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A port marketing strategy in the wake of new shipping alliances : a case study of Busan Port

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A PORT MARKETING STRATEGY IN THE WAKE OF NEW SHIPPING ALLIANCES

A Case Study of Busan Port

By

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DECLARATION

I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

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ABSTRACT

Title of Dissertation: **A Port Marketing Strategy in the Wake of New Shipping Alliances – The Case Study of Busan Port**

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The Northeast Asia has become one of the most economically vibrant regions and the fastest growing regions in the world on the strength of seaborne trade increase. Situated on the main trunk route in the Northeast Asian region, Busan Port has an advantageous geographical location for approaching important industrial regions such as China and Japan. In line with these strengths, Busan Port has kept its global position as a leading transshipment hub port in the region for the recent decades.

However, ports are faced with the more competitive situations as many changes occur in the market. In particular, the wake of new shipping alliances is the most important change in the maritime industry. Those shipping alliances will have a huge impact on the terminal operation of a port because the combined merchant fleets account for the majority of the world fleets. In this regard, as a dominant governance tool, the role of port authority as a landlord also should be reconsidered for the successful participation of private sector in public area.

It is essential to assess the performance of Busan Port to correspond to changes in the market. In order to measure the efficiency of each terminal in Busan Port, the data envelopment analysis (DEA) is used as a methodology. Through this analysis, it is possible to how efficiently Busan Port has been operated based on the concession contracts. In the final part of this research, appropriate marketing strategies and plans will be presented in order to survive in the competitive market situations.

KEYWORDS: marketing strategy, shipping alliances, DEA, transshipment, port authority, efficiency, concession contract

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List of Abbreviations

BCC	Banker, Charnes and Cooper
BIT	Busan International Terminal
BNCT	Busan New Container Terminal
BPA	Busan Port Authority
CCR	Charnes, Cooper and Rhodes
CRS	Constant Returns to Scale
DEA	Data Envelopment Analysis
DPCT	Dongbu Pusan Container Terminal
HBCT	Hutchison Busan Container Terminal
HJNC	Hanjin Newport Company
HPNT	Hyundai Pusan Newport Terminal
IMO	International Maritime Organization
KBCT	Korea Express Busan Container Terminal
PNC	Pusan Newport Company
PNIT	Pusan Newport International Terminal
VRS	Variable Returns to Scale

1 Introduction

1.1 Background

The Northeast Asia has become one of the most economically vibrant regions and the fastest growing regions in the world. In particular, the 8 out of 10 world largest container ports are located in Northeast Asia. Amongst those ports, Busan Port recorded the top 5th port in terms of container cargo volume of 17.04 million TEUs in 2012 (World Shipping Council, 2013). Situated in the south-eastern part of South Korea, Busan Port has an advantageous geographical location both for approaching important industrial regions in the country and for onward transport to China and Japan.

As a matter of fact, the main competitors in the region are China and Japan. The local Chinese governments keep investing in port infrastructure, which has enabled China to take 24.2% of the world's total container throughput in 2011. Japan, a competitor in proximity, seeks to make its ports as strategic international container hubs. In this regard, Busan Port is located on the main trunk route, with the sophisticated feeder network connecting 60 ports in Japan and 45 ports in China. The main strengths of Busan Port as a regional transshipment hub port compared to most neighboring ports are as follows: 1) geographical location on the main trunk route in Northeast Asia, 2) cost competitiveness, 3) well-organized and sophisticated feeder network, 4) weather condition with less typhoon and sea fog, 5) excellent connectivity with 358 weekly services, and 6) sufficient water depth to accommodate Triple E size ships.

In 2004, Busan Port Authority (BPA) was newly established by the Korean central government in order to improve the management of Busan Port and develop the Port as a leading seaport with the advanced managerial system. Since it was founded, in preparation for the 21st century, BPA has been implementing huge tasks such as Busan New Port development project, the development of North Port and distripark development plan. With those projects, it is expected to reduce logistics costs, improve the competitiveness without cargo backlog, and increase the cargo handling capacity by 23 million TEUs until 2020. Furthermore, Busan Port has integrated U-port system, monitoring and screening system and rapid customs procedure to accomplish its mission and tasks.

According to Vis and Koster (2003), a container port can function as a transshipment gateway in which the container cargoes to an intermediate destination, then to another destination. By using a quayside crane, an import container is unloaded from the ship, and then transferred by straddle carriers or vehicles like trailers to the stack.

When arrangements are finished by workers at the receiving end, the container can be moved to other transportation modes such as barges, sea ships or trains. For an export container, this process is carried out reversely. This is the typical pattern of operation in a container port which has greater than 100,000 TEUs throughput per year. Meanwhile, in a container port with less than 100,000 TEUs throughput, mobile cranes and reachstackers tend to be preferred to quayside cranes and straddle carriers. As a leading container port and transshipment gateway in Northeast Asian region, it is clear that Busan Port has a wide range of advantages and potential for promising future.

1.2 Statement of Problem & Objectives of the research

Despite all these advantages and efforts mentioned above, the global position of Busan Port as the top 5th container port has been continuously threatened and challenged by competitors in the recent years. For example, Ningbo-Zhoushan Port in China, ranking the 6th in 2011 and 2012, is chasing after Busan Port with the exponential growth in throughput. It recorded 14.72 million TEUs in 2011 and 16.83 million TEUs in 2012 respectively, so the gap between this Port and Busan Port has been getting smaller. Besides, the container cargo volume keeps increasing in Guangzhou Port (7th in 2012) and Qingdao Port (8th in 2012) of China.

In addition, as seaborne trade has been consistently increasing with the economic growth of the world, ports are faced with new changes and the competition between ports is becoming more and more intensive than the previous era. In particular, one of the biggest changes is the formation of new shipping alliances such as the 2M (Maersk and MSC), G6 (APL, Hapag Lloyd, Hyundai Merchant Marine, MOL, NYK, and OOCL), the CKYHE (Cosco, K Line, Yang Ming, Hanjin Shipping and Evergreen Line) and Ocean 3 (CMA CGM, China Shipping and UASC). The issue of new alliance formation is very up-to-date, changing frequently according to the approval of the relevant authorities.

In this competitive market environment, Busan Port needs to examine its status quo and performances in order to effectively respond to new challenges and take the lead in the international port industry. Currently, Busan Port Authority (BPA) is responsible for managing and developing Busan Port as a landlord, and there are container terminal operators within the Port. The reason why Busan Port has kept its leading position in the Northeast Asian region for many years is mainly the huge volume of container cargo. Therefore, it is essential to examine how effectively container terminals are being operated in Busan Port. For operating terminals, the container terminal operators in the Port made a concession contract with BPA.

In this study, the author would like to find out how efficiently and effectively Busan Port is operated by terminal operators based on a concession contract with them. Under the landlord port authority model, the concession contract is a good tool of private participation in the public sector. Currently, there are 9 container terminal operators in Busan Port. Therefore, they will be analyzed in terms of efficiency and then evaluated with their concession contracts. After this analysis and evaluation, the appropriate and promising marketing strategies and plans for Busan Port will follow corresponding to the result of the study. In this respect, the brief explanation of methodology for measuring efficiency is presented in the following part as below.

1.3 Methodology

There are multiple methodologies or techniques to measure the efficiency. The most simple and commonly used formula for efficiency is as follows:

$$\text{Efficiency} = \text{Output}/\text{Input}$$

However, estimating the efficiency of container terminals is not as simple as above because there are multiple inputs and outputs related to different activities and resources. Therefore, in order to implement the evaluation of terminal concession contracts, the author will use Data Envelopment Analysis (DEA) as a methodology. DEA is a useful tool to measure and assess the terminal efficiency. The basic principle of DEA is measuring the relative efficiency by weighted sum of outputs divided by sum of inputs. In this context, inputs usually try to minimize the cost measures, personnel, material used and outputs to maximize the profit, revenue and products. In the next chapter, the details and application of DEA is explained in the perspective of literature review.

2 Literature Review

The literature review for this dissertation goes to two main directions. The first is regarding the subject of other relevant studies and theses. The objective of this part is to find the significant aspect of subject which has not been sufficiently researched on, and which is the goal of this research. The second one is the description of methodology in other related studies. There are several techniques used to analyze and measure the efficiency in ports, and this paper is elaborating the reason for choosing DEA as a methodology.

2.1 Subject

Valentine (2002) implemented his study on the ports of North America and Europe by approaching the port efficiency from the organizational perspective and ownership factors. His paper is concentrating on the efficiency of the ports in North America and Europe based on the ownership elements and organizational structure. The performance of port can be affected by many factors such as the geographical location, connectivity, logistics service, infrastructure and superstructure. However, the organizational structure is a very important factor influencing its efficiency performance. Over the last two decades, many ports have experienced reorganization in line with global trend of privatization policies by governments. From 1990 to 1998, 28 developing countries had private participation in their 112 port projects with an investment of more than US$9 billion.

Cullinane and Wang (2006) did the research on the efficiency of European container ports with cross-sectional data envelopment analysis. They found out that studies of operating efficiency in Europe are minimal even if container terminals in the region were faced with fierce competition. A sample for estimation is comprised of 69 container terminals in Europe with over 10,000 TEUs throughput per annum. The authors are focusing on both efficiency and productivity which are comparable but different concepts, and frequently used to measure performances. It concludes that data envelopment analysis (DEA) and stochastic frontier analysis (SFA) are suitable to measure the operating efficiency in ports. From the results of applying the techniques, the authors found that ports with private-sector participation tend to show the higher level of technical and scale efficiency than those with greater public-sector involvement. Next, there is a tendency for gateway ports to exhibit the lower level of technical and scale efficiency than transshipment ports.

Lin and Tseng (2005) measured the efficiencies of 27 international container ports from 1999 to 2002. They applied both data envelopment analysis (DEA) and stochastic frontier analysis (SFA) with 3 inputs and 1 output. The study found that there are correlations between operation efficiencies and three key factors: port location (Asian region vs. non-Asian region), administration structure of port (private-owned vs. public-owned), and the growth rate of national economy (above-average vs. below-average). In recent years, the trend of privatization of port operation has been prevailing in port sector, and the global terminal operators are aiming to maximize profit which is in accordance with the features of SFA. According to the result of their study, Hong Kong Port has shown the best performance during that period in both models.

Munisamy (2008) applied DEA to measure the technical and scale efficiency of Asian ports. The author collected the raw data for analysis from *Containerisation International Yearbook 2007* including 71 major container ports in Asian 17 countries: China, Japan, India, Indonesia, Hong Kong, Bangladesh, Brunei, Singapore, Sri Lanka, Taiwan, Vietnam, Thailand, Philippines, Cambodia, Malaysia, Pakistan and South Korea. The results of analysis say that the most efficient ones are the ports in Singapore, Philippines, India, Cambodia, China and Bangladesh. In particular, 5 Chinese ports (Guangzhou, Lianyungang, Tianjin, Xiamen and Yantian) ranked within the top 10 in this research. Chinese government is focusing on liner services in response to the global trend, and the policies for becoming hub ports. As one of the biggest manufacturing plants and consumer markets, China has emerged with its hinterland economy growth. The port of Guangzhou and Yantian attained technology and expertise from Hong Kong. On the contrary, the port showing the least technical inefficiency is Muara Port of Brunei which recorded a score of 10.36. In efficient container ports, the inefficiency of inputs and outputs are all zero, while inefficient ports have too much inputs or too little outputs. In order to essentially improve the efficiency of container ports, it is more appropriate to increase changeable outputs rather than reduce the given inputs. Therefore, in the case of Muara Port, its container cargo throughput needs to be increased by 90% (886,230 TEU) sustaining the current level of inputs. The throughput (output) tends to be affected by external demands, whereas port efficiency can be improved by better managerial practices and operational planning (input).

Carvalho (2009) did the research on evaluating the performance of Portuguese seaports in the context of the European region. In line with the reform, Portuguese port sector encouraged private operators to involve in port services. The ports in this study are analyzed in terms of regulation policy, governance, institutional circumstances and operation types compared to three other countries; the UK, Netherlands and Spain. Spain is the main competitor of Portugal, and the other 2 nations have shown the top performance in measurement procedures. This study analyzes the status of Portuguese ports and those competitors each. For example, Portuguese ports have been faced with more severe level of competition as trade barriers ended in the European market. In other words, inside the European Union, it is not that important to know in which seaports cargoes are loaded and unloaded. In Portuguese ports, the participation of private sector has been achieved through BOT (build, operate and transfer) contracts. When the contract ends, infrastructure and superstructure should be given back to the Port Authority in operating conditions. Other countries, the United Kingdom can be an example of the most advanced privatized port in the world. In UK, port governance can be divided into 3 types: ports under private ownership, municipal management, or operated by a trust. Next, in the Netherlands, the Port of Rotterdam which is the busiest container port in Europe (World Shipping Council, 2013) has been managed and operated by an independent corporation since 2004. The main shareholder is the Rotterdam municipality, while a third of the company's share is owned by the State. On the contrary, Spanish port system is consisting of 44 ports of public interest. They are under the control of 28 Port Authorities. 'Puertos del Estado' is in charge of implementing the government port policies. Most of Spanish Port Authorities are still subject to support by the State through compensation for operating losses and subsidy. In terms of methodology, the author used data envelopment analysis (DEA) with two types of inputs, operational expenses (OPEX) and capital expenses (CAPEX). Outputs consist of passenger traffic and cargo throughputs which are divided into 5 types (container, roll-on roll-off, conventional, dry and liquid bulk). The result shows that all Portuguese ports had very low scores of efficiency except for Lisbon which had a high volume of passenger traffic. It concluded that if Portuguese seaports had been operated in more efficient way, it would have reduced cost up to 64 million euros in 2005.

2.2 Methodology

In this chapter, the methodologies of other relevant dissertations are presented to find which method is most suitable and appropriate one for this research. In an attempt to evaluate port concession contracts or measure the efficiency of terminals, there have been efforts to study and analyze how to assess the efficiency of seaports from many countries.

Oghojafor and Alaneme (2012) adapted an ex-post facto study as their methodology considering that their study is focusing on what has happened during the targeted period, and the researchers would not have any control on the variables. The measurement of efficiency was implemented based on the extent to which Nigerian Ports Authority (NPA) was able to accomplish the goals of the concession plan. The data for the research were collected from the annual reports of 2004 to 2005 which are the pre-concession years and 2007 to 2008 which are post-concession years. It analyzes the content of annual reports and compares the objectives of the concession with actual performance after concession. The findings of the study indicate that there was a huge increase in the total throughput from 44 million TEUs in 2005 to 54 million TEUs in 2006. Plus, turnaround time also reduced from 7.4 days in 2005 to 4.7 days in 2006 on average. Berth occupancy rate recorded 49.7% in 2005, but dropped to 47.4% in 2006 which means the congestion and waiting time for berthing decreased.

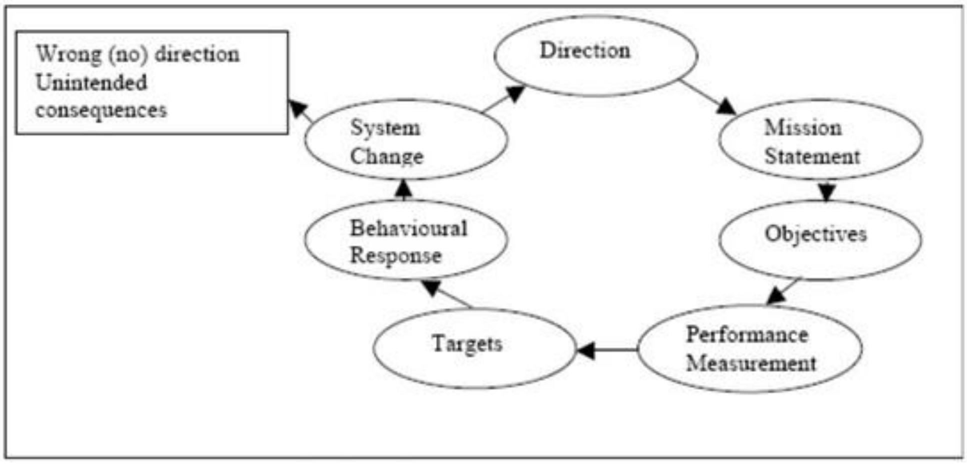
Figure 1 Cargo throughput for Nigerian ports authority (1995 -2007)

Year	Inward	Outward	Throughput	Waiting time	Turnaround time (days)	Berth occupancy (%)
1995	9,289,971	3,983,082	13,273,053	0.47	6.17	27.76
1996	10,224,300	5,251,001	15,475,301	0.46	6.34	36.68
1997	11,213,624	5,396,181	16,609,805	0.47	6.71	36.73
1998	14,286,864	5,038,854	19,325,718	0.39	7.31	41.39
1999	15,751,331	6,481,605	22,232,936	0.36	6.31	47.09
2000	19,230,496	9,702,384	28,932,880	0.34	7.01	44.76
2001	24,668,791	11,271,901	35,940,692	1.27	7.91	51.78
2002	25,206,380	11,780,861	36,987,241	3.99	11.34	56.58
2003	27,839,293	11,926,652	39,765,945	2.17	7.89	52.75
2004	26,907,075	13,909,872	40,816,947	1.44	6.44	50.93
2005	29,254,766	15,697,312	44,952,078	2.60	7.40	49.70
2006	33,722,488	20,918,560	54,641,084	1.00	4.70	47.43
2007	31,937,804	17,235,520	49,173,324	2.00	6.10	46.93
Total	279,533,183	138,593,785	418,126,968	1.30	7.05	45.10

Source: Mohammed (2008).

Carvalho (2009) evaluated the performance of Portuguese Seaports in the European Context with the Data Envelopment Analysis (DEA). According to him, it is quite complicated to measure seaports performance as they offer a wide range of services, and manage terminals in various contexts. In several fields, DEA has been comprehensively used but scarcely applied in the port sector. Measuring performance is tremendously important for the organization development because it can explain the current status as well as the future, as shown in the figure below. This performance measurement can help the system move in the desirable direction based on the behavioral responses towards the evaluation outcomes. If the performance is specified in the incorrect manner, it can lead the system to the wrong direction.

Figure 2 Performance measures and organizational development



Source: Dyson (2000)

It is a critical decision to choose inputs and outputs in DEA. Different results can be originated from different variables. At the same time, there is a possibility to make biased results due to the incorrect or less stringently chosen variables. His study is focusing on the efficiency of the whole Portuguese ports rather than one container terminal. When inputs and outputs are defined, the objective of a port should be considered. For example, when a port is aiming to maximize its profits, then the total number of employees can be regarded as an input variable. Nonetheless, if a port is aiming to increase the number of employment, then labor can be considered as an output variable. Given the public basis of Portuguese seaport system, the objective is assumed to be supporting the economic growth at the level of nation by means of maximizing total cargo throughput and passenger traffic while sustaining the lowest probable costs. In his study, costs are chosen as inputs in that the objective is to reduce the costs in Portuguese seaports. This has several benefits, including the correct reflection of several inputs and avoidance of favoring specific managerial aspects which are not essentially relevant to performance. Therefore, operational expenses (OPEX) and capital expenses (CAPEX) are chosen to be taken into account. Taxes are not included in any inputs because the evaluation results can be unfairly affected by different national systems of taxation. When the objective separation of extraordinary costs in the operational and capital costs is impossible, they are counted in the regular OPEX and CAPEX. In this regard, the core methodologies for analysis are Charnes, Cooper and Rhodes (CCR) and Banker, Charnes and Cooper (BCC). However, a Super-Efficiency model is used for the result discussions in order to give a deeper insight, and all models are run by the Data Envelopment Analysis (DEA).

Lin and Tseng (2005) applied both the Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA) to measure operating efficiencies of targeted international container ports which are a total of 27. The period is from 1999 to 2002 and researchers used DEA and SFA with 3 inputs and one output. The selection for top 27 ports is implemented based on the sources from the *Containerization International Yearbook* (various issues), and statistics of each port from 1999 to 2002. However, some ports are excluded due to the lack of data availability: Nagoya of Japan, Tianjin, Qingdao, and Guangzhou of China. The number of observations is 108 in total.

Lee, Kuo and Chou (2005) adopted DEA and Recursive Data Envelopment Analysis (RDEA) to rank certain container ports in Asia Pacific region. The ranks respectively obtained by those two methods were compared with each other, and examined for tactical action to improve efficiencies in each port. The outcomes from the traditional DEA are categorized into two parts: efficient and inefficient units. The reason why the authors added RDEA is that decision makers in their society are interested in the comprehensive ranking beyond the simple categorization through DEA only. The RDEA is comprised of two main steps for ranking organizational units. First of all, the DEA is applied for each unit independently and then the super-efficiency technique is run to rank efficient units for efficient DMUs. In the second step, inefficient DMUs are recursively assessed with step 1. Through RDEA, efficient units are identified on the frontier and ranked by the super-efficiency methodology, and then removed from the reference set. The process of identification and removal of frontier of the new reference set is repeated until the reference set becomes empty.

Based on the original CCR model, a variety of theoretical ways have been developed: A variable RTS variation was developed by Banker et al. (1984); Charnes et al. (1982) developed the multiplicative model in which a logarithmic structure is used to transform the data; Charnes et al. (1985) improved the model with additional variation which slack variables are contained in the objective function alone. Seiford and Thrall (1990) presented a useful discussion and comparison of basic models of DEA. A majority of theoretical studies applied the models to solve the practical problems in the field. One application is ranking DMUs and the results from ranking are grouped into 2 sets: efficient and inefficient ones defining the Pareto frontier. The authors of this study decided to apply another approach which is Recursive Data Envelopment Analysis (RDEA) in order to rank all the DMUs. In the previous literature review, the lack of discrimination has been considered one of problems in DEA applications, in particular if the number of DMUs is not sufficient or when inputs and outputs are too many compared to the number of units.

2.3 Selection of methodology

The individual efficiency of container terminals in Busan Port has not been studied on the basis of DEA methodology before, while only some parts in the Port were dealt with to compare with other domestic or foreign seaports. Therefore, DEA can be used for effective evaluation of concession contracts in Busan Port. When it comes to assessment of efficiency of a terminal or port, one of major difficulties comes from the fact that efficiency is result of combining numerous inputs (e.g. number of cranes, workers and berths) in order to achieve a certain degree of output (e.g. total TEUs or cargo traffic). In this regard, the concept of relative efficiency can be introduced and the methodology using this concept is DEA. Therefore, DEA can be usefully applied for this research and draw a beneficial conclusion for improving efficiency in Busan Port. The explanation of DEA technique in details and the analysis of terminal operating efficiency in Busan Port will be presented in chapter 5.

In this chapter, an overview of relevant studies regarding is implemented. Each research is focusing on the different regions, contexts and perspectives. However, there is one outstanding thing in common that most of them adopt the data envelopment analysis (DEA) as a methodology. Although the specific methods vary to some extent according to different characteristics of seaports and the perspective of researchers, those are still under the principles of DEA. Therefore, it is concluded that DEA is the most adequate methodology for this research. Before applying DEA in Busan Port, the current system of the Port is described in Chapter 3, and the changes in the market are presented in Chapter 4. After that, by reflecting those features and situations in DEA, it is possible to analyze in the integrated manners.

3 Current system of Busan Port

Busan Port is one of the biggest and busiest container ports, which is lying along the main North Asian arteries and hosting international shipping routes to Asia, Europe and the Americas. Before analyzing and evaluating the performance of the port, it is critical to look into the current system and scheme for deeper understanding. Busan Port is mainly consisting of the “North Port” and “Busan New Port,” which have container terminals in the area. Therefore, those two are the subject of this research even if other small harbors exist in Busan Port.

There are a total of nine container terminals in Busan Port, and the name of each terminal usually reflects the name of its operator. The four container terminals are located in the North Port: 1) HBCT (Hutchison Busan Container Terminal), 2) KBCT (Korea Express Busan Container Terminal), 3) BIT (Busan International Terminal) and 4) DPCT (Dongbu Pusan Container Terminal.

Next, Busan New Port, opened in 2006, is located in the north shore of Gadeok Island straddling Busan and Jinhae city. There are five container terminals in Busan New Port: 1) PNIT (Pusan Newport International Terminal), 2) PNC (Pusan Newport Company), 3) HJNC (Hanjin Newport Company), 4) HPNT (Hyundai Pusan Newport Terminal) and 5) BNCT (Busan New Container Terminal).

3.1 Legislation - Terminal operation scheme and management

Terminals in North Port

- HBCT (Hutchison Busan Container Terminal)

  : The terminal commenced its operation in 1978 and the feeder service in 1996. The current operator is Hutchison Korea Terminals (HKT), which is a member of the Hutchison Port Holdings (HPH) group. The concession period is 18 years from February 2002 to June 2019. This terminal was selected as Busan Port’s “Terminal of the Year” in 2006 for high productivity and efficiency.

- KBCT (Korea Express Busan Container Terminal)

  : The terminal opened in June 1991 and KBCT is currently in charge of operation. The concessionaire made a 5 year contract, which is from January 2013 to February 2017. As it was designated as Free Trade Zone by the government in 2001, KBCT can provide simplified customs clearance procedures with integrated logistics information system.

- BIT (Busan International Terminal)

: It opened for container vessels in April 1998. The present terminal operator is Busan International Terminal, which signed a contract for 4 years from December 2013 to December 2017.

- DPCT (Dongbu Pusan Container Terminal)

: DPCT opened in April 2002, which is owned by Dongbu Corporation. This concessionaire has a long term contract for 30 years from May 2002 to May 2031. It offers stevedoring services for large, middle to small-scale vessels, and on-dock services enabling more prompt process to vessel owners.

Figure 3 The North Port

Source: Busan Port Authority

Terminals in Busan New Port

- PNIT (Pusan Newport International Terminal)

: The terminal opened in March 2010 with the 30 year concession contract from November 2009 to October 2039. PNIT is a joint venture between PSA with the global connectivity and Hanjin Transportation with the local network. It has a fully integrated terminal operating system that optimizes the whole container terminal operations, and connects the terminal to the shipping community.

- PNC (Pusan Newport Company)

  : This is a private terminal owned by Pusan Newport Company. It commenced its operation of Phase 1-1 in December 2006, and 1-2 in June 2009. The terminal is equipped with the longest quay facility (2,000 m) in Korea.

- HJNC (Hanjin Newport Company)

  : HJNC was established by 100% investment of Hanjin Shipping in 2007. It commenced its operation of Phase 2-1 of the Busan New Port in February 2009, and the concession period is from the commencement to February 2039 for 30 years. Not only for container terminal, but also it provides container repair service, customs clearance and cleaning, and empty storage area. By cooperating with Hanjin Kerry Logistics and Hanjin Shipping Newport Logistics center, the terminal offers warehouse service. The gate operation hours are 24 hours.

- HPNT (Hyundai Pusan Newport Terminal)

  : It opened in February 2010, and the concession contract is valid until 2040 for 30 years. The terminal is available for the automated yard operation by remote controlling, and web-based real-time monitoring system. Instead of using engine-driven rubber –tired gantry crane (RTGC), it introduced the automated transfer crane (ATC) to comply with the environmental regulations.

- BNCT (Busan New Container Terminal)

  : This is the most recently constructed terminal in Busan New Port, which opened in January 2012. However, this terminal is the private one. BNCT offers the automated gate system and pooling system using real-time location tracking of transfer equipment. Plus, it has the connection with logistics centers in the hinterland.

Figure 4 Busan New Port

Source: Busan Port Authority

3.2 Infrastructure (facilities and equipment)

In particular, as Busan New Port was developed and started the operation very recently, the facilities and equipment within the port are considerably advanced with high technology.

Terminals in North Harbor

- HBCT (Hutchison Busan Container Terminal)

Figure 5 Termianl layout of HBCT

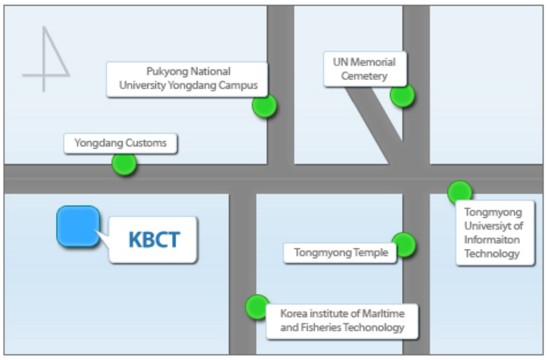
Source: HBCT

Facilities: The total area is 624,000 ㎡ including 335,000 ㎡ of the container yard. The total berth length is 1,447 m with 5 container berths. The depth alongside is 15 m.

Equipment: 14 container quay cranes, 32 rubber tyred gantry cranes, 78 yard tractors, and 5 reach stackers etc.

- KBCT (Korea Express Busan Container Terminal)

Figure 6 Terminal layout of KBCT



Source: KBCT

Facilities: The total area is 1,012,159 ㎡ including the container yard area 685,122 ㎡. The quay length is 1,500m with 5 berths and the draft is 15~16m.

Equipment: 15 quay cranes (container cranes), 32 units of transfer cranes, 64 yard tractors, and 9 reach stackers etc.

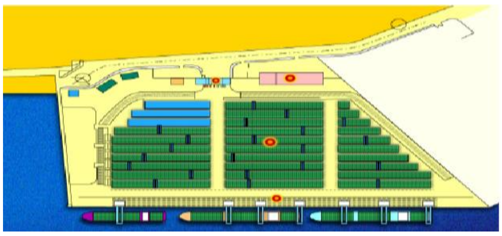
- BIT (Busan International Terminal)

Facilities: The total area is 727,000 ㎡ including the container yard area 384,000 ㎡. The water depth is 15 m and the berth length is 1,400 m.

Equipment: 11 container cranes, 30 transfer cranes, 54 yard tractors, and 8 reach stackers etc.

- DPCT (Dongbu Pusan Container Terminal)

Figure 7 Terminal layout of DPCT


Source: DPCT

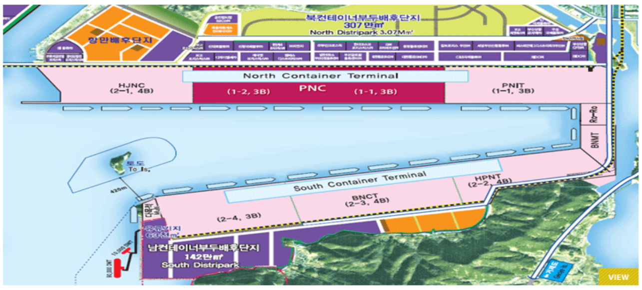
Facilities: The total area is 308,000 m^2 including the 153,490 m^2 area of container yard. The length of berth is 826 m with 1 berth and the draft is 15 m. The number of gates is 8 consisting of 7 lanes and 1 bulk.

Equipment: 7 gantry cranes, 17 transfer cranes, 36 yard tractors, and 3 reach stackers etc.

<u>Terminals in Busan New Port</u>

- PNIT (Pusan Newport International Terminal)

Figure 8 Terminal layout of PNIT



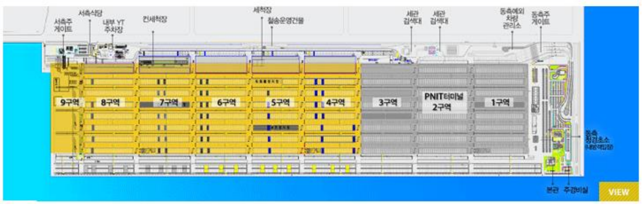
Source: PNIT

Facilities: The total area is 840,000 m^2 including the container yard area of 282,000 m^2. The water depth is 16 m, and berth length is 1.2 km with 3 berths. The number of gates is 4 consisting of 3 gate-in, 2 gate-out, and 1 flexible gate.

Equipment: 11 quay cranes, 30 rail mounted gantry cranes (RMGC), 66 yard tractors, 2 reach stackers etc.

- PNC (Pusan Newport Company)

Figure 9 Terminal layout of PNC



Source: PNC

Facilities: The total area is 1,210,000 m^2 and the container yard accounts for

525,000 ㎡. The length of 6 quays is 2,000 m which is the longest in South Korea. The draft is 16~17 m.

Equipment: 19 container cranes, 130 yard tractors, 42 transfer cranes and 3 reach stackers etc.

- HJNC (Hanjin Newport Company)

Figure 10 Terminal layout of HJNC

Source: HJNC

Facilities: The total area is 687,590 ㎡ including the yard area of 661,736 ㎡. The berthing capacity is 3 Berth (50,000 DWT X 3). The quay length is 1,100 M and the water depth is 16 M. The storage capacity is 68,800 TEU and the gate has 10 lanes.

Equipment: 12 quay cranes, 42 yard cranes (ARMGC), 3 top handlers, 5 reach stackers, 25 fork lifts etc.

- HPNT (Hyundai Pusan Newport Terminal)

Facilities: The total area is 553,000 ㎡. The berth length is 1,150 meters, and the water depth is about 16 meters.

Equipment: 12 quayside cranes, 38 automated transfer cranes (ATC), 2 empty container handlers (ECH), 3 reach stackers, 6 fork lifts etc.

- BNCT (Busan New Container Terminal)

Figure 11 Terminal layout of BNCT

Source: BNCT

Facilities: The total area is 840,000 ㎡. The berth length is 1,400 meters with 4 berths. The water draft is around 16 meters and the gate has 8 lanes (5 in-lanes and 3 out-lanes). In the case of Phase 1, the handling capacity is 1.8 million TEU per year with 37,585 TEU total stacking capacity.

Equipment: 11 ship to shore container cranes (STS), 42 ARMG cranes, 28 straddle carriers, 10 yard tractors, 2 reach stackers etc.

Table 1 The specification of each terminal in Busan Port

	HBCT	KBCT	BIT	DPCT	PNIT	PNC	HJNC	HPNT	BNCT
Concession period	18 years (February 2002 ~ June 2019)	5 years (January 2013 ~ December 2017)	4 years (December 2013 ~ December 2017)	30 years (May 2002 ~ May 2031)	30 years (November 2009 ~ October 2039)	Private terminal (no concession contract)	30 years (February 2009 .~ February 2039)	30 years (February 2010 ~ February 2040)	Private terminal (no concession contract)
Work force	391	537	478	345	518	640	502	620	412
Berthing capacity (The number of available vessels)	50,000 tonnes (4), 10,000 tonnes (1)	50,000 tonnes (5)	50,000 tonnes (4)	50,000 tonnes (2) 5,000 tonnes (1)	50,000 tonnes (3)	50,000 tonnes (6)	50,000 tonnes (2) 20,000 tonnes (2)	50,000 tonnes (2) 20,000 tonnes (2)	50,000 tonnes (4)
Loading/unloading capacity	1,700,000 TEU	2,000,000 TEU	1,560,000 TEU	780,000TEU	1,380,000 TEU	2,730,000TEU	1,600,000 TEU	1,600,000 TEU	1,600,000TEU
Water depth	15m	15~16m	15m	15m	16m	16~17m	18m	16~17m	17m
Pier length	1,447 m	1,500m	1,400m	826m	1,200m	2,000m	1,100m	1,150m	1,400m

3.3 Performance

3.3.1 Productivity, financial performance, and throughput of each terminal

1) Productivity in 2013

Terminals in North Port

- HBCT (Hutchison Busan Container Terminal)

  : 47.0 GBP, 28.1 GP

- KBCT (Korea Express Busan Container Terminal)

  : 47.7 GBP, 28.8 GP

- BIT (Busan International Terminal)

  : 39.8 GBP, 24.4 GP

- DPCT (Dongbu Pusan Container Terminal)

  : 48.4 GBP, 27.1 GP

Terminals in Busan New Port

- PNIT (Pusan Newport International Terminal)

  : 96.2 GBP, 33.2 GP

- PNC (Pusan Newport Company)

  : 99.6 GBP, 34.7 GP

- HJNC (Hanjin Newport Company)

  : 83.4 GBP, 31.2 GP

- HPNT (Hyundai Pusan Newport Terminal)

  : 85.8 GBP, 29.8 GP

- BNCT (Busan New Container Terminal)

  : 83.6 GBP, 28.8 GP

2) Financial performance (unit: Korean Won, KRW)

Terminals in North Port

- HBCT (Hutchison Busan Container Terminal)

  : 69,080,601,819 (2013), 70,649,386,016 (2012)
- KBCT (Korea Express Busan Container Terminal)

  : 70,247,814,543 (2013) 98,890,798,276 (2012)
- BIT (Busan International Terminal)

  : 36,014,880,734 (2013) 49,207,324,772 (2012)
- DPCT (Dongbu Pusan Container Terminal)

  : 50,187,750,354 (2013) 51,851,712,265 (2012)

Terminals in Busan New Port

- PNIT (Pusan Newport International Terminal)

  : 70,805,802,498 (2013) 46,762,471,065 (2012)
- PNC (Pusan Newport Company)

  : 159,997,865,317 (2013) 161,994,031,741 (2012)
- HJNC (Hanjin Newport Company)

  : 138,203,244,130 (2013) 153,116,540,312 (2012)
- HPNT (Hyundai Pusan Newport Terminal)

  : 137,942,229,754 (2013) 101,702,128,770 (2012)
- BNCT (Busan New Container Terminal)

  : 54,766,572,284 (2013) 23,428,556,007 (2012)

3) Throughput in 2013 and 2012 (unit: TEUs)

Terminals in North Port

- HBCT (Hutchison Busan Container Terminal)

  : 1,366,534 (2013) 1,286,488.75 (2012)

- KBCT (Korea Express Busan Container Terminal)

  : 1,744,861 (2013) 2,372,698.25 (2012)

- BIT (Busan International Terminal)

  : 1,465,206 (2013) 1,628,852.5 (2012)

- DPCT (Dongbu Pusan Container Terminal)

  : 1,032,732 (2013) 1,141,940.75 (2012)

Terminals in Busan New Port

- PNIT (Pusan Newport International Terminal)

  : 1,747,306.50 (2013) 1,220,232.75 (2012)

- PNC (Pusan Newport Company)

  : 3,299,456.75 (2013) 3,280,016.00 (2012)

- HJNC (Hanjin Newport Company)

  : 2,375,614.25 (2013) 2,442,635.75 (2012)

- HPNT (Hyundai Pusan Newport Terminal)

  : 2,391,889.50 (2013) 1,988,675.00 (2012)

- BNCT (Busan New Container Terminal)

  : 1,099,366.25 (2013) 459,968.50 (2012)

3.3.2 Transshipment activities of Busan Port

As the importance of Asian Pacific economy has been growing, the role of South Korea is also becoming more significant as a bridgehead to the market. In this respect, Busan Port is in a great position to serve as the gateway to Northeast Asia with the strategic location between two economic giants, China and Japan. Furthermore, in the world logistics, it is a major port on the North American and European trunk routes. This is the main reason why Busan Port has shown excellent performances in terms of transshipment activities.

According to Busan Port Authority (2013), the total container throughput of Busan Port has been increasing despite the sluggish economy in South Korea, where the domestic growth rate of import and export recorded 1.1 percent in 2012. Transshipment accounts for approximately 47 percent of Busan Port's annual throughput. For trans-Pacific traffic such as exports from China eastbound, Busan Port is playing a key role as a transshipment center. In 2012, most transshipment trades showed the double-digit growth rate except for China and the United States due to the downturn in those economies.

Since South Korea and the U.S. signed a free trade agreement in 2012, the volumes of trans-Pacific is expected to boost. Plus, the cost of trucking and inland transportation in Japan is more expensive than South Korea. Therefore, when shippers import from the U.S, they prefer shipments arrive through Busan Port by using smaller ships. In this type of trade, Japanese shippers prefer using the west coast ports in Japan which have direct links to Busan Port, rather than truck cargo into and out of hub ports like Kobe or Tokyo. This method can reduce logistics cost by 10 to 30 percent (Busan Port Authority, 2013).

4 Changes in Market Environment

4.1 Trade-related aspects

4.1.1 Changes in seaborne trade and world economy by globalization

In the history of trade, maritime transportation has consistently been a principal method for the global trade since 3,200 BC when Egyptian ships sailed along the coastline and the river. After that, Egyptian sail ships transacted with Sumatra, which is regarded as one of the most distant routes around 1,200 BC. Chinese merchants established regional trade chains by extending their routes to the South China Sea and the Indian Ocean in 10th century. However, the attempt of China to dominate the regional maritime did not last long because of European colonial powers, primarily England, the Netherlands, France, Spain and Portugal.

In the 16th century, these countries established the “true” global maritime network. At that time, most maritime activities focused on the specific regions like the Mediterranean, Pacific Asia, the North Atlantic, and the Caribbean. The steam engine made trade networks expand significantly in the middle of 19th century. After the opening of the Suez Canal in the second half of 19th century, maritime transport the exponential growth in the 20th century as the international trade and seaborne trade became closely related to each other. Similar to all transportation, maritime transportation is derived to assist trade activities and these are also affected by existing maritime shipping capacity.

In line with the economic development, maritime routes and transportation has become more important to the world economy. In particular, the pattern of freight routes was changed with the advent of containerization. Before containerization, the expense of loading and unloading was very expensive and the task took considerable time, with a cargo ship docked for longer time than at sea. On the basis of maritime transportation, the seaborne trade is implemented throughout the world. Like land and air transportation, maritime one can be controlled strategically and commercially by its usage. The geographical attribute tends to show constancy except for seasonality and cyclicality of weather patterns, strategic and commercial considerations are more vibrant. (Rodrigue, Notteboom, and Slack, 2013)

According to the United Nations Conference on Trade and Development (UNCTAD, 2013), the global economy and trade showed the highly integrated and interdependent performance in 2012. In that year, the growth rate of the world gross domestic product (GDP) decreased from 2.8 percent in 2011 to 2.2 percent. In recent years, there have been encouraging trends in the world seaborne trade. For example, in 2012, the volumes of international seaborne trade increased at an estimated 4.3% which is almost the same rate as the previous year showing the better performance than the world economy. This was mainly caused by a rise in the domestic demand of China as well as increasing trade among Asian countries and the so-called South-South trade. In ports worldwide, approximately 9.2 billion tons of goods were loaded.

As a matter of fact, the meaning of economic globalization is the growing interdependence of world economies caused by the increase in the volume of cross-border trade of commodities and services. In line with the economic development, the market frontiers continuously expanded and mutually integrated, which is the irreversible trend in the whole world (Gao Shangquan, 2000).

As the patterns of production and consumption have been globalized, the importance of container transportation has been increasing which is the recent trend in the international trade. This is mainly resulted from containerization reflecting the economies of scale and trend of forming shipping alliances. In fact, it is recently re-emphasized that containerization plays an important role for global trade. *The Economist* said that "Containers have been more important than freer trade for globalization" and Bernhofen (2013) concluded in his new study that containerization drove globalization more than trade liberalization. As regards formation of new shipping alliances, it is elaborated in the next section 4.2.

4.1.2 The influence from China, Japan and other countries on Korea

In 2012, the growth rate of exports from developed countries to developing economies exponentially decreased from 4.9 percent in the previous year (2011) to 0.4 percent as export volumes in the European Union and Japan reduced by -0.2 percent and -1.0 percent. In the case of Japan, during the second half of the year, exports dropped 11 percent which was supposedly resulted from the territorial dispute with China giving those two nations the negative effect on the trade. Even though the export growth rates in Western Asia and China recorded 6.9 percent and 7.2 percent increase, the rate in developing countries of Asia showed 3.7 percent of growth. Meanwhile, some developments might encourage the trade boost such as optimistic impact of the fiscal stimulus package and monetary policies of Japanese government.

Recently, China plays a very significant role and affects not only the trade of Asian region but also of the other regions in the world. China is growing at a rapid pace not only as a major base for manufacturing but also the largest market of the world. Japan is still steadily increasing its economic weight. In line with China's economic growth and trade increase, the speed of development in Chinese ports is exceeding its competitors through extensive investments following the Open Door Policy. They are expanding the infrastructure as well as linking the hinterland with diverse transport modes. It caused Chinese ports to account for huge amount in the market share.

According to UNCTAD (2013), economic growth in China decreased to 7.8 percent in 2012 from 9.3 percent in the previous year. Even in 2013, the growth rate of China was as low as 7.5%, which is the lowest record in more than a decade. The demand in Europe for Chinese exports weakened, and investment growth in China sharply declined. These affected the whole output growth in China, and this deceleration indicated that China made some effort to lower the speed of its economic growth under inflationary pressures. It also shows that the growth patterns are changing from an export-oriented and investment-driven to a more balanced growth on the basis of higher domestic consumption and demand. Growth in South Korea also decelerated because demand from European region decreased to a large extent. China, Japan and the Republic of Korea have negotiated on a trilateral trade agreement which may help boost trade in the region.

4.1.3 The tendency and pattern of trade

Currently, some main trends have an influence on international shipping and seaborne trade.

1) The 2008/2009 crisis has still affected global demand and trade negatively.
2) The structural shifts are happening in production patterns on a global basis.
3) Comparative advantages change as well as mineral resources like oil and gas.
4) Away from traditional center of growth, the South rises and economic effect shifts.
5) The demographics shows a different pattern between advanced countries with ageing populations, and developing countries with fast-growing populations that is relevant to the configuration of global production and consumption.
6) Very large size of container ships arrive in a port and transport-related technology keeps enhancing and improving.
7) Climate change and natural disasters are threatening factors.

8) Environmental sustainability becomes more important and energy costs matter.

In this context, both challenges and opportunities are arising for international seaborne trade. Among all these things, however, the most unstable problems are perhaps the interrelated issues of energy security and costs, environmental factors like climate change and sustainability. Despite these difficulties, there are still emerging opportunities.

1) The regional integration becomes deeper and the cooperation between the South and South gets stable.

2) Supply sources are diversified continuously due to the technology development and efficient transportation

3) New trading partners have emerged and access to new market is promoted by growing trade and cooperation

4) New sea routes are open or expanded. (e.g. the expansion of Panama canal and Artic routes)

5) Developing economies get involved with each other, particularly in South-East Asia and Africa, with lower value added and labor-concentrated sectors as China moves the value chain and strikes a balance again between higher value-added sectors.

6) Global demand is growing because of increase in world population and growing middle class/consuming group.

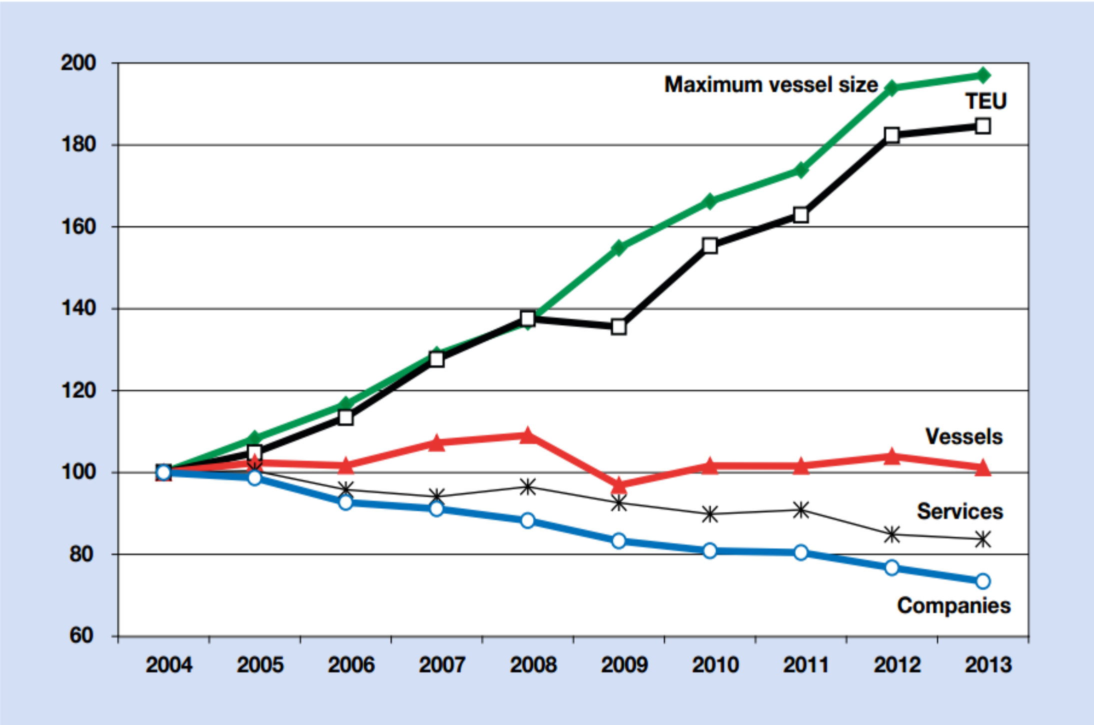
7) The banks in developing countries are emerging with the possibility to raise a fund to invest in transport infrastructure. (e.g. the proposed BRICS bank)

4.2 Shipping aspect

For the last 10 years, there have been two outstanding trends representing both sides of the coin. On the one hand, the size of ships is getting bigger, and on the other hand, the number of companies is declining. With regard to vessel size, the average capacity of the largest container ships in the 159 countries has nearly doubled to 5,540 TEU in 2013 from 2,812 TEU 10 years ago. In other words, bigger ships are deployed by fewer shipping companies.

Figure 12 Trends in container-ship fleet deployment (Index = 100 for 2004, data for mid-2004-mid-2013)

Figure 2.5. Trends in container-ship fleet deployment (Index =100 for 2004, data for mid-2004–mid-2013)



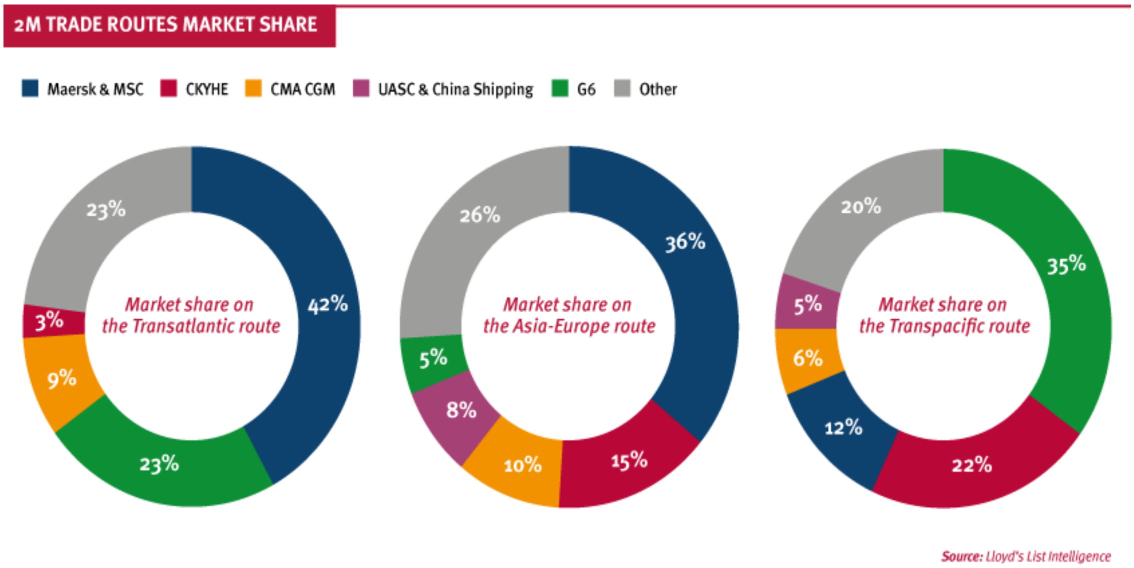
Source: UNCTAD, based on data provided by Lloyds List Intelligence.

4.2.1 The Introduction of New shipping alliances in the market

In 2013, the largest container ship operators continued to be Maersk Line of Denmark, Mediterranean Shipping Corporation of Switzerland, and CMA CGM of France. These 3 companies decided to cooperate with each other by means of slot-sharing arrangements, in order to improve their operation through a P3 Network alliance. This gigantic project was expected to control more than one-third of main sea trades and save billion dollars in operating costs based on the economies of scale. In the first place, this alliance planned to start operating later in 2014, promising to lower costs and bring the consolidation in the maritime sector. For the actual operation, the Network had won the approval of the United States (US Federal Maritime Commission) and European Union.

However, as the Chinese Ministry of Commerce decided to reject the P3 Network under the Anti-Monopoly law as of 17th June 2014, the P3 project was abandoned. Even if the P3 network has been rejected, there is always another possibility for a new alliance to come up because the shipping industry already favors the alliance due to the low costs and efficient fleet operation. The corresponding example is 2M alliance comprised of Maersk Line and MSC. Following the rejection of the P3, Maersk Line agreed to form another alliance with MSC leaving out CMA CGM. According to the chief executive officer of Maersk, total savings gains from 2M are expected to be a little smaller than the P3 because there is no synergies of a joint fleet, but 2M is simpler than P3 to operate. Maersk and MSC will keep their fleets separate, and the alliance is planned to start early in 2015.

Figure 13 2M Trade routes market share



In addition to the attempt of those 3 largest shipping companies, there are another alliances like the G6 and CKYHE. The members of alliances are APL, Hapag Lloyd, Hyundai Merchant Marine, MOL, NYK, and OOCL (for G6), and Cosco, K Line, Yang Ming, Hanjin Shipping and Evergreen Line (for CKYHE) respectively. In other words, more than half of the 20 largest container shipping lines are members of one alliance or another in an effort to lower costs by sharing vessels.

The reason why those shipping lines keep seeking for this “cooperation” is in order to improve the service for customers. It is possible to provide more stable, frequent and flexible services with customers by making an alliance. At the same time, as many shipping liners are making an effort to deal with the over-capacity of fleet, they can decline the over-capacity with the improved efficiency. The container industry is already faced with oversupply problem, and it promotes shipping lines to form an alliance. Considering the circumstance that shipping industry is currently faced with, this can be referred to as an unavoidable trend in the market.

4.2.2 Changes in shipping loops, daily services and routes

As aforementioned above, the largest vessel size has nearly doubled during 10 years from 8,238 TEU to 16,020 TEU. However, the new container carriers which are ultra-large sized are only deployed on few routes, particularly Europe – Asia. In regard to the average number of companies, it has declined by 27 percent from 22 in 2004 to 16 in 2013. This tendency bears important implications for the competition level. Whereas the 16 shipping companies still provide shippers with sufficient services to ensure a competitive market with abundant choices, the decrease in competition has caused a monopolistic market situation by a small number of companies. For instance, 22 countries were served by fewer than 3 carriers in 2004, while 31 countries were faced with less appropriate situation. Even regarding the key East-West routes, analysts have shown the concerns that shippers will have difficulties being confronted with less choice due to the diminishing number of medium-sized carriers in the market. The carriers chose to use “larger-sized” ships in response to the growing demand, instead of deploying a large number of ships. Hence, while the average number of deployed ships per country has maintained nearly constant, the total capacity of container vessels went up by more than 80 percent. The weekly port call changes of alliance in 2014 are presented in the figure 14 below. The absence of this figure is Guangzhou, which explains, partially, Hong Kong’s loss of 15 calls.

Figure 14 Weekly port call changes of alliance in 2014: Asia

Port	CKYHE-AE		G6-TP		P3-AE/TP		Total		
	Old	New	Old	New	Old	New	Old	New	Change
Chiwan	-	-	3	-	13	17	16	17	1
Taipei	1	2	-	-	-	-	1	2	1
Tanjung Pelepas	6	4	-	-	14	17	20	21	1
Yokohama	-	-	4	5	5	5	9	10	1
Dachan Bay	-	-	3	2	-	-	3	2	-1
Dalian	1	1	-	-	5	4	6	5	-1
Kobe	-	-	4	3	2	2	6	5	-1
Sendai	-	-	1	-	-	-	1	-	-1
Tianjin	2	1	-	-	-	-	2	1	-1
Kwangyang	1	1	3	3	5	3	9	7	-2
Nagoya	-	-	5	3	2	2	7	5	-2
Shekou	3	2	-	-	1	0	4	2	-2
Xingang	-	-	1	1	6	4	7	5	-2
Singapore	13	10	3	3	20	20	36	33	-3
Tokyo	1	1	7	4	-	-	8	5	-3
Nansha	3	2	-	-	7	4	10	6	-4
Qingdao	5	4	4	2	11	9	20	15	-5
Yantian	11	8	7	6	27	26	45	40	-5
Busan	3	4	14	9	15	13	32	26	-6
Kaohsiung	6	4	9	5	4	4	19	13	-6
Ningbo	10	7	4	4	23	20	37	31	-6
Port Kelang	-	-	-	-	12	5	12	5	-7
Hong Kong	11	7	7	6	22	12	40	25	-15
Ports without changes	**20**	**18**	**15**	**15**	**41**	**43**	**76**	**76**	**0**
Grand total	**97**	**76**	**94**	**71**	**235**	**210**	**426**	**357**	**-69**

Sources: Alphaliner, Seaintel

It is very important for Busan Port to attract these shipping alliances and make them come to the Port. In terms of port selection, there are main criteria for ports to consider. First, ports should have the ability to handle ultra large container vessels (ULCVs) in the efficient manner. Second, they need to have quays with enough length and depth. Third, cranes are needed to be capable of spanning around 22 rows across deck. Fourth, container yards are necessary to be able to evacuate large container volumes to the hinterland, requiring well-connected intermodal transportation. Last, ports need to improve vessel turnaround time to allow carriers coordinate the better schedule.

4.3 Port aspect

Considering that non-operational matters like governance model, rules and regulations, institutional circumstances significantly affect the performance level of ports, a holistic view is needed to see through changes in the seaport sector and to implement the performance measurement.

The port market situation in Northeast Asia is becoming more and more competitive. The share of Northeast Asia, consisting of South Korea, China and Japan, in the global export increased from 16.9% in 2007 to 21.0% in 2012. This is remarkable improvement in the regional economic weight (UNCTAD, 2013).

Figure 15 World Trading Volume & Value Forecast

◆ **World Trading Volume & Value Forecast** (unit: USD 1Tril., 1 mil. TEU)

	2010	2011	2012	2013	2014	2015
Export Value	14.9	17.0	17.9	19.1	20.8	22.8
Container Volume	527	570	610	653	698	750
NE Asia	**201**	**221**	**241**	**263**	**286**	**314**
Weight (%)	38.1	38.8	39.5	40.3	41.0	41.8

(Source: The Economist, 2011 Apr. Drewry, 2010 Oct.)

The Chinese ports are implementing progressive policies to promote themselves to the world maritime industry. In this respect, neighboring countries are confronting new challenges and future does not seem bright. It is expected that Shanghai port will keep the crown in the long term according to the Port Competitive Appraisal based on geographical advantages, cost advantages, container volumes and supportive national policy. Neighboring ports would rather transform their strategies from current competition- and quantity-oriented policy to cooperation- and value-oriented policy. Based on this, it is necessary to examine port concession as a governance tool, the new role of Port Authority as a landlord, and global operators and commercial function of ports.

4.3.1 Port concession as a governance tool

Over the recent decades, port authorities have had dramatic changes in terms of the market power. Ports play take part in supply chains as important nodes, however, their role tend to be decided rather by big shipping lines and global terminal operators than by the port authorities. In this regard, the concession policy can be an effective governance tool. As a matter of fact, port authorities can make a difference based on diverse characteristics: price, duration of contract, total cargo throughput, value-added and investment prerequisites.

In many countries, it is currently believed that port services and operations based on the enterprise will allow more flexibility and efficiency towards the market. This can be achieved by the competition among the private entities, and the rapid response to consumers' demands. (Notteboom, 2006) Traditionally, ports have been playing their roles like a governmental department but now there is inflow of private capital making the higher productivity and the lower cost. This affects not only ports but also importers and exporters. In line with this new environment, it has become common practice to make a concession contract between a port and a private operator. A private operator can provide port services such as terminal operations or nautical services with this concession contract given by a government or a port authority.

According to Notteboom (2002), the port/terminal ownership and operations can be divided into four major types of combinations: (1) public/governmental ownership and public participation in operations; (2) public/governmental ownership and private participation in port/terminal construction, operations and management; (3) public/government ownership and private participation in superstructure installation and operations and (4) private ownership and operations. The model of Public Ownership and Private Operations (POPO) is widely used in many ports around the world. Under this model, a private terminal operator and a landlord port authority sign a concession contract.

As a matter of fact, concessions are regarded as a very efficient tool to cope with monopolies. As there is a tendency of ports to be more competitive, the role of the private sector in ports is expanding. The performance of public ports to respond to the rapid changes in the industry has been unsatisfactory. In line with this output, concessions are becoming more common in that they reduce the considerable operational risks and financial burdens of governments, and at the same time, allow governments to maintain vital ownership of the port land.

4.3.2 The new role of Port Authority as a landlord in modern ports

In line with demands for improvement in port efficiency, growing customer responsiveness, and lower costs to move cargo, there has been necessity to change the ways of doing business. In other words, the traditional way of operating ports does not respond to the market demands and challenges at a proper speed. In the current port environment, the concession, transferring port operations to the private sector, has become one of the key powerful tools for port authorities in terms of success in the port community. As a landlord, port authority can control the organization and optimize the use of land which is scarce resources.

The concession policies in many ports have dramatically changed as new legal guidelines were imposed by national or international legislation on the basis of market considerations. It is one type of means for landlord port authorities to increase port operating efficiency and land use, to promote fair competition in the cargo handling market, to improve their roles and functions as regulators, and strike a balance of potential information between port authorities and terminal operators (port services providers). Due to the continuous changes and dynamics in the port environment, port authorities constantly make an effort to evaluate the validity and effectiveness of their concession policies within the legal framework (Notteboom, 2006).

With the concession policies, the vertical and horizontal integration has occurred in the market and this requires landlord port authorities to reestablish their role in the competitive environment. The landlord port authority is an independent entity under public law by specific legislation with the capability to conclude contracts such as concession agreements. Nowadays in large and medium-sized ports, the landlord port is the leading and dominant port model.

4.3.3 Global operators and commercial function of ports

In 1990s, many major shipping lines or terminal operators bought terminals all over the world, while the number of smaller owners diminished. The term for a large scale of private terminal operator is global terminal operator (GTO). As the world trade volume considerably increased and larger ships have been introduced, there is a need for investment in terminal facilities and equipment. The rapid changes in terminal management environment require more innovative strategies from the leading terminal operators.

GTOs account for larger parts of supply chain in shipping industry, and offer integrated terminal systems with warehouse and distribution centers. Likewise, they develop the intermodal transport in order to enhance connectivity between ports and inlands. The efforts of operators for improving logistics facilitate the door-to-door movement and the efforts also contain the transformation of shipping companies into terminal operators. For instance, China Ocean Shipping Company (COSCO) or the Nippon Yusen Kabushiki Kaisha (NYK) used to be container carriers, but they expanded their business into terminal operators (Rossignol, 2007).

According to Drewry (2013), top 10 global terminal operators in 2013 are as follows: PSA International, Hutchison Port Holdings, APM Terminals, DP World, COSCO Group, Terminal Investment Limited (TIL), China Shipping Terminal Development, Hanjin, Evergreen, Eurogate from 1st to 10th. This is based on the market share of the operators in the world throughput. Drewry's Annual Review of Global Container Terminals Operators said that opportunities are growing in the emerging markets due to the expansion of global terminal operators. In 2013, the editor of Drewry said GTOs have different and various strategies and activity levels. Some operators are focusing on adding their portfolios while others are having little change. More merger and acquisition (M&A) is expected particularly in carrier owned portfolios. Plus, there are new aggressive players in the market, some of which are expected to qualify as global/international operators.

Figure 16 The ranking of global terminal operators (2012)

Ranking	Operator	Million TEU	% share of world throughput
1	PSA International	50.9	8.2%
2	Hutchison Port Holdings	44.8	7.2%
3	APM Terminals	33.7	5.4%
4	DP World	33.4	5.4%
5	COSCO Group	17.0	2.7%
6	Terminal Investment Limited (TIL)	13.5	2.2%
7	China Shipping Terminal Development	8.6	1.4%
8	Hanjin	7.8	1.3%
9	Evergreen	7.5	1.2%
10	Eurogate	6.5	1.0%

Source: Drewry Maritime Research

Over the last few decades, the power of port authorities has changed in many aspects. Ports play an important role as nodes in the modern logistics and the supply chains, however, their role tends to be decided by the major shipping lines and global operators. The main functions of ports are traffic and transport function. A port connects sea water mode and land mode as a nodal point in the traffic. In addition, ports have another industrial functions related to cargo flows, shipbuilding, or offshore supply.

Until the middle of the 19^{th} century, the functions of ports were mainly sea transport, overland transport and cargo handling. However, from the 1860s, the commercial function has become dominant. Another service industries such as banks or mercantile houses were included in commercial activities of ports. This functional shift led to exponential changes in the throughput in seaports. Ports represent both public and private goods. They generate private goods which are direct economic gains through operations, and public goods which are additional indirect gains.

4.4 Environmental aspect

4.4.1 Growing demand for environmental protection and regulations

Almost in every industry, the demand to protect environment from pollution has increased throughout the world. The port, shipping and maritime industry are not the exceptions. Due to the increasing volume of seaborne trade and the number of ships, the work of International Maritime Organization (IMO) became intensified. Therefore, the IMO set global environmental standards for international shipping and facilitates identical implementation throughout the world as the United Nations specialized agency responsible for the safety and security of ships and prevention of pollution from shipping.

With regard to environment, the Organization has adopted 21 treaties. One of the most important treaties is the International Convention for the Prevention of Pollution from Ships (MARPOL) which was adopted in 1973. A sixth Annex which entered into force in 2005 extended the domain of the MARPOL treaty to preventing air pollution and emissions from ships. It addresses air pollutants such as nitrogen oxide (NOx) and sulphur oxide (SOx). According to IMO’s second greenhouse gas emissions (GHGs) study (2009), CO2 emissions from the shipping accounted for 2.7% of total CO2 emissions that human induced in 2007. If there is no appropriate regulation for this, the emissions seemed to increase between 200% and 300% by 2050.

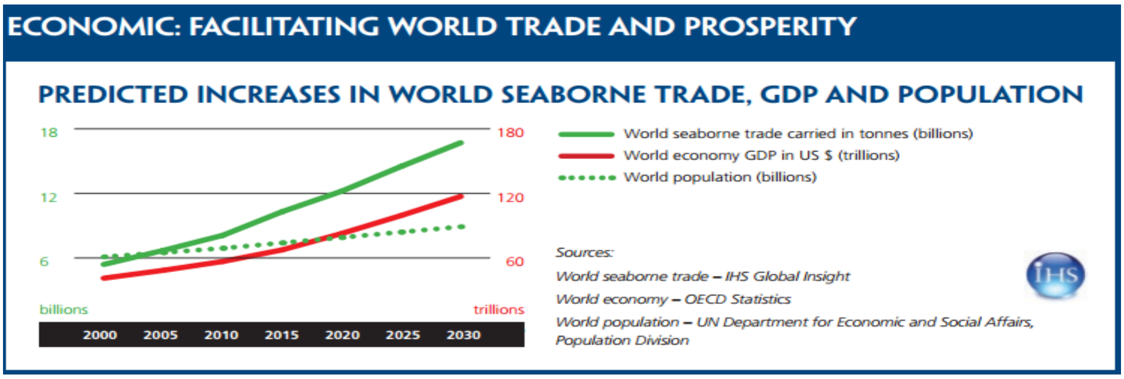
In response to this, IMO adopted technical and operational measures for an energy efficiency framework for ships under MARPOL Annex VI in 2011. Entering into force in January 2013, it is considered meaningful as the first global and legally binding CO2 reduction regime for international transport mode. This requirements include that new ships need to be constructed in accordance with mandatory design index, the Energy Efficiency Design Index (EEDI), with a minimum level of energy efficiency. Plus, the Ship Energy Efficiency Management Plan (SEEMP) became mandatory for all ships over 400 gross tonnage, and the Energy Efficiency Operational Indicator (EEOI) has been used as a monitoring or benchmarking tool to monitor ships and fleet efficiency performance.

4.4.2 Sustainable development in port and shipping

From the perspective of United Nations, sustainable development is comprised of three components: environmental, social and economic which are closely related to one another. The sustainable development is vital in both port and shipping industry. The theme of IMO World Maritime Day 2013 was 'Sustainable Development: IMO's Contribution beyond RIO+ 20.' As the environmental goals were agreed by the United Nations Summit, IMO is currently committed to setting up sustainable development goals for the international port and shipping industry.

The port and shipping industry play an important role in the world trade, facilitating the growth and economic development. Carrying about 90% of world trade, the volume of maritime trade is expected to grow more significantly in line with the continuous expansion of world population and economy. However, it is impossible to accomplish the sustainable development without cost efficient maritime transport. (International Chamber of Shipping, 2013)

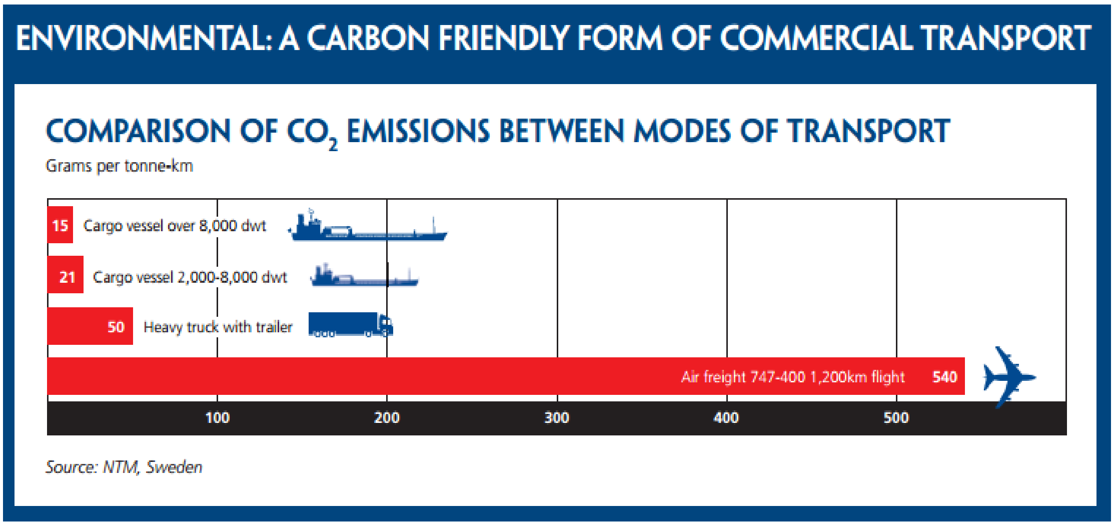
Figure 17 Facilitating world trade and prosperity



Source: International Chamber of Shipping

With the amendments to MARPOL Annex VI in 2013, the shipping is the only major industrial sector which has a binding global agreement to reduce CO2 emissions. In addition, as this includes the Energy Efficiency Design Index (EEDI) to new ships and the Ship Energy Efficiency Management Plan (SEEMP) to existing ships, it is expected to reduce CO2 emissions per ton of cargo effectively. In terms of impact of sulphur emissions on the environment, the shipping industry is currently switching from heavy fuel oil to low sulphur fuel to comply with MARPOL Annex VI.

Figure 18 A carbon friendly form of commercial transport



Besides, there are other efforts for sustainable development: ship recycling and ballast water treatment. The shipping industry prepares for the early entry into force of the IMO Convention for the Safe and Environmentally Sound Recycling of Ships. It is expected to develop safety and environmental standards in ship recycling yards, and impose obligatory requirements on ships. Next, the industry is also supporting the entry into force of the IMO Ballast water Management Convention. The objective is to deal with the possible damage that can be caused by the unwanted movement of invasive species to local marine ecosystems.

4.4.3 The New Green policies and regulations in South Korea

The Korean government set up basic plans to build a Green port which is efficient in energy consumption and low in carbon emissions by using new and renewable energy sources in port. The objective of reduction is approximately 30% compared to BAU (Business As Usual) by 2020. It is also aiming at enhancing safety against the climate change, and establishing the resource recycling port system. In this regard, Marine wind-power project was implemented in July 2009 which is the study in selecting the appropriate site in port to provide the sufficient wind energy. This project includes the substitution of old cranes powered by diesel to new ones powered by electricity, which can cut carbon emissions in ports.

When it comes to the modal shift, the government has been struggling to reform the logistics system in Korea to reduce the emission of CO_2 and to increase the independency of fuel energy. Korea is mainly dependent on road transport in freight transportation. The road is accounting for 92% of land freight transport in South Korea, while the railway is 8%. There has been an effort to increase the railway transport volume from 8% to 20% of land transport.

Plus, terminals in Busan Port make an effort from the environmental perspective. For example, HPNT (Hyundai Pusan Newport Terminal) introduced the automated transfer crane (ATC) to comply with the environmental regulations, instead of using engine-driven rubber-tired gantry crane (RTGC). It can minimize the use of fuel oil, subsequently reducing fuel consumption in the terminal. According to HPNT, carbon dioxide emissions reduced by up to 64.4% within this system. The roofs of terminal gates are equipped with the solar energy system, enabling nearly 5 percent of all electricity used to come from this solar energy. Based on these facts, it is possible to say that South Korea is also implementing new green policies in an effort to keep pace with the world maritime industry.

5 Assessment of Evaluation

In the previous chapters, the current status of Busan Port is given including facilities, scheme, and detailed information on concession contracts. Additionally, ongoing and expected changes in the market are presented in the wake of new shipping alliances. There are various factors influencing port performance and efficiency. In order to diagnose the weaknesses in the Busan Port and respond to new changes in advance, I propose to use Data Envelopment Analysis (DEA) approach to estimate the efficiency of container terminals in Busan Port. This chapter is divided as follows. The principles of methodology used, which is DEA, are explained. Next, the application of the tool in container terminals in Busan Port is presented. Through this process, it is feasible to evaluate the concession contracts in Busan Port and suggest corresponding improved marketing strategies and plans in the following chapter.

5.1 Data Envelopment Analysis (DEA)

For the recent decades, Data Envelopment Analysis (DEA) has been a very useful methodology to estimate the efficiencies both in the public and the private sector. DEA can be used to measure the relative efficiencies of units as a statistical methodology. This technique is useful when simple efficiency measures are difficult to attain as it can manage multiple inputs and outputs. In this dissertation, a set of inputs and outputs of each terminal in Busan Port are compared to among another based on the same criteria. In general, the units in DEA assessment have the characteristics of homogeneity and independence. Therefore, when a large number of units provide an 'identical' service in the relative isolation, this assessment can be most useful.

Prior to applying DEA, it is essential to understand the concept of efficiency and production because this methodology is based on the notion of the relative efficiency. First of all, the process of production can be described as converting certain inputs into outputs. In production, according to Farrell (1957), there are two different concepts of efficiency which are technical and allocative. Technical efficiency is the synonym of productive efficiency, which is converting physical inputs to outputs. Allocative efficiency is the concept of combining inputs and outputs in optimal ratio in line with the dominant prices to achieve minimization of production costs.

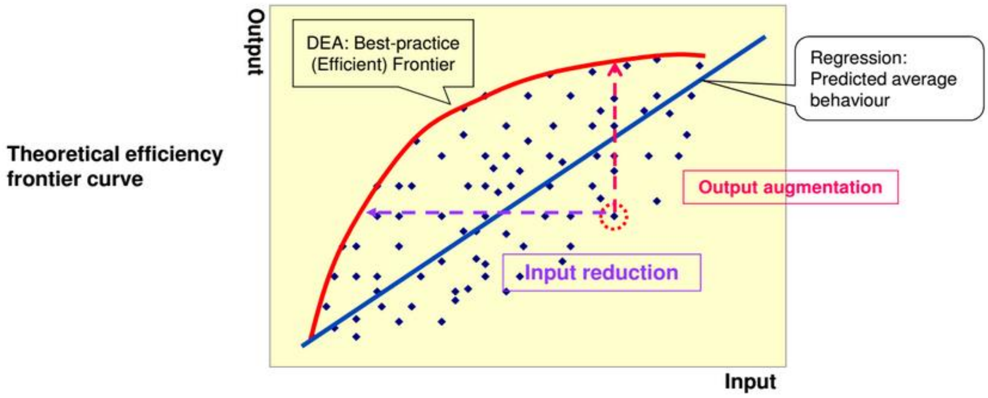
Ports are characterized by a list of performance outputs, types and the degree of port services. Outputs can vary according to the status and characteristics of each port:

total cargo throughput, level of services, the number of ship calls, revenue, total TEUs and container throughput etc. It is certain that a variety of inputs are necessary in order to produce these kinds of outputs. In fact, port efficiency is affected by diverse additional factors such as the degree of technology applied in a port, the level of cooperation with other relevant organizations, the attribute of port ownership and the way of application in operating a port. This complicated property of factors influencing port performance may make it difficult to assess efficiency.

Charnes, Cooper and Rhodes introduced the DEA for the first time in 1978 and the method was called CCR model. Based on the theory of Farrell, it uses a non-parametric technique and mathematical programming for rating efficiency. By using the concept of constant returns to scale (CRS), the CCR model assesses relative productive efficiencies of decision making units (DMUs) with multiple inputs and outputs. When it comes to DEA, the concept of DMU is important because it is a method for comparative efficiency analysis. This method is a mathematical technique based on observed practice in comparable DMUs. The construction of hypothetical composite of DMUs is a key element, and certain assumptions in regard to the technical production relationships

Sometimes called ‘Frontier Analysis,’ DEA is a performance measurement technique for evaluating the relative efficiency of DMUs. When weighted sum of outputs are divided by weighted sum of inputs, efficiency can be calculated. In general, inputs tend to be minimized and outputs to be maximized respectively. A relative efficiency depends on three types of efficiencies: technical efficiency presenting the ability of an organization to obtain maximal output from a given set of inputs, allocative efficiency presenting the ability of an organization to use the inputs in optimal proportions, given their respective prices and scale efficiency presenting whether the size of the unit is optimal or not. DEA examines a unit of production in comparison with other units in order to measure the efficiency of a unit. Regression technique requires a specific functional relationship between inputs and outputs, while DEA does not need that kind of information.

Figure 19 Theoretical efficiency frontier curve



Source: The lecture sources of Professor Daniel Moon (WMU)

DMUs can be divided into two categories, which are efficient and inefficient DMUs. In this respect, the DEA frontiers can be attained by connecting the efficient DMUs and this produces a piecewise linear DEA frontier. A point which is between two efficient DMUs is called convex combination of those two DMUs. Therefore, with convex combinations of efficient DMUs, the DEA frontier can be obtained. A DMU is a discrete unit that has flexibility with regard to some of decisions it makes, but does not necessarily accomplish freedom regarding these decisions.

For port operators, the efficiency appraisals are strong tool and should be used as an important starting point both for regional and national studies of port operation. Amongst various models of DEA, the author uses input-oriented CCR and BCC models to analyze operating efficiency of Busan Port in this study.

CCR model and BCC model

Among various DEA models, the CCR and BCC models are most widely used. The CCR stands for Charnes, Cooper and Rhodes who formalized the DEA model for the first time in 1978. The BCC The critical aspect differentiating the two models is the different assumption for returns to scale (RTS). As a matter of fact, while the CCR model has constant returns to scale (CRS frontier), the BCC model assumes variable returns to scale (VRS). In CRS, if there is any change in inputs (resources), it can lead to proportional change in outputs (products). DEA models can be divided into two fundamental directions: one is input-oriented direction to minimize inputs for a certain level of output, and the other is output-oriented direction to maximize outputs for a certain level of output.

In the DEA-CCR model, the efficiency is determined by making the ratio optimal between the outputs and inputs. With multiple resources (inputs) and multiple products (outputs), the DEA-CCR model is considered a multidimensional model constructing a non-parametric, piecewise linear surface, involving data. DEA is a non-parametric method assuming that inputs and outputs do not have predetermined functional relationship. Besides, DEA is different from parametric tools like regression analysis in that it does not neglect outlier DMUs. Regression analysis requires a specified functional relationship between inputs and outputs, while DEA does not require such a *priori* information.

Therefore, DEA is not a central tendency methodology (Cooper, 2007). Each DMU holds outliers as an efficiency measure because DEA regards that the produced maximum was attained by observing most productive units (Spares. 2005). Charnes, Cooper and Rhodes developed the measurement for technical efficiency, extending Farrell's work of 1957.

In DEA models, *n* productive units (DMU_s) are evaluated in which a DMU has *m* different inputs in order to produce *s* different outputs. The fundamental nature of DEA in measuring the efficiency of a DMU is maximizing its efficiency rate. However, the rate of any units must not be greater than 1. Plus, the weights of inputs and outputs must be greater than zero. These characteristics can be defined as linear divisive programming model:

Maximize $$\frac{\sum_i u_i y_{iq}}{\sum_j v_j x_{jq}} \quad (1)$$

Subject to $$\frac{\sum_i u_i y_{ik}}{\sum_j v_j x_{jk}} \leq 1 \quad k = 1, 2, ..., n$$

$$u_i \geq \in \qquad i = 1, 2, \dots, s$$

$$v_j \leq \in \qquad j = 1, 2, \dots, m$$

This model can be transformed into another model which is a linear programming one, and converted into a matrix as follows:

$$\text{Maximize} \quad z = u^T Y_q \qquad (2)$$

$$\text{Subject to} \quad v^T X_q = 1$$

$$u^T Y - v^T X \leq 0$$

$$u \geq \in$$

$$v \leq \in$$

Model (2) is called CCR model and assumes returns to scale. However, variable returns to scale (VRS) can also be considered in analyzing efficiency. When VRS is included with a condition of convexity $e^T\lambda = 1$, it becomes the BCC model. In other words, the BCC model stands for the extended CCR model by Banker, Charnes and Cooper in 1984. The result generated from the BCC model is pure technical efficiency, while the one from the CCR model is the combined measurement of technical and scale efficiency.

5.2 Application of DEA in Busan Port

In this study, the efficiency of each container terminal in Busan Port is measured with the data envelopment analysis (DEA). There are 4 container terminals in North port, and 5 terminals in Busan New Port. By taking multiple inputs and outputs into consideration, DEA methodology can find out the current status and drawbacks of container terminals in Busan Port, and eventually suggest appropriate marketing strategies which can intensify the strengths and make up for the weaknesses. Identified inputs and outputs are taken from the Port Operation team of Busan Port Authority, which is the author belongs to and work for.

5.2.1 Empirical Analysis

In this study, the DEA model is used to analyze the efficiency of container terminals in Busan Port. DMUs consist of 9 container terminals, 4 (HBCT, KBCT, BIT, DPCT) in North Harbor and 5 (PNIT, PNC, HJNC, HPNT, BNCT) in Busan New Port. Selected DMUs are appropriate for this analysis because they are all container terminals with the similar level of facilities and infrastructure. Plus, the selection of inputs and output is very important as it significantly affects the validity of the model. According to Nyhan and Martin (1999), in order to maximize the discrimination power of the model, the cautious attention and selection of inputs and outputs are required.

Chosen inputs are 1) berth length, 2) container quay cranes, 3) total area, 4) manpower, 5) water depth and 6) loading/unloading capacity of each terminal. The berth length, total area, water depth are key elements in the terminal infrastructure, and container cranes and manpower are the main factors which can indicate the scale of terminal.

Selected outputs are container throughput (TEU) in 2013 and revenue in 2013. The container throughput is one of the most important indexes of competitiveness and the source of ranking container ports every year. Secondly, the revenue can be used to demonstrate the financial accomplishment and performance of the entity. Therefore, container throughput and revenue in 2013 are selected as outputs considering its representativeness and importance. The reason of choosing the data in the year of 2013 is that Busan Port recorded the highest throughput (17.04 million TEUs) in that year since opening, and as it is the latest year, it can show the most up to date status of Busan Port.

The container cargo volume of each terminal is taken from the internal sources of Busan Port Authority, and the revenue data from the official website of Data Analysis, Retrieval and Transfer System (DART, url://dart.fss.or.kr) in South Korea. The descriptive statistics of variables are shown in the table below.

Table 2 Descriptive statistics of variables

Input variables	**Minimum**	**Maximum**	**Mean**	**Standard deviation**
Berth length (m)	826	2,000	1,335.9	327.3
Container quay cranes (no.)	7	19	12.4	3.3
Total area (㎡)	308,000	1,210,000	755,749.9	262,369.7
Manpower (no.)	345	640	493.7	99.7
Water depth (m)	15	18	16.2	1.1
Loading/unloading capacity (TEU)	780,000	2,730,000	1,661,111.1	516,682.8

5.2.2 Efficiency Analysis

The results of applying input-oriented CCR and BCC model are shown in the tables below.

Figure 20 Input-oriented CRS efficiency

DMU No.	DMU Name	Input-Oriented CRS Efficiency	Sum of lambdas	RTS	Optimal Lambdas with Benchmarks					
1	HBCT	0.71093	0.502	Increasing	0.189	PNC	0.313	HJNC		
2	KBCT	0.66633	0.613	Increasing	0.311	PNC	0.241	HJNC	0.060	HPNT
3	BIT	0.68669	0.587	Increasing	0.072	PNC	0.316	HJNC	0.199	HPNT
4	DPCT	0.88567	0.432	Increasing	0.432	HPNT				
5	PNIT	0.84792	0.731	Increasing	0.120	HJNC	0.611	HPNT		
6	PNC	1.00000	1.000	Constant	1.000	PNC				
7	HJNC	1.00000	1.000	Constant	1.000	HJNC				
8	HPNT	1.00000	1.000	Constant	1.000	HPNT				
9	BNCT	0.54051	0.397	Increasing	0.168	PNC	0.229	HJNC		

First, according to the results of CCR model, 3 terminals which are PNC, HJNC, HPNT, show the efficiency of 1. In BCC model, those 3 terminals and HBCT, BIT, DPCT are equivalent to the efficiency of 1. Based on the results from two different models, it can be concluded that 6 terminals are efficiently operated. On the other hand, the rest 3 terminals, KBCT, PNIT, BNCT which efficiency is smaller than 1 are relatively inefficient compared with efficient terminals which are on the efficiency frontier. However, by running DEA model, it is possible to attain not only the degree of efficiency but also reference sets to benchmark for inefficient DMUs. For example, HBCT has 2 reference sets for benchmarking which are PNC and HJNC, while KBCT has 3 reference sets which are PNC, HJNC and HPNT.

Figure 21 Input-oriented VRS efficiency

DMU No.	DMU Name	Input-Oriented VRS Efficiency	Optimal Lambdas with Benchmarks							
1	HBCT	1.00000	1.000	HBCT						
2	KBCT	0.96249	0.221	HBCT	0.428	BIT	0.151	DPCT	0.200	PNC
3	BIT	1.00000	1.000	BIT						
4	DPCT	1.00000	1.000	DPCT						
5	PNIT	0.98248	0.640	DPCT	0.248	PNC	0.111	HPNT		
6	PNC	1.00000	1.000	PNC						
7	HJNC	1.00000	1.000	HJNC						
8	HPNT	1.00000	1.000	HPNT						
9	BNCT	0.88235	0.242	HBCT	0.758	DPCT				

There are several outstanding characteristics from the results. First, BNCT shows relatively the lowest efficiency both in CCR (0.54051) and BCC (0.88235). As benchmarks, this terminal has PNC and HJNC in CCR, and HBCT and DPCT in

BCC. Secondly, among inefficient terminals, the lowest efficiency terminal is BNCT followed by KBCT in both models. Lastly, there are three terminals of efficiency 1 in CCR model, while there are six ones in BCC model. In other words, HBCT, BIT and DPCT are not efficient DMUs in CCR model with increasing return to scale (RTS).

5.2.3 Evaluation of Concession contracts

Based on the results and efficiency rates from analysis, it is possible to evaluate the concession contracts in Busan Port. As 6 container terminals show the efficiency of 1 in either CCR or BCC model, the concession contracts of those terminals are successful in terms of private participation in the public sector. Moreover, it is necessary to be aware that 2 terminals – PNC and BNCT – are private terminals without concession contracts. However, it does not mean that the rest 3 terminals with the lower efficiency are not successful because DEA methodology can only generate the "relative" efficiency of units. Therefore, in the wake of new shipping alliances, Busan Port Authority needs to strengthen the advantageous factors and compensate for weakness revealed from the analysis result. In this regard, marketing strategy and plan are presented in the following chapter.

6 Marketing Strategy and Plan for Busan Port

In the wake of newly formed shipping alliance, it is essential to improve marketing strategy of Busan Port. According to the results of analysis above, setting up new strategies is significant for Busan Port Authority. In this respect, the author would like to suggest 4 specific strategy and plan to make fruitful progress: organizing the port days, arranging an international press day, being a speaker at a conference and attending Facilitation (FAL) Committee at IMO.

6.1 Organizing the port days

It can be effective to "organize the port days" as a host. For example, Denmark holds 'Danish Maritime Days' with the objective of finding new solutions to the important challenges that the maritime industry is facing now and in the future. This event is a public-private partnership between Danish Maritime, the Danish Maritime Authority and the Danish Ship owners' Association. This type of governance makes it possible to cooperate with each other in the effective manner as stakeholders are from both public and private sector. Danish Maritime Days include conferences, exhibitions, receptions and briefings and cover new issues like Arctic shipping, advanced technologies, changes in international trade and development and offshore shipping. It is an annual event functioning as a platform to all stakeholders in the industry.

Similarly, 'Singapore Maritime Week (SMW)' is another leading event in the maritime industry, driven by the Maritime and Port Authority of Singapore (MPA). It consists of conferences, exhibitions, dialogues, and social events to celebrate all pleasant maritime things which are organized by MPA, the research and educational institutions. Since the inauguration in 2006, SMW has become bigger in size and more important by inviting participants from all over the world. Prominent speakers can share their opinions on current issues in the field, and this event provides an opportunity to discuss a good range of topics with maritime decision makers. Besides, this type of maritime event can promote and advertise its port within one place in a short time.

According to UNCTAD (1995), hosting a port day has a number of advantages as follows:

1) People come to an event to meet only delegations, while in a fair, visitors can feel tired with too many people and companies' booth;

2) Participants show their interests in the port's message by showing up in the event;

3) The port presentation in the event is more effective than the one in a fair with a broader view;

4) The atmosphere and the contact in person during the session can create confidence in the port;

5) With invitations, it is possible to select the public personally;

6) Organizing a port day in a certain region can show efforts of the port to meet business people of that region.

6.2 Arranging an International press day

The international press has powerful impacts. UNCTAD said that a port can organize an international press day by inviting representatives of specialized maritime magazines and papers. The travel and accommodation expenses are paid by press day organizer, a port. First of all, a port can give a general speech explaining the key changes in the port, the expected results and the prepared plans. After that, question periods are given to the audience. In principle, the representative of port community can be categorized into 4 groups: forwarders, stevedores, shipping agents and port authority. The journalists can submit questions beforehand as well as on site. After the press conference is over, a visit can be paid to one of specialized agencies or newly built facilities.

If this sort of international press day can be settled as an annual event, the journalists can keep it mind that the press day will be held for a certain period of time and arrange the schedule for that in advance. In addition, the journalists and representatives of papers will enjoy because they can meet each other on a regular basis, with the expectation of sharing information and insights on maritime issues. It is a unique occasion to have a conversation with the port community, shipping experts and relevant colleagues from the same field.

6.3 Being a Speaker at a conference

By taking part in different regions' conference as a speaker, it is possible to widen the perspective towards the world and build up further knowledge of the other regions. As a matter of fact, Busan Port Authority sent a speaker to European Sea Ports

Organization conference in May 2014 held in Gothenburg, Sweden. The original participants of the conference are from Europe's major ports, and the mission is to influence public policy in the European Union (EU). The main objective of the conference is to accomplish a safe, efficient and sustainable European port sector by functioning as a vital element of a transport industry. However, as BPA participated in the conference as one of speakers and gave a speech, it triggered much interest from the audience in the region. It is clear that the speech promoted Busan Port in a very effective way within a short time, in one place by introducing the development and improvement of the Port.

Furthermore, it is necessary to continuously send a speaker on behalf of BPA to an international conference not only in the same Asian region but also in the other region like Europe or America. As one of top container ports in the world, the outstanding statistics and outputs such total TEU can catch eyes of important decision makers in the maritime industry.

6.4 Attending Facilitation (FAL) Committee at IMO

Among various works of International Maritime Organization, Convention on Facilitation of International Maritime Traffic (FAL Convention) was adopted in 1965. The main objective of this Convention is to accomplish the most efficient maritime transport, seeking after the smooth transit of ships, cargo and passengers in port. As the attendance of the FAL Committee is open to all member states of IMO, Busan Port Authority can express its own opinions on the agenda. By attending FAL Committee as delegation, it is possible to hear other nations' voices and build up new or advanced strategies for marketing.

Originally, the purpose of the Convention is to facilitate maritime transport by reducing paper work and simplifying formalities. It includes the simplification of documentary requirements and procedures related to the arrival and departure of ships in ports. Therefore, it is possible to say that FAL Convention and a port authority are closely related to each other. According to IMO, 115 governments are contracting to the FAL Convention and those combined merchant fleets account for approximately 90.77% in the world's fleet by tonnage. Considering this in mind, attending the conference or meetings of FAL Committee should be considered as a new approach for strategic progress.

6.5 Superior logistics services at Busan Port

Busan Port serves as an international business-related complex specializing in the logistics, distribution and shipping industries. As a matter of fact, Busan New Port Development Project is one of the main projects ongoing in Busan Port, aiming to become the hub of international logistics and leading transshipment port in the Northeast Asia. With the harmonized cooperation with the municipality and central government, the project will be completed by 2020 containing 45 berths, 11 million m^2 yard and hinterland. Through this project, it is expected that logistics cost will reduce and the competitiveness as a gateway port will enhance.

Plus, as the part of Busan New Port (8.08 km^2 of the total 11.1 km^2) was designated as a Free Trade Zone (FTZ), foreign logistics companies in this district can be given the land by paying affordable price and the exemption of import tariffs. Furthermore, Busan Port has an optimal logistics environment with the excellent infrastructure which is connected to an airport, railways and roads altogether. In terms of the port selection, this sort of connectivity is very important for shipping lines. With these advantageous conditions, Busan Port can provide shipping companies with superior logistics services.

As a matter of fact, the hinterland condition plays an important role in a port's competitiveness. In general, hinterland condition includes several factors: professionals and skillful labor forces in operating ports, scale and activity of FTZ in port hinterland, volume of total container throughput. Busan Port has a huge hinterland covering the logistics nodes in South Korea, and this condition has a positive impact on the total container throughput of the Port.

6.6 Strategic plan based on the Gravity model

In transport geography, a spatial interaction mean flows between locations. In other words, it is a realized movement of cargo, passenger or information between an original place and a destination. This enables estimate the demand for transport services. As economic activities generate (supply) and attract (demand) flows, a movement occurs between two or more different places.

Among the spatial interaction methods, the gravity model is the most common formulation. The name of the model came from Newton's law of gravity because it has the similar formulation. This has been applied a wide range of contexts like commodity flows, traffic flows, and evaluation of market boundaries. In transport and regional planning, this gravity model can be used to find accurate parameters for spatial interaction models. Once this model is utilized for a port, it can be applied to simulate and predict additional flows. For example, if the better transport infrastructures were provided, it is possible to estimate how many additional container cargoes would be generated.

When Busan Port applies for the gravity model in its port planning, the estimation and prediction can be closer to the reality in the long term. This sort of model or methodology can play a key role in enhancing and improving strategic marketing plan of Busan Port Authority. Therefore, the effort to apply a wide variety of models or techniques should be continued corresponding to the market changes.

7 Conclusions

Busan Port has been taking the lead in the Northeast Asian regions for the recent decades as a transshipment hub port. With the advantageous location and advanced infrastructure, it has continuously recorded increasing container throughput despite the downturn in the world economy. However, the changes such as the new formation of shipping alliances are expected in the market and the competition between international ports is becoming more severe. In this respect, now is the time to assess the current performances of Busan Port and look into how efficiently the Port is operated in concession contracts scheme.

Busan Port has 9 container terminals, 4 in the North Port and 5 in the Busan New Port. The concession contract is described as an effective governance tool for a port authority. The participation of the private sector (terminal operators) in the public sector (port) is more common phenomenon than the past days. In this regard, the role of a port authority as a landlord is also becoming more significant than before. With the scarce resources (land), it is critical to operate container terminals in the efficient manners.

In order to respond to the wake of new shipping alliances and dominant model of port governance, the author suggests the evaluation of concession contracts in Busan Port. The concession contracts can be assessed based on the efficiency measured by the specific technique. For the measurement, the author uses the data envelopment analysis (DEA) model in this study. In details, Charnes, Cooper and Rhodes (CCR) and Banker, Charnes and Cooper (BCC) models are applied for the analysis. By applying these models, a total of 6 container terminals are concluded as efficient ones with efficiency of 1: PNC, HJNC, HPNT, HBCT, BIT and DPCT. Based on the result, it is possible to say that concession contracts between these terminal operators and Busan Port Authority (BPA) is successful in terms of efficiency.

However, the rest 3 terminal operators also show certain amount of efficiency, which is just lower than 1 and not zero. Bearing this in mind, BPA needs to enhance the marketing strategy and plan for the promising future. Plus, the result can be very useful when making a concession contract with other terminal operators in the future.

In particular, as the shipping alliances like 2M, CKYHE and G6 significantly affect the performance of ports, the strategic approach is necessary to take the lead in the market. The routes, loops and pattern of voyage will change according to the change of merchant fleets. The changes in the market have been analyzed in terms of trade-related, shipping, port and environmental aspects in the previous chapters. In this regard, the author presents the new sight for the marketing strategy for BPA. The contents are mainly based on the port marketing tools of UNCTAD, however, not all of them have been tried in Busan Port.

Therefore, with organizing the port days, arranging an international press day, being a speaker at a conference and attending Facilitation Committee conference can be new approaches for BPA. These strategies are all from the perspective of widening and broadening views of the organization.

The port and shipping industry is affected by various factors such as the world economy and the trade pattern. Even if there is cyclical tendency in the market, it is sometimes an unexpected thing which can cause significant effects. In order to survive this competitive and unpredictable market, it is critical to analyze the trends and tendency. If a port complies with the conventions and regulations of IMO in the correct way, and cooperates with other ports, it is possible to solve the problems in the effective way. Plus, it is very important to communicate with shipping lines on a regular basis to respond to their needs and demands.

Through the DEA methodology, the author presents that concession contracts in Busan Port tends to be successful as the efficiency of 1 is shown in 6 out of 9 container terminals in the Port. There have been good opportunities for Busan Port so far, and it is expected that the Port will keep playing an important role in the maritime industry in the future as a leading hub port in the Northeast Asia.

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