

## Comparative Analysis of Container Terminals in Northern Vietnam, 2005-2014

† Duc Minh Nguyen · Sung-june Kim\*

† Graduate school of Mokpo National Maritime University, Mokpo 530-729, Korea

\* Assistant professor of Mokpo National Maritime University, Mokpo 530-729, Korea

**Abstract** : Sea-ports in Northern Vietnam have experienced a rapid growth of container throughput in recent years. To accompany with such development, huge investment also has been performed to enhance not only local port capacity but also the regional logistics system. Container terminals in Northern Vietnam locate centrally along Cam river of Haiphong city, leaving 2 others in Quang Ninh province. Five out of totally 11 container terminals in the area are under the control of Vinalines - a national corporation in field of maritime industry. In this paper, those terminals are classified in terms of location and ownership. The volume of container throughput and facilities of all container terminals in Northern Vietnam from 2005 to 2014 are recorded in order to compare the performance of groups. A Data Envelopment Analysis (DEA) is then applied to evaluate the relative efficiency of such terminals. Before conclusion, number of suggestions will be contributed to related parties.

**Key words** : Northern Vietnam, container terminals, DEA, relative efficiency, performance

### 1. Introduction

Vietnam, an impressive developing economy and a market of 90 million people, has become a potential place for investment. The country's GDP has presented a gradual growth from 6.4 billion USD in 1990 to 171.4 billion USD in 2013, with the average annual growing rates of 6% (Worldbank, 2015). In the aspect of international trade, Vietnam also recorded excellent achievement with the total of import and export increased significantly in the same period.

As a result, Vietnam container port throughput doubled the figure from 2002 to 2012, surpassed Malaysia and kept up with the trend of ASEAN economy (CY Tung, 2014). However, the global economic recession in 2008 has considerably impacted the performance of Vietnam's sea-ports. The growing rates of Vietnam Ports Association (VPA) sea-ports' cargo throughput declined from 19% in 2008 to 4% in 2011, in which, containerized commodities growing rates was only 8%, compared with 18% one year earlier (VPA, 2015).

Container terminals in Northern Vietnam is not an exception in the general situation of the country's port industry. Vinalines, a national corporation which dominated the market for decades continuously, presents a down trend

of it's market share. Rising number of players and slowing down of throughput growing rates harden the competitiveness in the area. Terminals operators, owners and local authorities, therefore, require a comparative analysis which address position of players on the market, highlight major issues in order to develop port industry and logistics system of the region. The purposes of this paper is to reveal the current situation of container terminals in Northern Vietnam, and to classify them into groups according to location and ownership before comparing their general performance and efficiency. Number of suggestions will be then contributed to help related parties determine strategic decisions.

### 2. Overview of Container Port Industry in Northern Vietnam

Vietnam's sea-ports are divided into 6 groups according to the ports location: the Northern sea-ports from Quang Ninh to Ninh Binh province, the North-Central sea-ports from Thanh Hoa to Ha Tinh province, the Central sea-ports from Quang Binh to Quang Ngai province, the South-Central Sea-ports from Binh Dinh to Binh Thuan province, the South-Eastern sea-ports and sea-ports in Mekong Delta. (Decision 1037/QD-TTg, 2014)

† Author : ducnguyen@vamaru.edu.vn

\* Corresponding Author, s-junekim@daum.net 061)240-7352

Note) This paper was presented on the subject of "A DEA analysis on container terminals in Northern Vietnam, 2005-2014" in 2015 Joint Conference KINPR proceedings(Korea Maritime and Ocean University, 9th July, 2015, pp. 165-166).

Sea-ports in the Southern Vietnam are responsible for 66% of the country’s total throughput while the Northern ones account for only 30%. The container terminals in Northern Vietnam centralize in Quang Ninh province and Hai Phong city.

In 2005, there were only 5 container terminals in the region with the total throughput of nearly 700,000 TEUs. At that time, Haiphong Port Company (HPC), a Vinalines’ subsidiary, operated 1 container terminal named Chua Ve. From 2007 to 2012, 6 new terminals continuously presented in the area. HPC also began operating another container terminal named Tan Vu. The details are described in the Table 1.

Table 1 List of container terminals in Northern Vietnam

No	Terminals	Location	Time of operating	Ownership
1	Quang Ninh	Quang Ninh	2000	Vinalines
2	CICT	Quang Ninh	2012	Vinalines
3	Hai Phong	Haiphong	2000	Vinalines
4	Transvina	Haiphong	2005	Other
5	Doan Xa	Haiphong	2002	Vinalines
6	Green Port	Haiphong	2003	Other
7	Dinh Vu	Haiphong	2007	Vinalines
8	Nam Hai	Haiphong	2009	Other
9	Hai An	Haiphong	2011	Other
10	PTSC Dinh Vu	Haiphong	2011	Other
11	Tan Cang	Haiphong	2013	Other

Sai Gon Newport Corporation, the Vietnamese leading company in port operation which accounts for 85% of export container in South of the nation, also opened 2 container terminals in Haiphong city. The 2014 total container throughput in the area rocketed about 550% compared with the figure in 2005, reaching nearly 4 million TEUs. Currently, there are 11 container terminals in Northern Vietnam, including 2 in Quang Ninh province and all others in Haiphong city.

All container terminals in Haiphong city locate along the Cam River which connects the city center to Gulf of Tonkin. Old terminals, which started operation before 2005, including HPC, Doan Xa, Transvina and Green Port locate deep inside the river where channel is narrow and depth is limited. Later, with the presentation of Dinh Vu industrial zone and convenient road transportation, new born terminals including Dinh Vu, Nam Hai, Hai An, PTSC Dinh Vu, Tan Cang are located leading to the river mouth.



Fig.1 (a) Cam River



Fig.1 (b) Map of Haiphong

To compare with the two in Quang Ninh province, container terminals in Haiphong city have advantages of transport and hinterland connection. One in Haiphong are well connected by road, railroad to Hanoi and close to Cat Bi airport. Up to 2017, number of projects to improve local logistics infrastructure including project of upgrading Cat Bi domestic airport to be an international one or project of Dinh Vu industrial and economic zone or series of plans to expand roads linking ports to other cities are expected to complete. Lach Huyen deep water sea-port which is designed to accommodate 8,000 TEU vessel is also planned to begin operation in the near future.

The business environment in Northern Vietnam, therefore, will be much more dynamic and open for every player. The container throughput in the area will continue

growing but increasing competition will come along. Only ones having suitable strategies and efficient operation can make profit.

### 3. Comparative Analysis of Container Terminals in Northern Vietnam

The volume of container throughput and major facilities of the terminals from 2005 to 2014 are shown in Table 2 and Figure 2.

Table 2 Container throughput of terminals in Northern Vietnam from 2005 to 2014 (thousand TEUs)

No	Terminals	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
1	QuangNinh	118	113	34	33	185	204	260	240	28	29
2	HaiPhong	398	463	683	808	816	953	1018	964	1,040	1,000
3	DoanXa	75	96	120	172	250	219	227	244	237	214
4	CICT								72	88	102
5	DinhVu			131	232	359	399	439	455	516	574
6	NamHai					155	210	313	232	252	482
7	Greenport	36	77	118	128	319	335	373	396	347	360
8	Transvina	55	117	106	134	152	159	127	104	78	57
9	PTSC							76	155	241	271
10	HaiAn							110	183	277	309
11	TanCang									130	190

During this period, the number of berth and berth length doubled the figure while total area of container yard (CY) increased three times from about 470,000 to 1,600,000 m<sup>2</sup>. HPC is the leading player in term of both throughput and the number of major facilities.



Fig. 2 Changes in major facilities of all terminals

The overall trend of throughput is upward but there are still some exception: the two terminals in Quang Ninh

province. Quang Ninh terminal's throughput increased gradually from 118,000 TEUs in 2005 to 260,000 TEUs in 2011 before a down turn to 240,000 TEUs one year later.

During this period, there was a sharp drop in 2007 and 2008 due to accident of two cranes destroyed by hurricane. However, steep drop in 2013 and 2014 mainly due to bad competition with others in neighbour city. Another one in Quang Ninh province, the Cai Lan International Container Terminal (CICT) is in the same issue. CICT is a new invested terminal and it is recorded that the handling cost of this terminal is 10 USD/TEU higher than that of competitors in Haiphong city. Shipping lines, therefore, chose lightening in CICT and then, move to Haiphong for loading/discharging.

The terminal's recent annual report indicated that it lost 1 million USD every month. Data collected from all container terminals in Northern Vietnam from 2005 to 2014 will be analyzed to reveal details as the following.

#### 3.1 Analysis from 2005 to 2014

From the data presented in Table 2, comparison between throughput of container terminals in Quang Ninh province and Haiphong city can be shown in the Fig. 3. In the given period, the total throughput of container terminals in Haiphong city multiplied by 7 times while the performance of Quang Ninh province nearly stayed remain at the same level. In 2005, Haiphong city accounted for 82% of container throughput handled in the region and in 2014, the share increased to 96%.

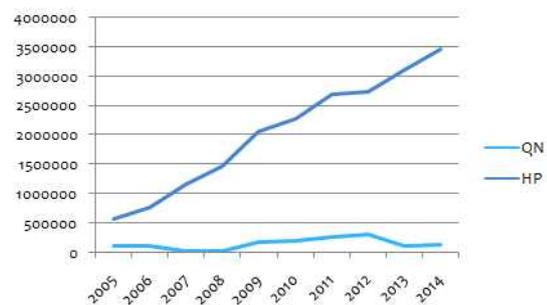


Fig. 3 Container throughput of Haiphong and Quang Ninh

Container terminals in Quang Ninh province are absolutely dominated by neighbour competitors and their situation can be even more difficult when Lach Huyen deep water sea-port begins operation. Without new resources and breakthrough strategies, the two in Quang Ninh will hardly compete.

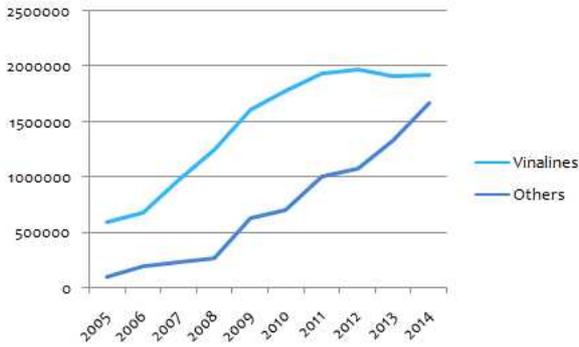


Fig. 4 Container throughput of Vinalines and others' terminals

On the other hand, both the two container terminals in Quang Ninh province are under the control of Vinalines. The national corporation also controls 3 others in Haiphong city named HPC, Doan Xa and Dinh Vu. In the beginning of port industry in Northern Vietnam, Vinalines absolutely dominated the market. However, accompanying with the quick development of the economy, new players enter the market and Vinalines is gradually losing its market share. In 2005, the share of Vinalines was 86%, then decreased to 66% in 2011 and declined to 53% in 2014.

### 3.2 Data Envelopment Analysis

#### a. Methodology

DEA, nowadays, is a quantitative method broadly applied to evaluate the efficiency of decision making units (DMU) by examining multiple inputs and outputs of a production process. The main idea is to calculate the efficiency score of such DMU as: (Lavoslav Čaklović and Tihomir Hunjak, 2012)

$$\text{Efficiency} = \frac{\text{Weighted sum of outputs}}{\text{Weighted sum of inputs}}$$

The application of DEA is presented widely in manufacturing and service activities. In port industry, DEA is also used to evaluate the port's performance and compare efficiency of a groups of port. The most efficient ports will be then benchmarked to improve the performance of the others. According to Seo et al. (2012), factors employed to make the DEA analysis for ports in the South-East Asia are number of berth, berth length, number of crane, C/Y and throughput but the analysis is for only one year. Park (2010) used also the same inputs as Seo et al. but outputs include both throughput and the number of shipping lines calling terminals. Notteboom (2000) used the same factors

as Seo et al. and also examine the relationship between ownership and efficient values.

However, using of DEA also has some drawbacks including lack of discrimination among efficient DMUs that occurs when the number of DMUs is small in comparison with the total number of variables in the analysis (Lidia, Marco, 2002). Golany and Roll (1989) stipulate that to get meaningful result, the number of DMU should be at least two times the number of outputs and inputs. Boussofiene et al. (1991) suggested that the number of DMU should be equal to the multiple of number of outputs and number of inputs. Bowlin (1998) even recommended the requirement of at least three times the sum of inputs and outputs considered.

In order to improve the discrimination, Despotis (2002) suggested several methods as the followings:

- Cross-efficiency approach
- Multi-criteria DEA approach
- Global efficiency approach
- Assurance Region Method (AR)
- Multicriteria Benefit/Cost analysis

In the case of this paper, the inputs are number of berth, total berth length, number of cranes and total area of container yard and the output is terminal's annual container throughput. By employing those factors, the paper intends to provide more details about the current condition of container terminals in Northern Vietnam. The result of the analysis doesn't reflect the speed of service or handling cost or labor employment but compare the operation of terminals' infrastructure in relation with annual throughput. The total number of outputs and inputs, therefore, is 5 when the number of DMU is 11. As a result, there will be more than one most efficient ports after doing DEA with the group of container terminals in the Northern Vietnam. However, by repeating the DEA year by year, we can get the overall view of which terminals is the most efficient one in the period and also sort the high and low efficient ones in term of ownership.

In this study, DEA output oriented CCR is employed because container terminals operate under constant return to scale (Seo et al., 2012) and DEA-SOLVER is used to run the model.

#### b. DEA result

The DEA result for the year 2012, 2013 and 2014 are presented in the table 3 (a), (b) and (c).

No	DMU	TEU	No of Berth	Berth Length	No of Crane	C/Y	Eff
		Output	Input 1	Input 2	Input 3	Input 4	
1	QN	240,000	3	680	8	49,000	0.626
2	CICT	72,000	3	594	4	151,000	0.222
3	HPC	964,000	10	1850	20	343,000	0.598
4	Dinh Vu	455,000	2	425	7	210,000	0.953
5	Nam Hai	232,000	3	600	8	215,000	0.357
6	Green Port	396,000	2	304	5	50,000	1
7	Transvina	104,000	1	120	2	40,000	0.669
8	Doan Xa	244,000	1	220	3	65,000	1
9	PTSC	155,000	1	250	4	40,000	0.721
10	Hai An	183,000	1	150	3	50,000	0.936

Fig. 3 (a) DEA result for the year 2012

No	DMU	TEU	No of Berth	Berth Length	No of Crane	C/Y	Eff
		Output	Input1	Input2	Input3	Input4	
1	QN	28,000	3	680	8	49,000	0.083
2	CICT	88,000	3	594	4	151,000	0.238
3	HPC	1040,000	10	1850	20	343,000	0.563
4	Dinh Vu	516,000	2	425	7	210,000	0.931
5	Nam Hai	252,000	3	600	8	215,000	0.342
6	Green Port	347,000	2	304	5	50,000	1
7	Transvina	78,000	1	120	2	40,000	0.425
8	Doan Xa	237,000	1	220	4	65,000	0.858
9	PTSC	241,000	1	250	4	40,000	1
10	Hai An	277,000	1	150	3	50,000	1
11	TanCang	130,000	2	403	5	200,000	0.281

Fig. 3 (b) DEA result for the year 2013

No	DMU	TEU	No of Berth	Berth Length	No of Crane	C/Y	Eff
		Output	Input 1	Input 2	Input 3	Input 4	
1	QN	29,000	3	680	8	49,000	0.087
2	CICT	102,000	3	594	4	151,000	0.166
3	HPC	1003,000	10	1850	20	343,000	0.457
4	Dinh Vu	574,000	2	425	7	210,000	0.927
5	Nam Hai	482,000	3	600	8	215,000	0.519
6	Green Port	360,000	2	320	5	90,000	0.634
7	Transvina	57,000	1	120	2	40,000	0.233
8	Doan Xa	214,000	1	220	4	65,000	0.690
9	PTSC	271,000	1	250	4	40,000	1
10	Hai An	309,000	1	150	2	50,000	1
11	Tan Cang	190,000	3	628	9	360,000	0.204

Fig 3 (c) DEA result for the year 2014

In 2012, the most efficient ports are Green Port and Doan Xa port. Dinh Vu port and Hai An port with the efficiency of 0.95 and 0.93, respectively, are nearly the perfect ones. One year later, there are 3 best container ports including Green Port, PTSC and Hai An, followed by Dinh Vu and Doan Xa which have quite high efficient points. Green Port, after 2 years at the highest position, is replaced by PTSC and Hai An in 2014. Dinh Vu, once again has a very good point of 0.92. There are some key points we can get in this 3 years period:

- The 2 container terminals in Quang Ninh province have very low efficiency, due to mostly the bad competition with others in Hai Phong city. The throughput of these terminals are far from equal to their capacity. For example, CICT, the maximum capacity is 1,200,000 TEUs/year but in 2014, the container throughput reached only 102,000 TEUs.

- There are only 2 out of 5 terminals under the control of Vinalines are relatively efficient, named Doan Xa and Dinh Vu. The other Vinalines' terminal, HPC, although recorded high volume of container throughput at gradual growing rate but the efficient point decreased from 2012 to 2014. It can be explained by the high number of old handling equipment.

- The most efficient container terminals in the area are small ones with one or two berths and the annual throughput less than 400,000 TEUs.

- All terminals in Haiphong city are in the Cam River which connects to the Gulf of Tonkin and terminals which locate more closely to the river mouth are more likely to be efficient ones. This fact states the importance of channel depth as well as convenient path to access in competition in the area.

#### 4. Concluding Remarks and Suggestions

The demand of handling imported and exported container in the Northern Vietnam is forecasted to grow in very near future. However, the cake is not enough for all. The competition will be even more fiercely when Lach Huyen - the International deep water sea-port with remarkable advantages of location and infrastructure begin operating in 2017. According to the DEA result and analysis given in the previous section, some suggestions are contributed:

- Almost Vinalines' terminals, HPC for instance, have a long history of operation and their infrastructure are, therefore, old. This condition, on the one hand, brings the advantage of handling charge but on the other hand, the

high number of old equipment decrease the port's efficiency. Purchasing and installing new facilities require great amount of investment. Vinalines is a national corporation and recent years, privatization has been chosen to improve the company's performance. Some subsidiaries of Vinalines has begun offering IPO. The result up to now is still not very successful but it is a right way to follow.

– One of very critical factors for terminals' success is the connection to hinterland. In order to survive against competition among terminals in Haiphong city, ones in Quang Ning province should pay more attention to their transport connectivity to domestic market. Currently rail way connection to Vietnam seaports is very limited, so improving rail way system and earning successful lesson of industrial zone locating beside terminals in Haiphong city is truly important.

– HPC is operating two container terminals named Chua Ve and Tan Vu. The former locates deep inside the Cam river with limited depth channel and old infrastructure. The latter locates closely to river mouth and some berth has just begun operation from 2009. Tan Vu terminal, therefore, should be focused and invested rather than Chua Ve terminal

The economic boom of Vietnam from 2005 to 2014 has brought great opportunities to the country's seaports development. The growing demand accompany with the appearance of new ports and harder competition for old ones in Northern Vietnam. Vinalines, which dominated the port industry market in the area for years, is losing its position in the market. Haiphong city has accounted for more than 90% of container throughput of Northern Vietnam. But the most efficient terminals in the area is not highly invested ones except ones with small capacity. The future research, therefore, should focus on benchmarking ones from both Southern part and oversea to improve the performance of major container terminals in Northern Vietnam.

## References

- [1] Boussofiane, A., Dyson, R. G., and Thanassoulis, E.(1991), Applied Data Envelopment Analysis, European Journal of Operational Research Vol. 52, pp. 1-15.
- [2] Bowlin, W. F.(1998), Measuring Performance: An Introduction to Data Envelopment Analysis (DEA), Journal of Cost Analysis Vol. 7, pp. 3-27.
- [3] Decision 1037/QĐ-TTg dated 24 June 2014 by the Prime Minister on approval of amended Planning for Development of Viet Nam's Seaport System by 2020 and Direction by 2030.
- [4] Despotis, D. K.(2002), Improving the discriminating power of DEA: focus on globally efficient units, Journal of the Operational Research Society, Vol. 53, pp. 314-323.
- [5] Golany, B. and Roll, Y.(1989), An Application Procedure for DEA, Omega 17, pp. 237-250.
- [6] Lavoslav Čaklović and Tihomir Hunjak(2012), Measuring DMU-efficiency by modified cross-efficiency approach, Mathematical Communications, pp. 559 - 573.
- [7] Lidia Angulo-Meza, Marcos Pereira Estellitalins(2002), Review of Methods for Increasing Discrimination in Data Envelopment Analysis, Annals of Operations Research Vol. 116, pp. 225 - 242.
- [8] Notteboom, T., Chris, C. and Julien, J. V. D.(2000), "Measuring and Explaining the Relative Efficiency of Container Terminals by Means of Bayesian Stochastic Frontier Models", Maritime Economics & Logistics, Vol. 2, No. 2, pp. 83-106.
- [9] Park, K. W.(2010a), "Comparison of Efficiencies of Container Ports in the East Asia, Europe, and North America", Journal of Korea Port Economic Association, Vol. 26, No. 4, pp. 219-246.
- [10] Seo, Y. J., Ryoo, D. K., Aye, M. N. (2012), "An analysis of container port efficiency in ASEAN", Journal of Navigation and Port Research, International Edition, Vol 36, No. 7, pp. 535-544.
- [11] Tung, C. Y.(2014) International Centre for Maritime Studies, Container throughput and Economic Development, Maritime Insight, Vol. 2, No. 3.
- [12] UNSECAP statistical year book 2014.
- [13] Vietnam Port Association(2015), <http://www.vpa.org.vn/index.jsp>
- [14] Worldbank(2015), <http://data.worldbank.org/country/vietnam>.

---

Received 22 September 2015

Revised 27 October 2015

Accepted 27 October 2015