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Original article

The Implications of the Growth of Port Throughput on the Port Capacity: the Case of Malaysian Major Container Seaports

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Abstract

Malaysia, situated between East and West, is an interface in world maritime trade, playing a crucial role in the business of moving container boxes in South-eastern parts of Asia. The prominent container terminals in Malaysia such as Port Klang and Port of Tanjung Pelepas are positioned among the top twenty ports in terms of volume handled. The annual average growth of throughputs in Malaysian container ports increased more than three-fold from the year 2000 to 2010. Within this context, the development of Malaysian seaports has been significantly influenced by three forces: increased use of containerisation, significant growth in domestic economic activities and ever-changing patterns in both supply and demand chains, all of which have led to increased transshipment activities and altered shipping routes. This phenomenon has brought dynamic change to Malaysian container ports, resulting in the establishment of new terminals and adapting emerging technology to enhance the ports' ability to accommodate larger vessels and an increased number of containers. This paper aims to present the development of Malaysian container seaports by addressing changes to acreage size and handling volumes during the last three decades. The results of the analysis suggest that major Malaysian ports are experiencing an exponential growth in container trade with the expansion of port capacity following trade growth and need effective strategies to reduce the operational pressures of Malaysian seaports. The results of this research offer directions for development strategies of seaports by utilising the existing inland freight facilities as an effective strategy for capacity enhancement and develop efficient distribution network to meet future demands.

Keywords: Trade Growth, Malaysia, Seaport, Container Terminal, Seaport Capacity, Dry Port

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I. Introduction

More than three quarters of the Malaysian total land mass is exposed to maritime water and justifies the importance of the maritime industry to the nation. The Malaysian maritime industry has developed drastically since the 1970s after the first official government announcement in the Third Malaysia Plan to transform Malaysia towards becoming a well-known maritime nation (Third Malaysia Plan, 1976). During the Fourth Malaysia Plan period, which was introduced following the Third Malaysian Plan, the development and expansion of port facilities and interrelated maritime services, including the establishment of new shipping lines, were undertaken to cope with the growth in freight traffic and trade development. The development of seaports is the ultimate backbone of international trade and reveals the potential competitive advantages of their hinterlands (Lam, 2006). The combined factors of economic liberalisation and globalisation have led to Malaysia's increased participation in international trade. In many countries, especially in South East Asia (SEA) regions, the developments in international trade have triggered high investment and development in ports and logistics infrastructure. In Malaysia, the phenomenal growth of port throughput has been significantly contributing to government decisions on seaport capacity expansion. Seaport storage capacity is defined as the amount of cargo that can be handled by a seaport per time period, usually a year and for containers it is the number of handling containers per year (Bassan 2007, p. 3). Seaport capacity and the volume of trade must be in balanced proportions to preserve seaport performance as well as ensuring domestic and international competitiveness.

Thus, this paper aims at identifying the development of Malaysian container seaports by analysing the growth of container volumes during the last three decades and the capacity constraints encountered by major Malaysian seaports. This study also reveals the ability of Malaysian container seaports' capacity to accommodate the increasing trend in container volume in this region. Moreover, suggestions to utilise existing inland facilities have also been provided as substantial substitutes for Malaysian seaports to cater additional volume of containers in this region. This study provides relevant strategies for seaports to improve their capacity constraint by improving infrastructure and facilities as well as diverting their focus towards inland components for effective dyadic integration with hinterland's components (Jeevan and Saharuddin, 2011). The migration of containers beyond seaport regions has become a major trend in the globalized world. Therefore, the ability of seaports to adapt with the current trend and extend their functions inland by utilising existing inland facilities provides an additional advantage to the seaports (Jeevan et al., 2015a). Despite playing a significant role in the trade predicated on globalisation, seaports also have to be focus on globalisation trade patterns in order to enhance their performance, capacity and extending its role beyond the region (Jeevan et al., 2015b). The results of this research offer directions for the future capacity development strategies of seaports to move simultaneously with trade growth and providing significant strategies for capacity utilisation for effective collaboration from the inland component. Therefore, the prediction of the container volume in Malaysian container seaports is important to address the requirement for the seaport capacity extension and to reveal the role of

inland facilities to assist seaports in order to provide seaports an additional external capacity for an effective operation and improve the integration with hinterlands.

II. Malaysian Seaport Industry

Container trade development in Asia is more significant compared to other countries in the world. Asia contributes almost 46.5% of total container traffic. China, India and other regions in South East Asia (SEA) have high potential for further container development (Lee at al., 2006). Due to the impact of globalisation, China, India and SEA countries have become main exporters to many countries and therefore ports in the region have become vital nodes in the global supply chain (Carbone and Martino, 2003). As a result of higher container volumes generated in Asian hinterlands, the size of vessels has grown and therefore many ports in Asia have been facing the challenge of limited capacity in port access and port terminals. For these reasons, a substantial amount of investment in port capacity expansion projects has been undertaken by governments in the region. At the same time, they have invested in advanced port technology, mainly in cargo handling, and strived to preserve their competitiveness by handling larger vessels and minimising vessel turnaround time (Nazery, 2007b). Malaysian ports have invested heavily in port infrastructure and port capacity expansion projects in anticipation of increasing container volumes. The location of major Malaysian ports along main trade lanes such as the Straits of Malacca has become a motivating factor for the ports to provide all the services at competitive rates (Figure 1). A substantial new capacity is required in all major ports in Asia to meet future container trade (UNESCAP, 2007). Ports in Malaysia are classified as federal ports, state ports and private ports. The federal ports were established as federal statutory bodies which are under the jurisdiction of the Ministry of Transportation. Port Klang Authority, Penang Port Commission, Johor Port Authority, Kuantan Port Authority and Bintulu Port Authority are the major examples of this type of category. Additionally, Lumut Port, Sabah Port Authority, Kuching Port Authority, Rajang Port Authority and Miri Port Authority are ports owned and operated by state government. (MIMA, 2013).

Figure 1: Location of major Malaysian container seaports

Source: Authors

Port Klang, Port of Tanjung Pelepas (PTP), Johor Port, Penang Port and Kuantan Port contributed almost USD 373.44 million to the national economy in 2010 (MITI, 2013). In addition to attractive government policies such as promoting multi-modalism, pushing ahead with port privatisation, developing ancillary services, developing land side transportation and enhancing automation and computer in port operation but sufficient capacity for each container port is crucial to ensuring the successful performance of ports (Lam and Yap, 2008). Therefore, this section presents the capacities and various government strategies to develop Malaysian container ports. Port Klang, known as Port Swettenham until being renamed in 1972 and now also known as the National Load Centre, is a main container hub for the region as well as playing a pivotal role in the economic development of the country. Its geographical location makes it attractive to many ships from the eastbound leg and the last port of call on the westbound leg of the Far East–Europe trade route. Since the government hubbing strategies pursued in 1993, the facilities and services in Port Klang are synonymous with those of a world class port, having trade connections with over 120 countries and more than 500 ports around the world (PKA, 2013). Port Klang was the first port authority in Malaysia and one of the first in the world to corporatize and privatise facilities (Sgouris, 2003). In 2010, Port Klang recorded 8.7 million TEUs and was ranked 13th out of 50 container ports in the world. From 1993 to 2010, the number of vessels arriving in Port Klang also dramatically increased by 44.4%. Based on this significant change in container volume, Port Klang has increased its storage capacity from 3.6 million TEUs to 8.7 million TEUs in 2010 (PKA, 2013).

Port of Tanjung Pelepas (PTP) started to operate as one of the container terminals in 1999. PTP, situated at the southern tip of the Malaysian peninsular, is recognised as an ideal port for both regional and global transshipment and distribution activities. Its high accessibility to Singapore by national highway, connection to the national rail grid, access to southern Thailand and potential to be connected to Yangon, Laos and Phnom Penh in the future as a part of the Trans-Asia Railways connectivity, places PTP in an ideal position for cross-border transaction through an intermodal network by 2015 (MITI, 2010). PTP is the southern gateway which interconnects the Johor–Singapore and Indonesia (JSI) Triangle (Iskandar Malaysia, 2013). There has also been a significant increase in container throughput and quantity of ships' arrivals in PTP. The container throughput in PTP increased from 37,539 to 5.7 million TEUs from 2000 to 2010. The number of vessels berthing in PTP also increased from 1,300 to 4,162 in that time period. The storage capacity of PTP is 6.2 million TEUs and it is designed to handle approximately 8 million TEUs annually. This dramatic increase was caused by the dual function of PTP, as national distribution centre and a transshipment hub (PTP, 2013). In this regards, the storage capacity in PTP is over-utilised due to the development in the maritime trade especially in this region.

Johor Port is located adjacent to PTP but the services in Johor Port are more diverse as it caters for both bulk and container freight. The port provides sufficient facilities to handle palm oil, petroleum and petrochemical products as well as dry bulk and general cargo (Johor Port, 2013). Johor Port has been fully operational since 1976 and was privatised in 1993. This port serves major shipping lines regularly with a storage capacity of 1.2 million TEUs at one time, and total container throughput as at 2010 was 953,286 million TEUs. The number of vessels arriving at Johor Port decreased from 2000 to 2010 due to the introduction and development of PTP (MOT, 2013). Penang Port was established in 1956 and was privatised in 1994. Penang Port is an international port

strategically located in the Straits of Malacca on the North West Coast of the Malaysian peninsular. The port is an important hub for the Indonesia–Malaysia and Thailand Growth Triangle (IMT–GT). It plays a significant role in the trade development of these regions (MITI, 2010). The current storage capacity of Penang Port is 660,000 TEUs. In 2010, the total throughput recorded was 956,185 TEUs (MOT, 2013). On the east coast of Malaysia, Kuantan Port is the main container terminal, operating since 1984. It is strategically located next to the South China Sea, which is the main trade trunk in the Asia Pacific region, Asian and Far East market (Nazery, 2007b). As a key investment and trading destination gateway in East Malaysia, Kuantan Port has become the backbone for the establishment of the East Coast Economic Region (ECER). This port is linked to the manufacturing industrial hub by highways, railway and pipe rack facilities. The container storage capacity in this port is 135,000 TEUs and the amount of container throughputs recorded as at 2010 is 141,894 TEUs (MOT, 2013). In a nutshell, PTP, Penang Port and Kuantan Port suffer from an over-capacity issue, Johor Port is under-capacity and Port Klang achieved the optimum level in container handling by achieving an even proportion of storage capacity with container handling

III. Malaysian container throughput development

Malaysia's strategic geographical proximity to the main trunk route through the Malacca strait brings numerous opportunities in the international maritime market. More importantly, the ability of Malaysian ports serving as container mega hubs such as PTP and Port Klang has proved that Malaysia is well established in the maritime industry. In conjunction with this assumption, the Malaysian Government has increasingly recognised the significant contribution of the maritime sector to the nation's economic development (Saharuddin, 2001). Thus the volume of cargo handled in Malaysian ports has increased since the 1980s (Malaysian Freight Transport Report, 2012), with government funding policies in the port sector having been aligned with these rising cargo volumes. For example, the Third Malaysia Plan (1976) formulates overall policies to determine the long-term requirements for port infrastructure, port operations and port expansion as well as to enhance the utilisation of Malaysian ports. As a result of new government policies towards supporting the port industry in Malaysia, there has been an increasing volume of cargo handled in Malaysian ports in the last three decades (Table 1).

Figure 1: Location of major Malaysian container seaports

Cargo type	1980	1985	1990	1995	2000	2005	2010
General cargo	13	12.3	25.3	30.1	23.3	44.7	47
Liquid bulk	5.7	20.3	47.2	60.7	87.5	103.8	202
Dry bulk	2.2	12.3	15.2	23.7	28.6	38.2	44
Container	2.2	7.3	15.7	37.8	84.5	182.7	246
Total	**23.1**	**52.2**	**103.4**	**152.3**	**223.9**	**369.4**	**539**

Source: Tenth Malaysia Plan (2011)

Changes in government policies towards the port sector and international trade have been the key to enhancing this increase. General cargo grew to 34 million, liquid bulk improved to almost 196 million, dry bulk to 41.8 million and containerised cargo increased to 243.8 million from 1980 to 2010. Overall, total cargo in Malaysian ports experienced tremendous improvement from 23.1 million in 1980 to 539 million in 2010, almost 515.9 million of growth in that particular period. This significant rise in cargo volumes has stimulated government funding and investment policies towards port infrastructure development (Malaysian Freight Transport Report, 2012). Therefore, efforts by the Malaysian government to enhance the performance and productivity of ports is crucial to improving turnaround time at ports, upgrading storage facilities, improving capacity and network expansion. Port Klang, Penang Port, PTP, Kuantan Port and Johor Port, being the major container seaports in Malaysia have shown an increasing trend in container trade volume and number of vessel arrivals over the years (Soon and Lam, 2013). These container ports represent the northern, central and southern region in the Malaysian peninsular. Port Klang represents the Central region, Penang Port represents the Northern region, PTP and Johor Port represent the Southern region, and Kuantan Port represents the Eastern region. Table 2 depicts the total container throughput and number of vessel arrivals for each of these ports from 2000 to 2010.

Table 2: Total container throughput and vessel arrivals by ports in Malaysia, 2000–2010

Ports	*Containers (TEUs)*			*Number of vessels*		
	2000	2010	CAGR	2000	2010	CAGR
Klang	3,206,753	8,778,210	11%	12,416	17,940	4%
Penang	635,780	956,185	4%	7,263	6,136	-2%
PTP	37,539	5,736,209	65%	1,300	4,162	12%
Johor	659,181	953,286	4%	6,485	4,882	-3%
Kuantan	62,783	141,894	8%	1,677	2,405	4%
Total	***4,602,036***	***16,565,784***	***13.66%***	***23,992***	***35,525***	***4%***

Source: Marine Department (2013)

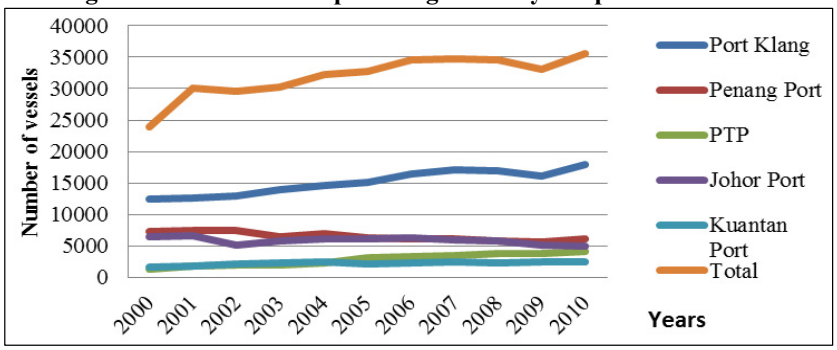
According to Table 2, the volume of containers in each of the major ports of Klang, Penang, PTP, Johor and Kuantan has grown at a compound annual growth rate (CAGR) of 11%, 4%, 65%, 4% and 8% respectively. Notably, PTP experienced a growth in container volume from 37,539 to 5,736,209 with the highest CAGR over the period from 2000–2010 of 11%. Figure 2, below, shows the pattern for the number of ships calling at the main Malaysian ports from 2000 to 2010. This pattern shows the number of ships as fluctuating in the first eight years. Then, the quantity of ships starts to increase in Port Klang, PTP and Kuantan Port in the last two years. On the other hand, there is no significant change in the number of ships calling in to Johor Port and Penang Port from

the beginning until it starts to decrease in 2009 and 2010. The CAGR of the number of vessels calling at each port indicates relatively higher growth rates despite some ports indicating a fall in the number of ships. It is interesting that although the number of ships falls, the volume of containers handled at each port has grown substantially such as in Penang Port and Johor Port. This perhaps reflects the fact that vessels had grown in size over the decade in order to benefit from economies of scale and therefore fewer numbers of calls were made to ports **(**Slack et al., 2002) and another factor is port Klang has been gazetted as a hub container port to cater for larger container vessels. Again, PTP has experienced a growth in vessel numbers from 1300 to 4162 at a CAGR of 12%. The results suggest that Malaysian ports have invested in the capacity expansion of ports in order to facilitate the ever-increasing demand for port infrastructure and berthing facilities.

The dramatic change in container volume happened in three decades due to several significant factors. Firstly, the implication of containerisation has affected Malaysian seaports operation. After receiving its first container in 1971, the strategy to improve seaport capacity to accommodate container has taken place from the 1970s until 1990 (Jamaluddin, 2003). In the late 1990s, PTP started it operation and provided additional capacity for Malaysian seaport trade. The operation of PTP has increased the volume of containers handled in Malaysia from 20,698 TEUs to 5.7 million in 2010 (PTP, 2013). In 2005, Malaysia has transformed its economy to manufacturing and trade based from agriculture and commodities dependent based. As a consequence from the transformations, the volume of export manufactured commodities has upsurged to 78.4 % of the total Malaysian exports (Nazery, 2007a). However, the implication from seaport privatisation between 1986 until 1990s which aimed to establish seaports featuring with modern terminal facilities in order to improve its performance has become one of the major contributions for container growth in this region. Moreover, rapid industrialisation growth, development of inland freight facilities and collaboration in seaport's multimodal infrastructure with inter-regions including Thailand, Singapore, Indonesia and Brunei has become additional factors which contributes container development in Malaysia especially from 1980 until 2010.

Port Klang demonstrates the largest variation of the increase, and the other ports demonstrate a steady number of vessels over the last 10 years (Figure 2). As the size of vessels continues to increase, the volume of containers that can be carried to ports for handling has significantly increased. The growth of port trade in the main four Malaysian ports demonstrates an exponential growth over the last decade, despite a slight downfall in the growth rate in the last three years. In Section five below, Figure 3 shows the TEU growth of five major ports in Malaysia. Vessels alliances have a close relationship with this situation where the number of vessels decreases but the volume of containers keeps increasing especially in Penang Port and Johor Port. The process of shipping alliances has begun since 1994 and the trend became significant in 2000 (Alderton, 2004).

Figure 2: Number of ships calling at Malaysian ports 2000–2010



Source: Marine Department (2013); MOT (2014)

IV. Methodology

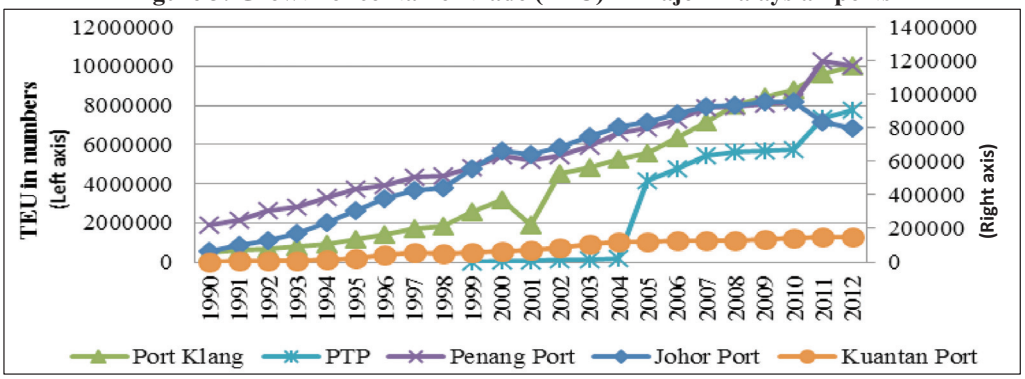
Time series data of the five main Malaysian ports' throughput and total port capacity for the period 1990 to 2012 was collected from various sources. The data was analysed using several statistical techniques. First, a trend analysis using polynomial regression was conducted for total TEUs trade of the five major ports. The regression analysis was conducted to determine the relationship between total containers in the seaports with the total capacity in the each seaport. The data to conduct the regression analysis was obtained from reliable secondary data and consists of formal reports and statistics from Ministry of Transportation (2013; 2014), Marine Department, Malaysia (2013) and Maritime Institute of Malaysia (2013). Total port capacity of the five ports demonstrates a growth pattern that was determined by government port infrastructure policy. Therefore, it was considered as exogenously determined. Secondly, a three-period moving average method was applied to identify the trend of port capacity growth. Growth of the total container throughput of the five major ports was forecast for a 10-year period from 2012 and matched against the growth of port capacity. Regression analysis and three-period moving average methods are required in this research to identify the current capacity of Malaysian seaports to accommodate container volume in the future. Moreover, the result from these analyses will determine the additional strategies that are required for these seaports to sustain in the maritime business.

V. Analysis of results and discussion

The growth of port trade in the five main Malaysian ports demonstrates an exponential growth over the last decade, despite a slight downfall in the growth rate in the last three years. The growth of Port Klang and PTP shows in the left axis and the container growth of Penang Port, Johor Port and Kuantan Port illustrates in the right axis in Figure 3. The growth of containers has to be divided into two main axes because the growth margin among those ports is very enormous and also to clearly portray the container growth trend in every port in Malaysia. The growth in the TEU trade of Port Klang is shown in the right axis while the other four are shown on the left axis. All ports demonstrate an increasing trend of TEU growth. Increasing port trade, especially in TEU, has

implications for port management. This situation arises because container port operations are closely connected with physical capacities (Van Ham, 2005) and proper economic conditions such as sustainable cargo creation based on local economic conditions (Notteboom and Rodrigues, 2008).

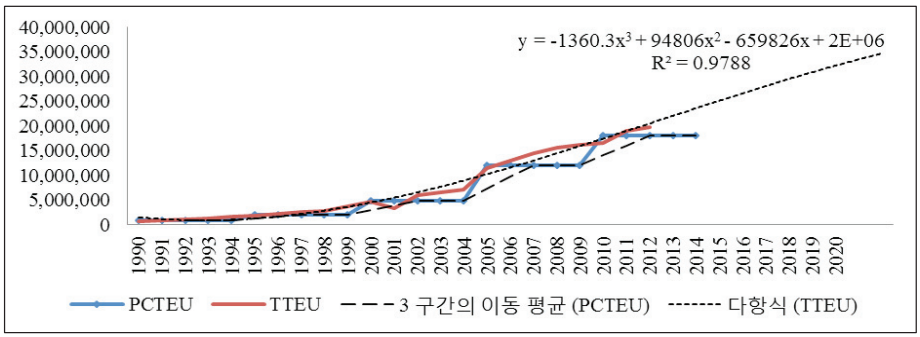
Figure 3: Growth of container trade (TEU) in major Malaysian ports



Source: Marine Department (2013)

One of the major implications of the extensive growth of containers in Malaysian ports is the provision of adequate port capacity to ensure that the Malaysian maritime industry, especially the ports sector, is prepared to move ahead simultaneously with globalisation. The Malaysian port sector has been subjected to government regulation and national policy on infrastructure development. The expansion of ports is therefore determined by the decisions made by the government at a national level and subject to national planning policy. Over the last decades port capacity expansion was continuous but with a five-year production lag. Since 1966, every five years the Malaysian Plan contributes to the capacity development of Malaysian seaports based on TEU performance (Tenth Malaysian Plan, 2011). The strategy implemented by the government to invest in seaport capacity prevents surplus investment in capacity which would then trigger an over-capacity problem. Therefore the port capacity expansion of major ports demonstrates a clear pattern that every five years additional capacity is added to the port sector. Figure 4 shows total Port Capacity in TEU (PCTEU) of major Malaysian ports and Total TEU (TTEU) growth for the period 1990–2012.

Figure 4: Total TEU growth and total port capacity of major Malaysian ports 1990–2012



Source: Authors

The strategy in the Malaysia Plan 2006–2010 is to utilise existing facilities but place emphasis on better delivery and quality of services and the expansion of networks as well as capacity expansion. In this regard, infrastructure will be developed to facilitate the growth of containers in Malaysian seaports (Malaysian Freight Transport Report, 2012). During the last two decades the port capacity expansion strategy was based on the growth of total TEU trade. However, according to Figure 4, port capacity is superseded by the total TEU trade as a whole and clearly shows that trade volume growth is followed by capacity expansion. The ports have been able to accommodate large volumes of the TEU despite limited port capacity during the period 1997–2000, 2002–2004, 2005–2010 and 2011 onwards. During these periods, the Malaysian government applied the strategy which is stated in the Malaysian Port Policy. In this policy, the government focused on the utilisation of existing resources to enhance the seaport performance. The utilisation of current resources from an operational aspect, transportation features or service enhancement triggered improved seaport performance at the same time as making the ports well organised to receive more containers than the existing capacities for the five-year time period. According to Mak and Bernard (2001) the Malaysian Port Policy agenda includes the utilisation of existing port capacities, improving port efficiency on port productivity, promoting multi-modalism, pushing ahead with port privatisation, improving ancillary services, utilising land and extending the port leg, enhanced rail transportation and promoting computerisation in port operation and high encouragement of the participation of the private sector, all of which have been emphasised by the government. Furthermore, utilisation of existing port capacities such as optimising port infrastructure, reducing external cost from congestion and accidents, optimisation of the transportation system and introduction of new transport systems are expected to occur in this situation (Kim et al., 2013).

The trend line fitted to data on the total TEU of the five major ports demonstrates an increasing growth over the next 10-year period. The change in total TEU due to the change in one year (that is ‘x’ in the regression equation) on average would be around 1.4 million [= -1360.3(1)3 + 94806(1)2 – 659826(1) + 2E+06] for all Malaysian ports. The trend line forecast (polynomial) is a good model fit by considering a very high R square value (R2=0.9788). The total port capacity of the five Malaysian ports remains at approximately 18,000,000 TEUs in the next three-year period. The challenge is whether the ports are able to accommodate such an ever-increasing TEU volume within the ports. Given that the large volume of TEUs is the transshipment in one of the ports (PTP) and with ever-increasing TEU originating from and destined to the hinterland, all ports should be

able to provide adequate capacity to containers. Malaysia's total trade has dramatically increased from 1980 until 2010. Based on the statistics provided by Principle Statistics of Malaysian Trade from 1980–2010, Malaysia's total trade was recorded as USD 16,519 million in 1980, USD 50,810 million in 1990, USD 219,217 million in 2000 and in 2010 approximately USD 373,652 million was achieved. Therefore port capacities become vital in contributing towards national economic development. The port system of a county primarily serves the country's international trade.

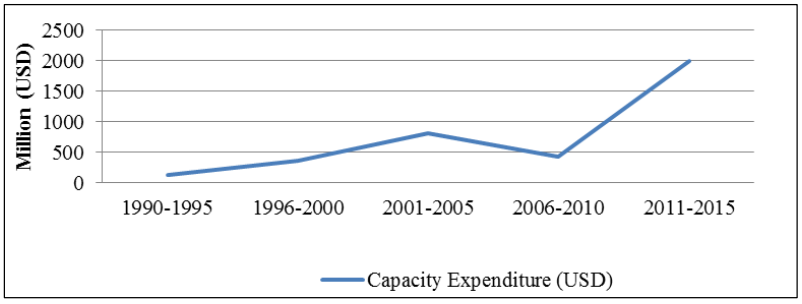
Growth in trade means growth in the port business. Ports therefore should be prepared to accommodate growing trade volumes in a competitive world trade. Malaysian international trade has been rapidly increasing primarily due to increased export-oriented industrialisation over the last two decades. Major ports in the country have been the gateways to international trade and over the years ports have developed and modernised to reach the world-scale competitive international port league. The performance of the port sector is a primary concern of port users, both shipping lines and shippers. Providing efficient and reliable port services is a key determinant in the port choice of shipping lines (Chang et al., 2008). Therefore maintaining such a high standard of port services is a challenge for port management. With increasing port trade, a port faces limitation of port capacity, long cargo dwelling times and long ship turnaround times unless port management continues to improve the standards and technology and port physical capacity in line with port volume. The Malaysian port sector demonstrates a good record with regard to container dwelling time, recorded as four days, while the international practice for container dwelling time is seven days (Alex, 2013; World Bank, 2013).

Malaysian ports have been able to achieve this higher efficiency due to continuous expenditure on efficiency improvement in port terminal infrastructure, cargo handling technology and equipment, and port information technology. All ports have been able to perform over their existing capacity, however, at the cost of increasing capital expenditure on port infrastructure and services. High volumes of port trade prompt port management to take initiatives towards expanding port capacity. Within a centralised port management system where the public sector has the sole discretion of making investment decisions on port infrastructure, port capacity expansion demonstrated a clear pattern of growth. Figure 5 illustrates that capital allocation for the Malaysian port sector has been on the rise and, during 2014 and 2015, it will be significantly increased. The expenditure trend of Malaysian port capacity shows a fluctuating flow from 1990 to 2010. The amount of investment in port capacity increased almost six times from 1990 to 2005. In contrast, the volume of capacity expenditure shrank from 2006 to 2010 compared to previous years. These phenomena occur because the port capacities are adequate to comply with the number of containers in that time period as depicted in Figure 4. In the Tenth Malaysia Plan (2011), the Malaysian government decided to invest a massive amount of capital to upgrade the capacity of seaports. This important decision has been made because Malaysian seaports will face tremendous constraint in terms of their capabilities in handling surplus containers from 2016 onwards (Containerisation, 2012).

The strategy of existing resource utilisation will not be able to conform to the drastic increase in the volume of containers. Therefore additional resources such as space, infrastructure

enhancement, network construction and involvement of additional logistics entities are needed to enhance seaport competitiveness (Notteboom and Yap, 2011). According to Notteboom (2004), the excessive growth of the container throughput will have an operational impact on the seaport's system. As a result, an immediate new strategy is needed to reduce the operational pressures of Malaysian seaports. Such a strategy is important as it would allow seaports to accommodate the increasing volume of containers as well as the high number of vessel arrivals to Malaysian waters in the future.

Figure 5: Total cost allocation of port capacity 1990–2013



Source: Tenth Malaysian Plan (2011)

VI. Implications and conclusion

Exhausted utilisation of existing port capacities and over-capacity planning will affect the internal operation of seaports and, at the same time, leave some obstructions on the external seaport network such as rail and intermodal terminal networks (Ghaderi et al., 2015a; 2015b). The volumes of containers in Malaysian seaports are expected to grow and this situation will be expected to outpace the current capacity possessed in each seaport. In this case, strategy to improve seaport capacity would be an effective strategy to prevent these circumstances from arising. Although the seaport authorities and policy makers allocate a substantial amount of financial aid to improve the seaport capacity, it will significantly increase the seaport chargers, causing environmental issues because major container seaports choose to reclaim for additional space. However, if seaports are unable to improve their seaport capacity, it will cause some other disadvantages from different dimensions especially congestion, long turn-around time not only for vessels but also for containers and also affecting the efficiency in the supply chain. Hence, strategies to improve seaport capacity or ignoring the requirement for additional capacity in Malaysia's scenario will substantially affect the competitiveness of Malaysian container seaports and lose to the severe competition with its neighbouring seaports. Therefore, Malaysian seaports require a logistical solution to overcome this dilemma. The interaction of seaports with external logistics centres such as dry ports will produce an efficient long-term solution by providing additional external capacity for seaports beyond the region. The ability of dry ports to provide almost all the services, the same as a seaport, will attract more stakeholders to use these external facilities which are located near to their manufacturing area.

This situation will enhance the existing capacity of the seaport which can then be reserved for transshipment purposes, especially in PTP and Port Klang. The emergence of dry ports in assisting seaports in terms of capacity makes Malaysian ports more competitive compared to their rivals.

In contrast, if the government continues to increase the capital expenditure on improvement in Malaysian ports every five years, it will have a less positive impact on Malaysian seaport attractiveness among the shipping lines due to high port charges. Seaport charges will simultaneously increase with the amount of capital expenditure, because increasing port charges is the only appropriate approach for the port authorities to take when compensating for the cost which has been invested earlier. Although high fleet frequency and continued container traffic volume may contribute to the cost recovery but increment in port chargers will also be necessary because the large scale capital investment in seaport capacity requires a long term payback period (Ho and David, 2006). This situation influences the attractiveness of Malaysian seaports to shipping lines, this situation will also bring many benefits to rivals. The assistance provided by dry ports results in a huge transportation benefit to the nation. To enhance dry port performance, the development of the seaport–dry port corridor must be enforced. This establishment of a seaport–dry port corridor will reduce traffic and increase accessibility to the seaport. Both of these factors will contribute to Malaysian seaport performance, especially in terms of hinterland connectivity, faster vessel turnaround time and improvement in cargo dwelling time. From a regional aspect, the stimulation of dry ports in the seaport system creates high employability to the local community. Additionally, the infrastructure development, comprehensive transportation system and introduction of various modes of transportation provide many options for local entrepreneurs to achieve on-time delivery to their respective customers. At the same time, the support of dry ports means that seaports are able to accommodate higher volumes of containers, and less investment in capacity enlargement is necessary. These strategies have been implemented in China where dry ports have been introduced to decrease the pressure on seaport capacity while simultaneously offering lower port charges (Qin, 2010). Therefore, rather than the Malaysian government allocating large amounts of money solely for capacity expansion, the same amount may be used to enhance the quality of the transportation system especially the rail system, upgrade the seaports–dry ports–stakeholders corridor connectivity, and increase accessibility to and from the seaports with the promise of long-term profits to stakeholders, seaports, dry port operators and to the nation as a whole.

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