Haian	110,000		59,225	47.8%	65,776	31.1	(8,977)	-2.8	309,000		Small
	Nam Hai DV	85,213	37.4%	(120,197)	-34.1%	(15,781)	-5.9	192,721	66.6	142,390	41.9%	Medium
	VICT	51,483	16.0%	(71,826)	-17.1%	34,556	8.6	81,224	16.2	102,481	21.3%	Medium
	Đinh Vu	6,151	1.4%	(38,932)	-7.9%	(9,888)	-1.9	(17,906)	-3.0	(71,669)	-11.1%	Medium
	Green port	9,625	2.6%	(72,711)	-17.3%	(40,518)	-10.1	(53,256)	-12.9	(181,758)	-33.5%	Medium
	Sai Gon	(127,093)	-29.1%	(35,734)	-10.3%	(76,796)	-21.3	20,054	6.2	(304,934)	-46.9%	Medium
	Hai Phong	(15,627)	-1.5%	(182,379)	-15.9%	(72,678)	-6.5	(190,862)	-16.0	(539,238)	-35.0%	Large
	Tan Cang SG	(493,715)	-16.0%	33,555	1.1%	(157,538)	-4.6	90,596	2.4	(781,871)	-17.0%	Large

Note: (): Negative shift effects; %: additional percentage of the actual TUE-shift compared with the total expected TUE-shift; Vietnam: TCIT - Tan Cang-Cai Mep international terminal, CMIT - Cai Mep international terminal, VICT -Vietnam international container terminals Indonesia: JICT - Jakarta International Container Terminal, BICT - Belawan International Container Terminal, UTPM - Unit Terminal Petikemas Makassar

Table-4. A category-based shift analysis for the ASEAN-5 container Container ports

Nation	Category	10 - 11	%	11 - 12	%	12 - 13	%	13 - 14	%	10 - 14	%
MAL	Large	(178,482)	-0.9%	(17,478)	-0.1%	544	0.0%	57,531	0.3%	(162,528)	-0.8%
	Medium	199,017	33.8%	22,337	2.7%	19,757	2.3%	(38,731)	-4.1%	231,581	34.8%
	Small	(20,535)	-7.5%	(4,860)	-1.9%	(20,301)	-7.7%	(18,800)	-7.3%	(69,053)	-22.3%
PHIL	Large	10,327	0.3%	61,362	1.7%	85,005	2.3%	69,319	1.8%	225,745	6.3%
	Medium	(1,511)	-0.3%	(102,409)	-17.0%	(91,631)	-18.4%	(133,047)	-32.8%	(327,613)	-54.6%
	Small	(8,816)	-1.3%	41,047	5.7%	6,626	0.9%	63,727	8.3%	101,868	14.0%
THAI	Large	(163,752)	-2.3%	(31,108)	-0.4%	14,419	0.2%	14,718	0.2%	(193,203)	-2.3%
	Medium	174,450	102.3%	17,516	4.9%	(21,225)	-5.5%	2,260	0.6%	215,536	111.4 %
	Small	(10,697)	-7.7%	13,592	10.3%	6,806	4.5%	(16,978)	-10.1%	5,549	3.5%
INDO	Large	(231,487)	-2.8%	52,273	0.6%	(167,961)	-1.8%	(69,086)	-0.8%	(449,505)	-4.7%
	Medium	118,317	7.0%	(23,774)	-1.2%	107,284	5.3%	(4,556)	-0.2%	214,446	11.1%
	Small	113,170	25.6%	(28,499)	-4.6%	60,677	10.1%	73,642	11.1%	235,059	46.6%
VN	Large	(509,343)	-12.3%	(148,824)	-3.7%	(230,216)	-5.1%	(100,267)	-2.0%	(1,321,109)	-21.5%
	Medium	399,343	22.4%	89,599	3.6%	164,440	5.6%	109,244	3.1%	1,012,109	49.7%
	Small	110,000		59,225	47.8%	65,776	31.1%	(8,977)	-2.8%	309,000	

Note: (): negative shift effects

The HHI and CR3 outcomes reflect the advanced assessment of the deconcentration experienced by national container ports, including Vietnam and Indonesia. The SSA results presented in Tables 3 and 4 show a higher dynamic in terms of container shift in Vietnam. Vietnam's large ports, such as Hai Phong and Tan Cang Saigon, lose a potential growth of nearly 1,320,000 TEU (-35% and -17%, respectively) to the country's medium-sized ports, which experience a 49.7% additional increase during 2010–2014. The TCIT, CMIT, and Haian ports show a remarkable total shift, with gains of 922,885 TEU, 402,714 TEU, and 309,000 TEU, respectively, during 2013–2014. The Indonesian container port system was less dynamic, although the loss of potential growth in majority of large ports is also seen in the Koja, Terminal Petikemas Surabaya, and JICT ports. However, the remaining two large ports of Tanjung Priok and Berlian Jasa Terminal, both experiencing 7.3% increases, continue to demonstrate the best performance. As a result, the overall loss observed in the large port category is quite moderate (-4.7 %). While the small and medium-sized ports generally demonstrate the best performance, the additional growth percentage is especially high in the small ports (46.6% higher than the expected total growth for the small ports).

With respect to concentration pattern in the ASEAN-5 group, the Philippine port system experiences the most dynamic TEU-shift. There is a considerable increase in potential TEU in both small and large ports at the expense of the medium-sized ports (Davao Port), which experience a continuous loss in expected TEU volume from -0.3% during 2010–2011 to -32.8% in the remaining period of observation. The Port of Manila demonstrates the best performance with an extra gained container amount of 225,745 TEU, doubling the total amount of TEU gained by the small ports during 2010–2014. This result also helps to justify the concentration tendency in the Philippine's port system.

The shift analysis indicates that during the beginning of the periods 2010–2011 and 2011–2012, Malaysia's small and large ports were overshadowed by the rise of the country's medium-sized ports, which gained an approximate 200,000 TEU during 2010–2011. However, the large ports recover well during the remainder of the period when compared to the deterioration of the other port categories (from a negative shift of 178,482 TEU to a positive shift of 57,531 TEU in the last period). The large Port of Tanjung Pelepas (PTP) and Port Klang have retained their positions by alternately taking over potential TEU from the other ports during the observed period. However, Malaysia's large ports (e.g., Johor and Penang) and the country's small ports (e.g., Rajang and Kuantan) lose ground to medium-sized ports, Sabah in particular.

The shift analysis of Thailand port system reveals that the country's small and medium-sized ports are major factors contributing to the positive TEU-shift. Nonetheless, a further examination of potential TEU loss for large ports indicates that the TEU-shift loss observed in the Bangkok port's performance was the result of its potential TEU being transmitted to ports in the other categories, although mainly to the Laem Chambang port, accounting for approximately one half of the Bangkok port's TEU loss. This might explain the stagnation in the degree of concentration calculated by the HHI. Although there were constant rises in the small and medium-sized ports, the TEU-shifts also occurred between the large ports.

VI. Discussion

This section elaborates on the reasons for ASEAN-5 concentration tendencies and discusses predictions of future trends.

Viet nam: Deconcentrated container port evolution

The deconcentration in the Vietnam container port system is attributed to a container shift to new terminals having better investments and more favorable locations. In 2008, the southern ports of Vietnam suffered a capacity overload, which led to an extended period of continuously expanded port projects, culminating in the years 2009–2011, an issue clearly reflected in the marked drop seen in the HHI results. Thereafter, the level of redundancy in exploitation capacity became severe, and the deployment speed of new port projects gradually decelerated. For example, the Port of Saigon had to relocate its operations to Sai Gon-Hiep Phuoc, a new port that is currently under construction and is expected to be completed in 2016. This move caused an interruption in Saigon port's activities and a downturn in the port's SSA results. Moreover, the Cat Lai Terminals belonging to the Tancang Saigon port, currently Vietnam's most powerful port, are operating at full capacity, and congestion typically occurs during the peak season. Therefore, container volume has gradually shifted to other ports in better locations, such as Vietnam International Container Terminals (VICT), or to emerging international ports, as shown in the SSA results (Tan Cang-Cai Mep International Terminal [TCIT] and Cai Mep International Terminal [CMIT]). These ports are situated on the Vung Tau-Thi Vai River, which has a depth ranging from 7.2 meters to 14.0 meters. The Cai Mep-Thi Vai port complex plays an important role in Vietnam's seaport development plan projected for completion in 2020, with a version projected for completion in 2030, approved by the Vietnam Prime Minister. In addition, the Hai Phong ports partly contributed to the deconcentration of the port system due to the relocation of the Hoang Dieu port to Chua Ve and Tan Cang Dinh Vu port (Nam Hai DV), deep-water ports that boast modern facilities.

However, Vietnam's container port system is expected to witness a high level of concentration during the next 5 years due to hub port developments comprising the deep-sea port Lach Huyen project in the city of Hai Phong, which enables direct shipments to and from other ports throughout the world, together with Cai Mep-Thai Vai deep-water port in the city of Vung Tau, which is set to become a deep-water hub for Asia-European liner services and a competitive international freight transit center.

Indonesia: Deconcentrated container port evolution

The deconcentration trend of Indonesia's port system during 2010–2014 was caused by the congestion that began in 2011 at the key gateway port of Tanjung Priok, which was originally designed for a capacity of 5 million TEU per year but reached 5.8 million TEU, indicating the need to further develop its infrastructure. Therefore, container transference directly to other smaller ports was the optimal solution for reducing the congestion which is proven via the resuilt of SSA showing the significant growth in container traffic of small and medium-sized ports.

In the long term, the deconcentration trend might be retained, since Indonesia's port governors' plan to build up the Priok and Cilamaya ports in an effort to diminish congestion at Port Tanjung Priok. Additionally, ASEAN's single market creation in 2015 led to the emergence of new strategic port projects, such as the international hub ports, Kuala Tanjung in North Sumatra (Pelindo I), situated adjacent to the Malacca Strait, and the expanded Port of Bitung in North Sulawesi (Pelindo IV), with the expectation of becoming the national principal transit hub.

Thailand: Concentrated container port evolution

The high level of concentration in Thailand's port system is explained by the amount of container volume that, for the most part, go to two main ports, specifically Laem Chabang and Bangkok. The BSAA Annual Report 2014–2015 indicated that the Bangkok port has been working to reduce congestion resulting from factors including increased activity and crowding at the port, larger vessels, and a lack of space for expansion. Thus, considerable numbers of containers have been moved to Laem Chabang, a factor that is reflected in the SSA results. Meanwhile, Thailand's largest port, Laem Chabang, also suffers from congestion, but it has been alleviated via spurts of expansion projects.

Furthermore, because of the commencement of the ASEAN Economic

Community (AEC) in 2015, the port authority of Thailand aims to expand a third large basin of Laem Chabang to increase its capacity by 8 million TEU to a total 18.8 million TEU and to transform Laem Chabang into the main transshipment hub of the Indo-China region. Therefore, the concentration of Thailand's port system will experience an upward trend due to the completion of the Lamchangbang port expansion, while the Port of Bangkok will remain at its current level, since it has already reached its full capacity and lacks space for expansion.

Phillipines: Concentrated container port evolution

The increasing trend in the Philippine's port concentration is generated by a stagnation and downturn in the container throughput of Port Davao, one of the country's three largest ports, based on the CR3 results, as well as a constant increase in the container traffic of Manila, the largest seaport in the Philippines. The Manila port is the country's busiest port, with a utilization rate of nearly 72%, although the Subic and Batangas ports have undergone development to deal with excess traffic in the port of Manila as well as to boost growth in Central Luzon and Calabarzon. Nonetheless, shipping operators continue to choose the Port of Manila for their operations, which has led to the port's congestion and the underutilization of the other two ports in the Greater Capital Region (Patalinghug *et al*. 2015). Moreover, the AEC encouraged ASEAN port development. Because the Philippines hopes to become a major maritime hub in the Asia-Pacific region, many projects are underway to upgrade the infrastructure of Philippine gateway ports, and this probably raises the possibility of a future deconcentration trend. However, because the gap between the Port of Manila and others is still very huge, the concentration will continue to occur, as there is no port able to supersede the position of Manila in the short term.

Malaysia: *Concentrated container port evolution*

Malaysia has rapidly expanded its economy and FDI over the last 5 years, and it may be the only ASEAN-5 country having a port system reaching the advanced level with the full support of an effective hinterland network and modern infrastructure. The concentration of Malaysia's port system can be justified by the majority of container throughput going predominantly to two main ports (PTP and Port Klang), and this concentration will remain in the future, as Malaysia's government strategy is focusing only on developing existing seaport facilities via expansion projects in terms of capacity as well as hinterland networks. Thus, there will be no new port emergences. The PTP is one of those expansion projects: PTP has invested $430 million in its berths and equipment in order to deal with the mega vessels of the 2M sharing agreement between Maersk Line and MSC. Because PTP is Maersk Line's main Southeast Asian hub and one of the few ports in the world that can accommodate a fully laden, 18,000-TEU vessel, it was therefore an obvious port of call in the 2M agreement.

In summary, the results reveal differences in the concentration tendencies in ASEAN-5 Container ports as the result of the port development in serving larger container vessels, becoming regional transshipment hubs or diseconomies of scale in port operation as well as port congestion. The container ports of Indonesia and Vietnam experienced a deconcentration trend for the duration of the study, which is attributed to the development of hub ports (new), port congestion, and, based on the models of Barke (1986) and Hayuth (1988), "the peripheral port challenge." In contrast, the Container ports of Malaysia, the Philippines, and Thailand experienced a concentration. Malaysia's and Thailand's Container ports are perhaps reaching the final stage of Taaffe's model of port development, which points to an increasing level of port concentration as certain hinterland routes and urban centers develop more than others. Moreover, Thailand's ports have undergone a period of severe port congestion and "the peripheral port challenge" in the port of Bangkok. Thus, the Laem Chabang port with the favourable location for developments of a hub port and hinterland network is an optimal alternative for the ports of Bangkok's problem. In other words, Thailand's container ports might be the future scenario of Vietnam's and Indonesia's container ports. The concentration of the Philippines port system is slightly different from those of Vietnam and Indonesia, since it stems from a port preference that does not follow any previously studied models. The congestion and hinterland link problems are also occurring in Malina but without the deconcentration of the port system. Addition to port preference, the concentration in the Philippine port system might be affected by other external factors, such as the economy (e.g., the downturn of Port Davao) and government policies.

Ⅶ. Conclusion

In this study, quantitative measurements were applied for examining the concertation dynamics in the container port systems of Southeast Asia through the use of HHI, CR3, and SSA. The findings reveal dissimilarities regarding to the pattern and degree of concentration of ASEAN-5 container ports in evolution process. And the spatial development of these container ports all follow conventional phases of previously researched modals. The results reveal that the container ports of Vietnam and Indonesia share many common features with models of Barke (1986) and Hayuth (1988). While, container ports of Malaysia and Thailand follows phrases of Taaffe's model. Only Philippines container ports has unique traits since it's concentration stems from a port preference, which might be the one not follows any previously studied models during the studied time. The discussed reasons also indicated that concentration patterns as well as dynamics of ASEAN-5 container port systems have been greatly influenced by government's port polices.

The study provides both managerial and theoretical implications. In academic aspect, a fundamental background in port concentration for more in-depth subsequent analyses in terms of port development in Southeast Asia. In practical aspect, the comparison of container port concentration degrees of this research assist port policy makers and port managers of the Southeast Asian countries to gain insight into the actual status of the container port developments in region as well as understand international container port position of each country, thereby making policy regarding to development of container ports.

The limitation of this study is the length of its studied duration. Since, the availability of statistical data related to seaport in Southeast Asian is indeed restrictive, public information systems has not been well developed, therefore the data is rather dispersed and hard for collecting. In addition, the study has not yet addressed interconnections or interactions within container port systems. Other factor such as shipping network also has impact on the concentration and competition among ports. Therefore, future studies conducted over a longer period of time should continue to evaluate and more focus on the interaction of container port systems in Southeast Asia.

투고일 2016. 09. 30.
1차 심사일 2016. 12. 25.
게재확정일 2017. 01. 10.

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