# Container trade and shipping connectivity of Vietnam: implications of Comprehensive and Progressive Agreement for Trans-Pacific Partnership and 21st Century Maritime Silk Road

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**Abstract:** The Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) and the 21st Century Maritime Silk Road (MSR) are key developments that will impact container trade performance and liner shipping connectivity. This is the first study in literature to analyse container trade and shipping connectivity from a longitudinal perspective and derive the implications of CPTPP and MSR on shipping connectivity. The example used is that of Vietnam who is a participant of both initiatives. Developments in container trade and shipping connectivity are analysed over a 20-year period for major ports in Vietnam. Our analysis shows container terminals located in Ho Chi Minh City, Haiphong and Bà Rịa-Vũng Tàu in Vietnam to see distinctively different impacts on their shipping connectivity. Policy insights and implications from the perspective of container shipping network dynamics, port capacity and hinterland infrastructure development, terminal capacity utilisation and regional competition are discussed.

**Keywords:** container trade; shipping connectivity; longitudinal analysis; Comprehensive and Progressive Agreement for Trans-Pacific Partnership; 21st Century Maritime Silk Road; Vietnam.

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## 1 Introduction

The 21st Century Maritime Silk Road (MSR) project was announced by China in 2013 as part of the country's belt and road initiative (BRI). The aim is to promote economic and social development through the strengthening of trade relations between countries (China Daily, 2015). The MSR is a reflection of China's growing economic clout in the international arena and can be seen as a manifestation of the desire by China to develop and strengthen its strategic and commercial interests where international trade becomes an important facilitator. As of 1 March 2018, there are 71 countries that have signed on to the initiative. A more recent development is the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) which is a free trade agreement concluded in early 2018 (Australia Department of Foreign Affairs and Trade, 2017). The agreement was a follow up from the Trans-Pacific Partnership (TPP) trade deal which fell through as a result of the US pulling out in 2017. The eleven countries involved in the CPTPP account for 13.5% of the world's GDP. Both initiatives are aimed at boosting trade ties. As such, the CPTPP and MSR are likely to have a significant impact on the subsequent evolution of container trade and shipping connectivity.

The volume of container port throughput is influenced by container trade flows that utilise the services of the port. The dynamics of the container trade and liner shipping connectivity has the potential to underwrite significant changes in the port's container traffic. Connectivity is actualised through origin-destination flows which are manifested through containers handled at ports (Russo et al., 2014). These flows can be differentiated by transhipment and empty containers. The authors in their modelling of global container flows highlighted the important influence on container trades and connectivity by the location of production and consumption areas and attributes possessed by transport services and infrastructure. The degree and extent of competition and cooperation between ports in the context of shipping networks is also seen to influence connectivity (Low et al., 2009). In their analysis of port selection, Magala and Sammons (2008) noted the key role played by supply chains in determining connectivity where the port is an important node in a logistics network. Tang et al. (2011) further proposed that connectivity encapsulates a host of container trade and port-related factors such as trade volume, cargo traffic, port turnaround time, port draft, operating hours and port charges.

Our research aims to analyse container trade and shipping connectivity, and derive the implications of CPTPP and MSR on shipping connectivity for Vietnam. To understand their implications, it is necessary to examine connectivity at the micro level through the nature of shipping services and how they have evolved over time as container trade volume changes. Unique conditions of each port will require analysis at the individual port level. Container trade in this case is measured by container throughput handled by the country or port whereas shipping connectivity is measured by slot capacity deployed by container shipping services that are connected to the country or port. We use the case of Vietnam as the country is a participant in both CPTPP and MSR. In 2016, Vietnam handled 11.1 million twenty-foot equivalent units (TEUs) of containers making it the world's 16th biggest country by containers handled (Vietnam

Seaports Association, http://www.vpa.org.vn/statistics-2016/). In terms of liner shipping connectivity, Vietnam is ranked 18th in the world out of 156 countries. This makes Vietnam the third best connected by liner shipping services in Southeast Asia after Singapore and Malaysia.

In terms of trade, Table 1 showed that the largest trade partners of the country remained mostly unchanged between 2005 and 2015 except that Australia was replaced by the UAE. However, the volume of trade grew by almost five-fold in a decade to reach US$323 billion in 2015. The impetus on growing trade driven by developments in the CPTPP and MSR will see closer integration of Vietnam into the global trade system. Assuming these developments bring about greater container trade for the country, the impact will bring changes to the state of shipping connectivity seen in key ports of the country. Changes in volume of containers handled and state of shipping connectivity will trigger requirement for different levels of port capacity and demands to existing transport infrastructure. As such, the paper also aims to shed insights and implications from the perspective of port capacity and hinterland infrastructure development. Implications on terminal capacity utilisation and regional port competition will also be discussed. The rest of the paper is organised as follows. A review of literature is presented in the following section. Section 3 presents the research methodology. Section 4 presents the research findings and discusses policy implications while the research conclusions are presented in Section 5.

**Table 1** Key trading partners of Vietnam

| *2005* | | | *2015* | | |
|---|---|---|---|---|---|
| | *Billion US$* | *%* | | *Billion US$* | *%* |
| China | 9.1 | 13.2 | China | 66.0 | 20.1 |
| Japan | 8.4 | 12.2 | USA | 41.3 | 12.6 |
| USA | 6.8 | 9.8 | South Korea | 36.5 | 11.1 |
| Singapore | 6.4 | 9.2 | Japan | 28.3 | 8.6 |
| South Korea | 4.3 | 6.2 | Thailand | 11.4 | 3.5 |
| Thailand | 3.2 | 4.7 | Singapore | 9.3 | 2.8 |
| Australia | 3.2 | 4.7 | Germany | 8.9 | 2.7 |
| Malaysia | 2.3 | 3.3 | Hong Kong, China | 8.3 | 2.5 |
| Germany | 1.7 | 2.5 | Malaysia | 7.7 | 2.4 |
| Hong Kong, China | 1.6 | 2.3 | UAE | 6.2 | 1.9 |
| Top 10 | 47.1 | 68.0 | Top 10 | 223.9 | 68.3 |
| Total | 69.2 | 100.0 | Total | 327.8 | 100.0 |

*Source:* World Trade Organisation (2018a)

## 2 Literature review

Investigation of container trade and its relation with shipping connectivity has seen a variety of approaches being employed. The methods include those using the approach of port selection through global supply chain flows (Tavasszy et al., 2011), deployment of slot capacity (Lam and Yap, 2011a), shipping line strategy (Ng, 2006; Lam and Wong, 2018), hinterland access (Van der Horst and Van der Lugt, 2011) and complementary relationships between ports (Lam and Yap, 2011b). These studies emphasised the importance of geographical location in the context of global container trade flows as well as logistics capabilities in the specific locality which resulted in certain ports becoming container hubs. Chen et al. (2018) further noted that inefficiencies to terminal operations could inhibit the full beneficial effects of containerisation from being realised. Analyses made from the perspective of shipping networks also included approaches covering deep sea and short sea services (Da Costa Fontes and Goncalves, 2017), commodity flows (Lee et al., 2006) and network centrality (Li et al., 2014). These studies saw detailed analyses made using various parameters of connectivity including network structures and inter-port linkages made by shipping services. The aim is to understand a port's role, level of connectivity and relative position within shipping networks. The role of logistics in being a key facilitator of the world economy and seaborne container trade is recognised. Liu et al. (2018) found global logistics and trade structures to be significant in defining a port's relative position in the hierarchy of shipping networks in a region. Xu et al. (2015) further observed that differences between container ports in their ability to access spatial and financial resources as a result of evolving shipping technologies has led to significant inequalities across the world's shipping network.

Investigating the dynamics of container trade has also seen analyses made from the perspective of its relationship with international trade. Bernhofen et al. (2016) in their research into the effects of containerisation and global trade found containerisation to be a driver of economic globalisation and corresponding boost for global trade. The effects of containerisation and its positive contribution to the expansion of global trade were ascertained by Kuby and Reid (1992) and Hummels (2007). These studies noted the important role played by containerisation through the effects of trade generation, improved efficiency in transport operations and extension of hinterland reach. Factors that determine the cargo-generating potential of a container port's hinterland will also affect its status as a commercially viable gateway and load centre.

The recent initiative by the Chinese government in launching the MSR initiative is expected to have significant impact on container trade and shipping connectivity particularly for the Asia Pacific and Indian Ocean regions. Ruan et al. (2017) highlighted the complexity and scale of international trade and shipping logistics network which offered ports the chance to respond with strategies to capitalise on new opportunities made possible through increasing container trade. From the liner shipping perspective, Qiu et al, (2018) added that vessel sharing between liner companies could lead to improvements in profit and reduction in $CO_2$ emissions to the benefit of the environment. Lee et al. (2017) also noted potential structural dislocations that are likely to impact on trade flows with corresponding consequences for international logistics, hinterland transportation, infrastructure development, port competition and regional cooperation. In December 2014, Chinese Premier Li Keqiang announced during the Fifth Leaders Meeting on the Greater Mekong Sub-regional Economic Co-operation the initiative for closer integration through a series of transport corridors for the region (Tsui, 2015). Based on the schematic shown in Figure 1, five out of nine proposed transport corridors will involve Vietnam. Apart from the land transport perspective, the country's main seaports in the north, central and southern regions were also identified as key transport nodes in the project. Another development which is likely to impact on container trade and liner connectivity is the CPTPP deal. The positive impact of free trade agreements on trade is recognised. In the application of the CGE model to ASEAN, Toh and Gayathri (2004) found expansion of free trade agreements beyond the ASEAN Free Trade Area

(AFTA) to result in greater economic benefits for Vietnam including lower adjustment costs as the country industrialises. The CPTPP in particular is expected to benefit key exports of Vietnam which are consumer goods, machinery and electronics/electrical products and textiles and clothing (World Trade Organisation, 2018b).

**Figure 1** Economic corridors proposed by China for the greater Mekong sub-region (see online version for colours)


*Source:* Tsui (2015)

The literature has shown a range of methods and perspectives employed to analyse the dynamics of container trade and shipping connectivity. Some of the research has also covered Vietnam although not as the main discourse but as part of analyses that pertain to the wider Asia-Pacific region. As such, our research aims to address the gap in literature in four aspects. Firstly, the impact of the CPTPP and MSR is likely to be significant. Their effects on container trade and shipping connectivity dynamics should be investigated in sufficient detail so as to make the results meaningful for academia and government decision makers. Secondly, the rising position of Vietnam as a major country in container trade will likely see the nation exerting a greater influence on the region's container trade and liner shipping dynamics. This development is underscored by Vietnam's fast-growing economy and manufacturing sector, rising income level and large population which is fast approaching 100 million, making it one of the world's most populous country. As such, developments especially in key Vietnamese ports will likely have ramifications for container shipping and trade networks in the Asia-Pacific region. Thirdly, although the literature considered container trade and shipping connectivity from various perspectives including capacity deployment and port-to-port connections, the studies took reference to a particular period in time and did not sufficiently consider the evolution of shipping networks given changing trade dynamics over the course of time. Our research intends to examine from a longitudinal perspective the interaction of both demand and supply parameters. Fourthly, empirical evidence is lacking on the granularity of shipping service deployment on whether these are mainline, regional or feeder in nature. There are important implications for this. Different types of service calls will require different levels of investment into port capacity and even location selection. Hence, understanding the nature of service calls will allow resources to be more efficiently channelled towards future development of port capacity as container trade volume and shipping connectivity in Vietnam increases. This is crucial from the viewpoint of policy makers particularly in attracting prospective investors of infrastructure capacity for a developing country. As such, our research aims to address these gaps in the literature using the case of Vietnam.

## 3 Research methodology

The research framework is presented in Figure 2. Drawing from the literature, shipping connectivity is defined as shipping services that a port is connected to. As such, shipping connectivity can be quantified and represented by the number of these services that are calling at a particular container port as well as number of container slots that are deployed in these services. We propose the dynamics of container trade and shipping connectivity to be analysed from three aspects. The first is to assess container trade performance. This is done by identifying major container ports and their terminal-handling facilities including evolution of their container throughput and market shares. The intention is to ascertain how container trade has evolved from the demand perspective. As there could be discrepancies at the individual port level, container trade performance shall be analysed by individual ports, with the unit of measurement being container throughput in TEUs. The second aspect is to examine container port development from the perspective of new container-handling facilities that came on-stream and how they had contributed to the dynamics of the container port and shipping landscape in Vietnam. A key focus of analysis from the terminal aspect is the timing of new container port developments and the rate of capacity utilisation over time. This aspect addresses the terminal-side of developments and determines whether there were any constraints on container growth from the supply-side. Unit of measurement being total length of berth facilities used to handle containers.

The third aspect analyses developments in liner shipping connectivity. Investigation shall be conducted for shipping services that are calling at key ports in Vietnam. Analyses will dwell into details of these services to uncover their nature in terms of service frequency, port-of-rotation, shipping companies involved, vessels deployed, vessel capacity involved and how these factors translate into annual slot capacity made available for the port. Through such analyses, we will formulate a detailed constitution of shipping connectivity for individual ports and whether they are mainline, regional or feeder in nature. Following from Robinson (1998), mainline services are those which operate on key east-west trade routes such as the Asia-Europe, Transpacific and Transatlantic trades whereas feeder services are those that ply within a geographical region such as intra-Southeast Asia and intra-South China Sea. For regional services, these are defined as shipping services that extend beyond the coverage by feeder operators but less than the distances covered by mainline services. For example in the case for the port of HCMC in Vietnam, regional services would be those that ply beyond Southeast Asia and South China to call at the Middle East, Africa, Australasia and Northeast Asia. The unit of measurement being the total amount of container slots that are deployed by shipping services to call at the port in TEUs.

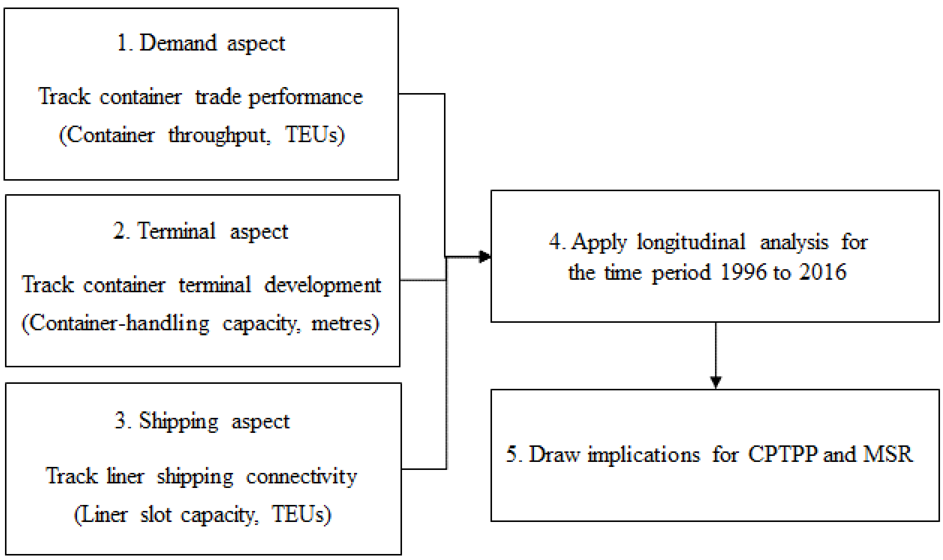
With reference to Lam (2011), to compute the slot capacity deployed by liner services that call at a particular port in Vietnam, we employ the equation:

$$Y_t = \sum_{i=1}^{n} K_{it} F_{it} V_{it} \quad (1)$$

where $Y_t$ is the total annual slot capacity deployed by $n$ liner services that call at a particular port in Vietnam for time period $t$. $K$ denotes the number of calls made at the port for the particular service, $F$ denotes the frequency of calls made in a year, and $V$ denotes the average vessel capacity deployed in the service.

Having determined the three aspects of container trade, terminal capacity and shipping connectivity faced by Vietnam, longitudinal analysis shall be used to determine how the three aspects interacted with one another over time. The time frame of our analysis is a period of 20 years covering the years 1996 to 2016. The choice of years in our selection is intentional. The year of 1996 is a significant milestone for the Vietnamese economy as the country applied to become a member of the WTO just a year before in 1995. We have included the year 2016 so as to incorporate the latest information on annual data for container trade, capacity development and shipping connectivity for major ports in Vietnam. Results from the findings will be used to draw implications in the context of the CPTPP and MSR from the perspective of container shipping network dynamics, port capacity and hinterland infrastructure development, container terminal utilisation and regional container port competition.

**Figure 2** Research framework for analysing dynamics of container trade and shipping connectivity for Vietnam



There are three components that require data input for this research. Data for container throughput handled by ports in Vietnam is sourced from the Vietnam Seaports Association (http://www.vpa.org.vn/statistics-2016/). Statistics obtained were subsequently organised by the respective terminals. Data for container port capacity was sourced from respective websites of terminal operating companies and corroborated with capacity information available from the Vietnam Seaports Association (http://www.vpa.org.vn/statistics-2016/). As for data on liner shipping services, these were sourced from various issues of Containerisation International yearbooks (Informa Plc., 1996–2015) and Alphaliner (http://www.alphaliner.com) pertaining to data for 2016.

## 4 Findings and implications

Our analysis identified three major ports in Vietnam. These are Haiphong in the north, and HCMC and Bà Rịa-Vũng Tàu (BRVT) in the south. Together, they accounted for 10.4 million TEUs or 94% of containers handled in Vietnam in 2016. The bulk of container handling takes place in the south in the Mekong River Delta. The region consists mainly of cargo terminals situated in Vietnam's commercial capital of HCMC and BRVT province (see Figure A1 of Appendix). Total container throughput handled by this region reached 7.8 million TEUs in 2016 accounting for 70% of the country's market share. This ranks it among the top 20 busiest container ports globally. In fact, the greater HCMC area is the fourth busiest container port in Southeast Asia after Singapore, Port Klang and Tanjung Pelepas. As for the north in the Red River Delta, container-handling facilities are located in the vicinity of Haiphong (see Figure A2 of Appendix). Container throughput handled by the port reached 2.7 million TEUs, making up 24% of the market share for containers handled in Vietnam. Almost all liner services which called at Vietnam will include any of the three ports. The exception is the Wan Hai North Asia-Thailand Express which calls only at the port of Danang in central Vietnam. Of these services, 74 called exclusively at the greater HCMC port area whereas 44 called exclusively at Haiphong. The number of services that made parallel calls at both port regions was relatively little at ten.

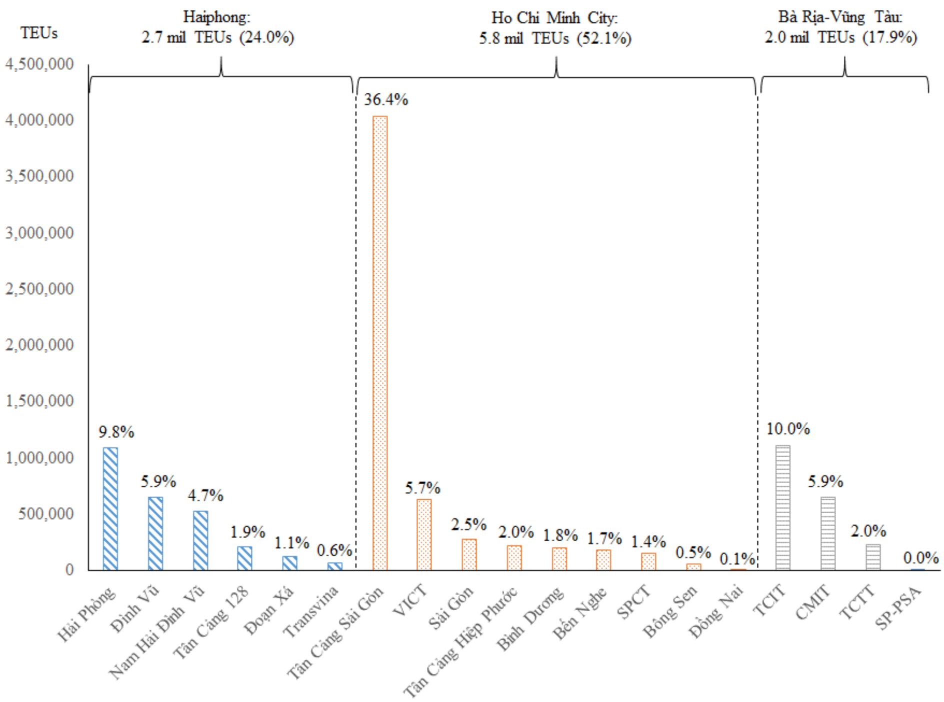
Looking within each port, Figure 3 shows the largest of these being HCMC where the busiest container terminal Tân Cảng Sài Gòn (also known as Cat Lai Port) alone accounted for 36.4% of the country's container traffic. This was followed by International Container Terminal Tân Cảng – Cái Mép (TCIT) which is located in the BRVT port area with 10.0% of the national market share. In the third place is Hải Phòng consisting of the Chùa Vẽ and Đình Vũ facilities which made up 9.8% of the national market share. As a whole, we note that despite the large number of container-handling facilities located throughout Vietnam, the country's container port market share is concentrated in just three locations. As such, the discussion of research findings shall focus on the three port areas of Haiphong, HCMC and BRVT.

### *4.1 Research findings for the Haiphong port area*

Empirical evidence on the dynamics of container trade and shipping connectivity shows Haiphong to remain largely a feeder port in the 20-year period of observation. With reference to Figure 4, Haiphong saw steady growth of container trade demand with

15.5% CAGR and shipping connectivity at 15.4% CAGR between 1996 and 2016. Feeder cargo was found to be almost the sole driver of container port performance up till 2013. Thereafter, the results showed a rising share of regional services in particular for those that connect to Northeast Asia which consist of Japan, South Korea and North China. Service details presented in Table 1 shows the volume of slot capacity operated by such services to have grown by almost 30 times between 1996 and 2016 to reach 1.4 million TEUs. Expansion of calls by regional services also coincided with the Nam Hải Đình Vũ terminal coming on-stream in 2014. Share of regional services grew to reach 43.5% in 2016. Nonetheless, the size of vessels operated by regional services remained relatively small, averaging 1,081 TEUs as shown in Table 2. In fact, the market for feeder services saw larger vessels deployed with ship sizes averaging 1,202 TEUs.

**Figure 3** Containers handled for major Vietnamese ports by individual terminals (2016) (see online version for colours)

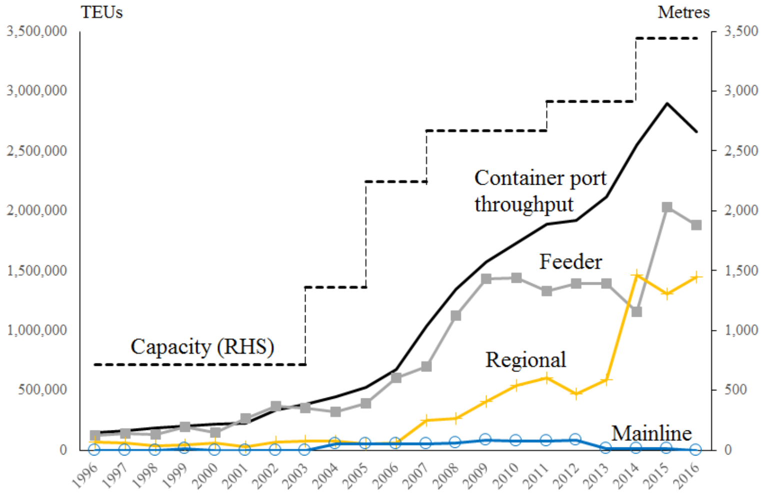



Note: Percentages denote market share held by respective container terminals in Vietnam.

*Source:* Calculated using data from Vietnam Seaports Association (http://www.vpa.org.vn/statistics-2016/)

Analysis of terminal development saw container-handling capacity keeping pace with demand and shipping connectivity. However, limitations posed by draft alongside container-handling terminals with the deepest at only 10.5 metres meant that Haiphong does not have to capability to handle the current generation of mainline container vessels. This is corroborated by shipping data which showed no mainline services to be calling at the port as of 2016. With the current draft, Haiphong may have difficulties even handling third generation container vessels with capacities of 3,000–4,000 TEUs. As such, there is the need for upgrading of terminal facilities in the port to handle larger container vessels. This will ensure that the port remains a key node especially for regional services that ply in the region.

**Figure 4** Port demand, terminal capacity and shipping connectivity for Haiphong (see online version for colours)




*Source:* Calculated using data from Vietnam Seaports Association (http://www.vpa.org.vn/statistics-2016/)

**Table 2** Developments in shipping connectivity by trade routes for Haiphong

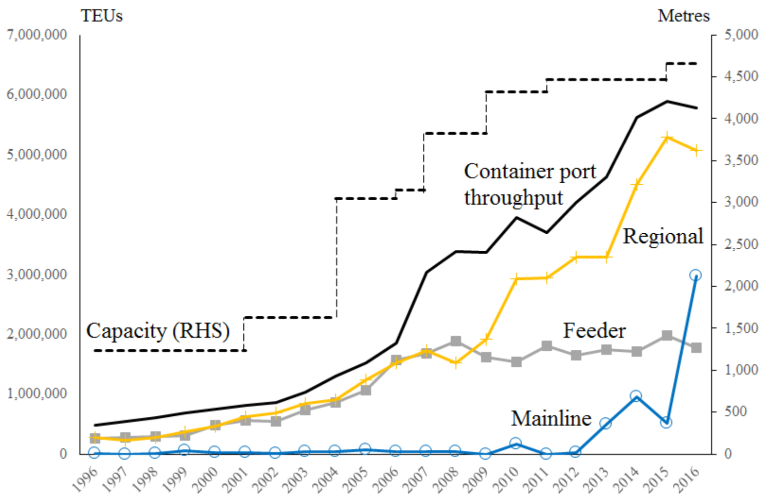
| *Trade route* | *1996* | | *2006* | | *2016* | |
|---|---|---|---|---|---|---|
| | *TEUs^* | *Ave. vessel size* | *TEUs^* | *Ave. vessel size* | *TEUs^* | *Ave. vessel size* |
| Mainline# | - | - | 49,000 | 1,884 | - | - |
| Transpacific | - | - | 49,000 | 1,884 | - | - |
| Asia-Europe | - | - | 49,000 | 1,884 | - | - |
| Regional | 74,000 | 320 | 57,000 | 532 | 1,448,000 | 1,081 |
| SEA-NE Asia | 50,000 | 310 | 57,000 | 532 | 1,448,000 | 1,081 |
| SEA-ISC | 24,000 | 380 | - | - | - | - |
| Feeder | 116,000 | 264 | 713,000 | 484 | 1,964,000 | 1,202 |
| SEA-S China/Taiwan | 80,000 | 260 | 278,000 | 440 | 1,382,000 | 1,205 |
| Intra-SEA | 37,000 | 273 | 435,000 | 518 | 581,000 | 1,197 |
| Total | 190,000 | 281 | 819,000 | 648 | 3,411,000 | 1,135 |

Notes: SEA denotes Southeast Asia and ISC denotes Indian Subcontinent. ^TEUs measure the amount of slot capacity deployed by shipping services for the trade route on an annual basis. #Note that figures for mainline services may not add up as a shipping service can be deployed on multiple main trade routes. For example, Haiphong's data for 2006 showed the same pendulum service to cover both the transpacific and Asia-Europe trade routes.

## 4.2 Research findings for the HCMC port area

Results for the port of HCMC present a sharp contrast to that of Haiphong. With reference to Figure 5, analysis of container trade and shipping connectivity found HCMC to have evolved from one of a feeder-regional nature to one where regional-mainline services form the majority of shipping capacity that called at the port. Demand growth for HCMC can be categorised into three time periods. The first period which lasted up until the period before the Global Financial Crisis struck in 2009 saw feeder and regional trade driving container port performance. The second period involved the opening of the Vietnam International Container Terminal in the second half of the 2000s and corresponded to the strong boost to HCMC's connectivity to regional services. By 2015, the share of capacity provided by regional services was triple that of feeder services.

**Figure 5** Port demand, terminal capacity and shipping connectivity for Ho Chi Minh City (see online version for colours)




*Source:* Calculated using data from Vietnam Seaports Association (http://www.vpa.org.vn/statistics-2016/)

In the third period, we saw HCMC gaining popularity as a port-of-call by mainline services. With reference to Table 3, these are the Transpacific, Asia-Europe and Asia-Mediterranean trade routes. As of 2016, distribution of market share by feeder, regional and mainline shipping service slot capacity are respectively 18.0%, 51.7% and 30.3%. Development of terminal capacity has also grown in line with demand and shipping connectivity. Port demand grew at 13.2% CAGR while shipping connectivity saw CAGR of 15.4%. Table 2 showed that average vessel size has grown considerably since 1996. Vessels deployed on mainline services calling at HCMC averaged 8,389 TEUs in 2016 compared to just 1,552 TEUs in 1996. Hence, continued up scaling of mainline container vessels to above 18,000 TEUs in size could see HCMC being bypassed by major shipping lines as such vessels would require drafts alongside terminal facilities in access of 15.0 metres. Nonetheless, HCMC holds a key advantage with its sizeable local container cargo base totalling in excess of 5.5 million TEUs. As such, the port is likely to remain as an important port-of-call for many shipping lines wanting to tap on opportunities offered by the growing Vietnamese container market.

**Table 3** Developments in shipping connectivity by trade routes for Ho Chi Minh City

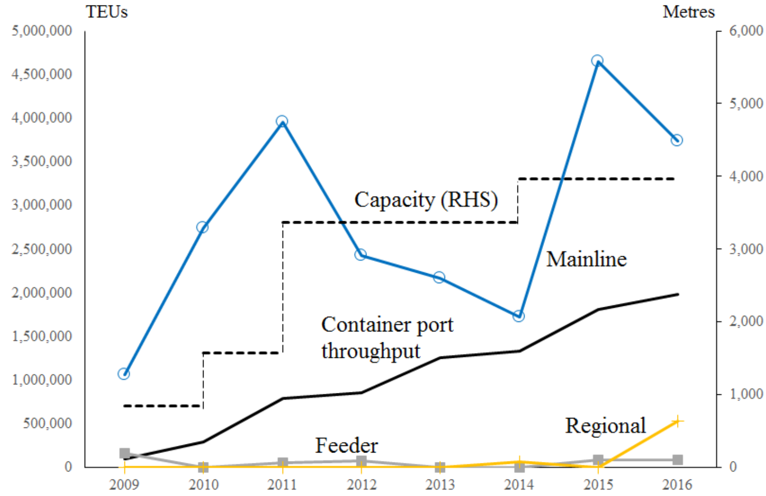
| *Trade route* | *1996* | | *2006* | | *2016* | |
|---|---|---|---|---|---|---|
| | *TEUs^* | *Ave. vessel size* | *TEUs^* | *Ave. vessel size* | *TEUs^* | *Ave. vessel size* |
| Mainline# | 14,000 | 1,552 | 49,000 | 1,182 | 2,976,000 | 8,389 |
| Transpacific | - | - | - | - | 1,752,000 | 7,299 |
| Asia-Europe | - | - | 49,000 | 1,182 | 781,000 | 7,910 |
| Asia-Mediterranean | - | - | - | - | 1,454,000 | 9,231 |
| Mediterranean-SEA | 14,000 | 1,552 | - | - | - | - |
| Regional | 283,000 | 659 | 1,531,000 | 1,088 | 5,072,000 | 1,931 |
| SEA-NE Asia | 238,000 | 704 | 1,412,000 | 1,103 | 5,048,000 | 1,930 |
| E. Asia-Australasia | 21,000 | 701 | 28,000 | 1,076 | 24,000 | 2,001 |
| SEA-Middle East | - | - | 30,400 | 705 | - | - |
| SEA-ISC | 24,000 | 313 | 60,500 | 1,163 | - | - |
| Feeder | 258,000 | 377 | 1,576,000 | 841 | 1,768,000 | 1,409 |
| SEA-S China/Taiwan | 90,000 | 394 | 511,000 | 921 | 332,000 | 2,052 |
| Intra-SEA | 168,000 | 357 | 1,065,000 | 798 | 1,436,000 | 1,292 |
| Total | 555,000 | 588 | 3,156,000 | 1,003 | 9,816,000 | 3,713 |

Notes: * SEA denotes Southeast Asia and ISC denotes Indian Subcontinent. ^TEUs measure the amount of slot capacity deployed by shipping services for the trade route on an annual basis. #Note that figures for mainline services may not add up as a shipping service can be deployed on multiple main trade routes.

## *4.3 Research findings for the BRVT port area*

The BRVT port area has seen strong growth in container handling since the SP-PSA terminal became operational in 2009. By 2016, the port area was handling almost 2.0 million TEUs on an annual basis, making it the third busiest port in Vietnam. With reference to Figure 6, a distinctive feature that separates the BRVT port area is the high proportion of mainline services connected to the port. In fact, mainline services form the bulk of shipping connectivity with market share at 85.8%. Since the inception of the port in the late 2000s, demand growth has been driven largely by mainline shipping services which connect BRVT to the Asia-Europe and Transpacific trade routes. This development is aided by most terminals having drafts alongside of at least 14.0 metres. Cái Mép International Terminal (CMIT) which is jointly owned by Saigon Port, Vietnam National Shipping Lines and APM Terminals even has drafts of up to 16.5 metres. This allows the facility to receive the largest container ship in operation. Table 4 shows that average vessel size in 2016 was 8,547 TEUs which is 1.7 times compared to the average figure in 2009.

**Figure 6** Port demand, terminal capacity and shipping connectivity for BRVT (see online version for colours)




*Source:* Calculated using data from Vietnam Seaports Association (http://www.vpa.org.vn/statistics-2016/)

**Table 4** Developments in shipping connectivity by trade routes for BRVT

| *Trade route* | *2009* | | *2016* | |
|---|---|---|---|---|
| | *TEUs^* | *Ave. vessel size* | *TEUs^* | *Ave. vessel size* |
| Mainline# | 1,059,000 | 5,079 | 3,742,000 | 9,214 |
| Transpacific | 1,059,000 | 5,079 | 2,550,000 | 8,288 |
| Asia-Europe | - | - | 1,192,000 | 11,547 |
| Asia-Mediterranean | - | - | 509,000 | 9,781 |
| Regional | - | - | 533,000 | 5,086 |
| East Asia-ISC | - | - | 533,000 | 5,086 |
| Feeder | 160,000 | 1,538 | 88,000 | 1,700 |
| Intra-SEA | 160,000 | 1,538 | 88,000 | 1,700 |
| Total | 1,219,000 | 4,952 | 4,364,000 | 8,547 |

Notes: Figures for BRVT were only available from 2009 onwards. SEA denotes Southeast Asia and ISC denotes Indian Subcontinent. ^TEUs measure the amount of slot capacity deployed by shipping services for the trade route on an annual basis. #Note that figures for mainline services may not add up as a shipping service can be deployed on multiple main trade routes.

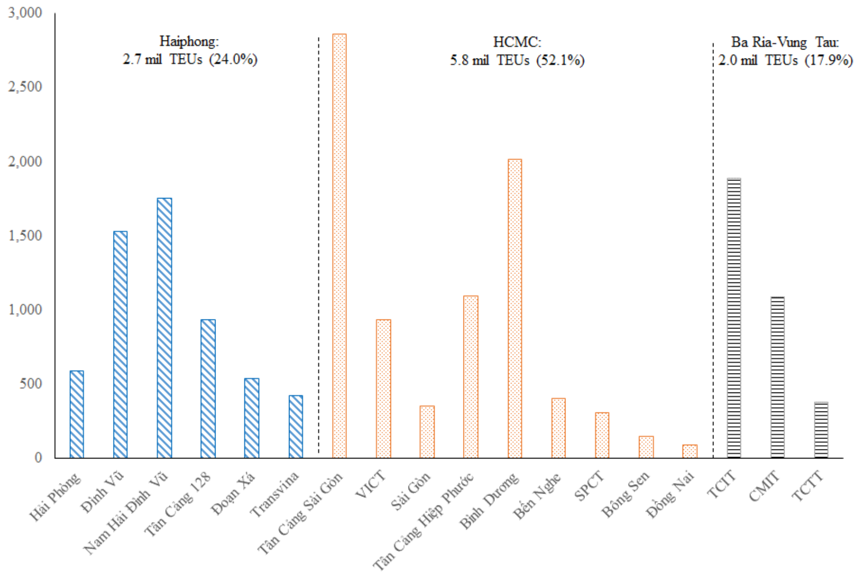
For BRVT, the share of regional services remains relatively small at 12.2% and feeder services are almost non-existent. Nonetheless, BRVT port area has the lowest capacity utilisation compared to HCMC and Haiphong ports. Capacity utilisation measured by TEUs per metre of berth for BRVT was 501 TEUs in 2016 vis-à-vis 774 TEUs for Haiphong port and 1,238 TEUs for HCMC. This suggests some degree of over-capacity which could be attributed to the terminals being located some 75 kilometres from the main industrial areas of HCMC. Nonetheless, strategic location of BRVT port area is likely to see it remaining attractive as a port for mainline container services. Sustained container traffic growth could also see the port hosting more regional shipping services looking to tap into the growing local container traffic as well as serving as a transhipment hub for the South China Sea region.

### *4.4 Implications in the context of CPTPP and MSR*

Based on the above findings, there are four areas of implications in the context of the CPTPP and MSR. Firstly, growing container trade in the three abovementioned ports will see greater demand for terminal facilities able to handle larger container vessels. Martin and Martin (2015) noted that this will require raising the proportion of ship working time in relation to port time and increasing the number of moves per hour performed by quay cranes. The impact will filter through to quay-to-yard transfers and gate and yard operations and the workload expected to be exacerbated by traffic peaks. For Haiphong, it is essential that policy makers and terminal operators have port facilities upgraded to allow the port to be better connected at least for regional services that are deploying larger container ships. In order for this to take place; drafts alongside terminals require substantial deepening from the existing 10.5 metres to at least 15.0 metres based on vessels currently in operation and on the order book. This can be made to existing facilities or through Greenfield developments further out towards the South China Sea. By doing so, the shipping market which continues to see larger vessels deployed on regional trade routes will allow Haiphong to progress beyond being a feeder port to other container hubs in the region as these vessels will be able to make direct calls at the port. Shipping connectivity to other regions in the world can thus be expanded.

The second implication of our research relates to infrastructure development particularly for the hinterland. Mateo-Mantecón et al. (2012) in their analysis for Santander in Spain found total gross added value (GAV) for the port to be 9.3 times of its direct GAV. This observation highlights the importance of well-developed hinterland infrastructure for the economic contribution of an entire region. The lack of viable alternative hinterland transport infrastructure can also lead to significant disturbances should disruptive events such as inclement weather, port strikes or overloading of transport capacity occur. Trepte and Rice (2014) noted that Hurricane Katrina saw national food prices to rise by 2.5% to 3.5% because other ports in the vicinity of New Orleans could not absorb the surge in cargo volume. It is worth noting that Vietnam held the 70th position in the world and fourth in ASEAN for logistics infrastructure (The World Bank, http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators). With reference to the BRVT port area, the challenge of infrastructure development is exacerbated by the BRVT being located in the southwest region of the Mekong River Delta. Although the port can handle the largest container vessels, it is located some 75 kilometres from the main manufacturing districts in HCMC. In addition, the port area is accessible by only one major highway (i.e., National Highway 51). In the case for HCMC, although its terminals are located much closer to the city centre, limitations of river draft could impede navigational access by large container vessels. In view of growing container traffic and increasing vessel sizes, the state of hinterland infrastructure and connectivity development in the Mekong River Delta may require a thorough review by relevant authorities. It is worthwhile noting that logistics costs in Vietnam being equivalent to 20.8% of GDP which is significantly higher than the 9–14% seen in developed countries (Vietnamnet Bridge, 2017). As such, addressing the hinterland infrastructure and connectivity development could help to ensure that container growth potential, manufacturing competitiveness and investment attractiveness of the greater HCMC port region are not impeded by constraints posed by hinterland infrastructure.

**Figure 7** Capacity utilisation by TEUs per metre of berth for major ports in Vietnam (see online version for colours)




*Source:* Calculated using data from Vietnam Seaports Association (http://www.vpa.org.vn/statistics-2016/)

The third implication relates to terminal utilisation. With reference to Figure 7, there are significant variations in capacity utilisation for container-handling facilities in the three major ports. For example, capacity utilisation measured by containers handled per metre of berth was almost 3,000 TEUs for Tân Cảng Sài Gòn whereas nearby Sài Gòn achieved utilisation of only 353 TEUs per metre of berth. Next door Vietnam International Container Terminal which has a slightly shorter berth length was able to perform 935 TEUs per metre of berth. Appendix showed that container-handling facilities are scattered across the port regions with many terminals possessing berth lengths of 600 metres or less. The discrepancies in capacity utilisation suggest there could be scope for policy makers, port authorities and terminal operators to amalgamate some of the terminals to generate economies of scale in operations and boost utilisation especially in face of growing container traffic which will put additional demand on handling resources.

The fourth implication relates to the aspect of regional port competition. Investigation of shipping connectivity for the three ports revealed majority of shipping services that called at a particular port do not call at the other two ports. For example, of the 75 shipping services that called at HCMC in 2016, only ten included Haiphong and one included BRVT in their port-of-rotation. Similarly, of the 54 shipping services that called at Haiphong, only ten included HCMC in their port-of-rotation and none called at BRVT.

This development is attributed to the strong hub positions exerted by the ports of Hong Kong and Singapore on Vietnamese ports. With references to Tables A1–A3 data for 1996 and 2006 for Haiphong and HCMC and 2009 for Vung Tau showed that Hong Kong and Singapore accounted for the largest share of shipping capacity for ports connected to these ports with figures approaching or exceeding 50% in all cases. Data for 2016 shows that, while Hong Kong continues to remain in the lead, Singapore's position was overtaken by Shenzhen. In the case for BRVT, connectivity for Singapore fell to the sixth position as the city was overtaken by connectivity to Port Klang, Shanghai and Ningbo. As a whole, growing local container traffic at these Vietnamese ports are likely to attract more direct calls from regional and mainline services. In view of this development, policy makers and terminal operators could leverage on the sizeable local container cargo base to attract transhipment business. The strategic location of BRVT port area with improved hinterland connectivity to the main manufacturing districts could be an attractive site to pursue this development.

## 5 Conclusions and recommendations for future research

This research contributes to the literature by being the first to analyse container trade and shipping connectivity from a longitudinal perspective and derive the implications of CPTPP and MSR on shipping connectivity. The research also included detailed analyses on the evolution of shipping services on whether they are feeder, regional or mainline in nature and how these services interacted with port throughput and port capacity over time. The example used is that of Vietnam with its growing market of container traffic. The study showed that while Vietnam's accession to the WTO has seen trade expand with corresponding increases in the country's container trade and shipping connectivity over a twenty-year period, dynamics exhibited at the local container port landscape for the three major ports in Vietnam are unique. The results showed Haiphong to remain largely a port for feeder services. Although the share of regional services is growing, inability to accommodate larger vessels could limit Haiphong to the role of feeder port even as CPTPP and MSR brings about greater container traffic. The results for HCMC revealed that it has evolved from a feeder-regional port to become a port-of-call for regional and mainline services. As mainline container vessels increasingly get bigger, inability to receive these vessels could see HCMC being bypassed for mainline trades. As for BRVT, its strategic location to serve deepsea vessels will ensure that mainline services remain the mainstay for the port.

With the prospect of increasing container trade driven by the CPTPP and MSR projects, the study highlighted key implications where government policy makers, port authorities, industry practitioners and academia should take note. Firstly, growing container trade is likely to be accompanied by calls from larger container vessels. Ability to accommodate these vessels with the required investments in terminal capacity particularly with regards to draft alongside will allow these ports to receive direct calls from such vessels and expand shipping connectivity to other regions in the world. Failure to do so could see Vietnam bypassed on the main trades. The second implication relates to infrastructure development particularly for hinterland connectivity in the Mekong River Delta. A thorough review may be required to ensure that container growth potential, manufacturing competitiveness and investment attractiveness of the greater

HCMC port region is not impeded by constraints posed by hinterland infrastructure. As for the utilisation of terminal facilities, large discrepancies seen between container terminals in the three ports suggests there could be scope for terminal operators to amalgamate some of them to boost economies of scale in operations and utilisation rates. This will become an increasing priority in face of demands for greater handling capacity presented by rising container traffic. The fourth implication relates to regional port competition where strong hub effects exerted by the ports of Hong Kong and Singapore resulted in Haiphong and HCMC being feeder ports. However, this situation is likely to change as growing local container traffic attracts more direct calls from regional and mainline services. As such, policy makers and terminal operators could leverage on the sizeable local container cargo base to attract and develop the transhipment business. Strategic location of BRVT port with improved hinterland connectivity to the main manufacturing districts is seen as an attractive site for this proposition.

The study highlighted the complex and dynamic nature of the container trade and its interaction with shipping connectivity and terminal capacity development. The result of this interaction is likely to be different given the unique attributes of each port. Decision makers in government and business should be aware of these characteristics in crafting suitable responses in anticipation of growing container traffic as a result of the CPTPP and MSR initiatives. To date, analyses made in the context of the CPTPP and MSR initiatives have attracted limited attention in the literature. Future research should consider expanding the scope to incorporate other elements of container trade and shipping connectivity including transhipment flows, order of port-call and impact from shipping line-operated terminals in order to provide a better understanding on the impact from CPTPP and MSR initiatives. Implications for environmental sustainability, infrastructure development in delta regions, foreign direct investment, supply chain networks, port development financing, terminal productivity, economic management and strategic planning of the port network in relation to the country's maritime sector also warrant further research. Understanding the evolving relationship and dynamics of the container port and shipping business in the context of the CPTPP and MSR could shed new insights for transportation and logistics studies.

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## Appendix

**Figure A1** Key container-handling facilities in the greater Ho Chi Minh City region (see online version for colours)


**Figure A2** Key container-handling facilities in the Haiphong region (see online version for colours)


*Source:* Compiled using Google Maps with data from various terminal operators in Vietnam

**Table A1** Share of shipping capacity by ports connected to Haiphong

| | *1996* | | | | *2006* | | | | *2016* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Port* | *'000 TEUs* | *% share* | | *Port* | *'000 TEUs* | *% share* | | *Port* | *'000 TEUs* | *% share* |
| 1 | Hong Kong | 127 | 66.8 | 1 | Singapore | 389 | 54.8 | 1 | Hong Kong | 2,135 | 64.2 |
| 2 | Singapore | 107 | 56.1 | 2 | Hong Kong | 341 | 48.0 | 2 | Shenzhen | 1,160 | 34.8 |
| 3 | Kaohsiung | 65 | 34.2 | 3 | Qui Nhon | 220 | 31.0 | 3 | Singapore | 920 | 27.7 |
| 4 | Busan | 47 | 24.8 | 4 | Da Nang | 190 | 26.8 | 4 | Busan | 874 | 26.3 |
| 5 | Da Nang | 46 | 24.2 | 5 | Kaohsiung | 143 | 20.1 | 5 | Quanzhou | 719 | 21.6 |
| 6 | Moji | 39 | 20.5 | 6 | HCMC | 74 | 10.5 | 6 | HCMC | 609 | 18.3 |
| 7 | Chittagong | 24 | 12.7 | 7 | Bangkok | 70 | 9.9 | 7 | Kaohsiung | 578 | 17.4 |
| | Mongla | 24 | 12.7 | 8 | Nha Trang | 58 | 8.1 | 8 | Incheon | 549 | 16.5 |
| 9 | HCMC | 22 | 11.3 | | Tg Pelepas | 58 | 8.1 | 9 | Shanghai | 508 | 15.3 |
| 10 | Yokohama | 2 | 1.3 | 10 | Yokohama | 51 | 7.2 | 10 | Da Nang | 505 | 15.2 |
| | Kobe | 2 | 1.3 | | Kobe | 51 | 7.2 | 11 | Qui Nhon | 464 | 13.9 |
| | | | | 12 | Antwerp | 49 | 6.9 | 12 | Xiamen | 426 | 12.8 |
| | | | | | Camden | 49 | 6.9 | 13 | Tokyo | 344 | 10.3 |
| | | | | | Dalian | 49 | 6.9 | | Yokohama | 344 | 10.3 |
| | | | | | Genoa | 49 | 6.9 | 15 | Kwangyang | 267 | 10.1 |
| | | | | | Hamburg | 49 | 6.9 | 16 | Port Klang | 317 | 9.8 |
| | | | | | Houston | 49 | 6.9 | 17 | Kobe | 302 | 9.5 |
| | | | | | Jakarta | 49 | 6.9 | 18 | Shantou | 264 | 9.1 |
| | | | | | Masan | 49 | 6.9 | 19 | Tg Pelepas | 259 | 7.9 |
| | | | | | Qingdao | 49 | 6.9 | 20 | Laem Chabang | 257 | 7.8 |
| | | | | | Shanghai | 49 | 6.9 | | | | |
| | | | | | Tianjin | 49 | 6.9 | | | | |
| | *Total* | *190* | *100.0* | | *Total* | *710* | *100.0* | | *Total* | *3,328* | *100.0* |

Note: Figures for TEUs do not add up to 100% as a single shipping service can involve calls at multiple ports.

**Table 2A** Share of shipping capacity by ports connected to Ho Chi Minh City

| | 1996 | | | | 2006 | | | | 2016 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Port* | *'000 TEUs* | *% share* | | *Port* | *'000 TEUs* | *% share* | | *Port* | *'000 TEUs* | *% share* |
| 1 | Hong Kong | 286 | 51.5 | 1 | Singapore | 1,499 | 47.5 | 1 | Hong Kong | 5,694 | 58.0 |
| 2 | Singapore | 212 | 38.1 | 2 | Hong Kong | 1,487 | 47.1 | 2 | Shenzhen | 5,158 | 52.5 |
| 3 | Kaohsiung | 204 | 36.8 | 3 | L Chabang | 1,201 | 38.0 | 3 | Singapore | 4,269 | 43.5 |
| 4 | Bangkok | 159 | 28.7 | 4 | Bangkok | 857 | 27.1 | 4 | L Chabang | 3,867 | 39.4 |
| 5 | Keelung | 146 | 26.3 | 5 | Busan | 670 | 21.2 | 5 | Shanghai | 3,740 | 38.1 |
| 6 | Taichung | 125 | 22.6 | 6 | Keelung | 596 | 18.9 | 6 | Busan | 3,047 | 31.0 |
| 7 | Kobe | 120 | 21.7 | 7 | Kwangyang | 478 | 15.1 | 7 | Kaohsiung | 2,824 | 28.8 |
| 8 | L. Chabang | 90 | 16.2 | 8 | Kaohsiung | 437 | 13.9 | 8 | Qingdao | 2,237 | 22.8 |
| 9 | Incheon | 86 | 15.6 | 9 | Port Klang | 427 | 13.5 | 9 | Bangkok | 2,033 | 20.7 |
| 10 | Busan | 61 | 11.0 | 10 | Shanghai | 417 | 13.2 | 10 | Guangzhou | 1,825 | 18.6 |
| 11 | Moji | 60 | 10.8 | 11 | Taichung | 363 | 11.5 | 11 | Ningbo | 1,804 | 18.4 |
| | Osaka | 60 | 10.8 | 12 | Ningbo | 328 | 10.4 | 12 | Kwangyang | 1,691 | 17.2 |
| 13 | Nagoya | 58 | 10.4 | 13 | Yokohama | 317 | 10.0 | 13 | Port Klang | 1,632 | 16.6 |
| | Tokyo | 58 | 10.4 | 14 | Tokyo | 315 | 10.0 | 14 | Xiamen | 1,578 | 16.1 |
| 15 | Chittagong | 24 | 4.3 | 15 | Kobe | 305 | 9.7 | 15 | Long Beach | 1,409 | 14.4 |
| | Mongla | 24 | 4.3 | 16 | Haiphong | 276 | 8.8 | 16 | Yokohama | 1,353 | 13.8 |
| 17 | Haiphong | 22 | 3.9 | 17 | Osaka | 245 | 7.8 | 17 | Tokyo | 1,296 | 13.2 |
| 18 | Brisbane | 21 | 3.8 | 18 | Shenzhen | 235 | 7.4 | 18 | Piraeus | 1,241 | 12.6 |
| | Jakarta | 21 | 3.8 | 19 | Qingdao | 185 | 5.9 | 19 | Kobe | 1,163 | 11.9 |
| | Manila | 21 | 3.8 | 20 | Ulsan | 184 | 5.8 | 20 | Nagoya | 1,156 | 11.8 |
| | Port Klang | 21 | 3.8 | | | | | | | | |
| | *Total* | *555* | *100.0* | | *Total* | *3,156* | *100.0* | | *Total* | *9,816* | *100.0* |

Note: Figures for TEUs do not add up to 100% as a single shipping service can involve calls at multiple ports.

**Table A3** Share of shipping capacity by ports connected to BRVT

| | *2009#* | | | | *2016* | | |
|---|---|---|---|---|---|---|---|
| | *Port* | *'000 TEUs* | *% share* | | *Port* | *'000 TEUs* | *% share* |
| 1 | Hong Kong | 1,059 | 86.9 | 1 | Hong Kong | 3,454 | 79.1 |
| 2 | Singapore | 897 | 73.5 | 2 | Shenzhen | 3,356 | 76.9 |
| 3 | Shenzhen | 848 | 69.6 | 3 | Port Klang | 2,424 | 55.5 |
| 4 | Tokyo | 534 | 43.8 | 4 | Shanghai | 2,382 | 54.6 |
| | Oakland | 534 | 43.8 | | Ningbo | 2,382 | 54.6 |
| 6 | Port Klang | 487 | 39.9 | 6 | Singapore | 1,952 | 44.7 |
| 7 | Xiamen | 323 | 26.5 | 7 | Norfolk | 1,608 | 36.9 |
| | Los Angeles | 323 | 26.5 | | Savannah | 1,608 | 36.9 |
| 9 | Kaohsiung | 276 | 22.6 | 9 | Busan | 1,380 | 31.6 |
| | Kobe | 276 | 22.6 | 10 | Charleston | 1,295 | 29.7 |
| | Laem Chabang | 276 | 22.6 | 11 | Colombo | 1,270 | 29.1 |
| | Shanghai | 276 | 22.6 | 12 | Hamburg | 1,192 | 27.3 |
| | Seattle | 276 | 22.6 | | Le Havre | 1,192 | 27.3 |
| | Vancouver | 276 | 22.6 | | Rotterdam | 1,192 | 27.3 |
| | Yokohama | 276 | 22.6 | 15 | New York | 1,184 | 27.1 |
| 16 | Halifax | 250 | 20.5 | 16 | Oakland | 942 | 21.6 |
| | New York | 250 | 20.5 | 17 | Halifax | 871 | 20.0 |
| | Norfolk | 250 | 20.5 | | Vancouver | 871 | 20.0 |
| 19 | Long Beach | 211 | 17.3 | | Vostochnyy | 871 | 20.0 |
| | Osaka | 211 | 17.3 | | Seattle | 871 | 20.0 |
| | *Total* | *1,219* | *100.0* | | *Total* | | *100.0* |

Notes: Figures for TEUs do not add up to 100% as a single shipping service can involve calls at multiple ports. #Figures for BRVT were only available from 2009 onwards.