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Original article

The Malaysian Intermodal Terminal System: The Implication on the Malaysian Maritime Cluster*

Mohamad Rosni OTHMAN [1], Jagan JEEVAN [2], Shamsul RIZAL [3]

[1] School of Maritime Business and Management, University of Malaysia Terengganu, Malaysia, rosni@umt.edu.my
[2] School of Maritime Business and Management, University of Malaysia Terengganu, Malaysia, Jagan@umt.edu.my
[3] Malaysian Maritime Academy (ALAM), Malaysia, shamsulrizal@alam.edu.my

Abstract

The maritime sector in Malaysia is best known globally due to the Straits of Malacca and being a nation surrounded by sea. Malaysia also has a substantial maritime industry consisting of numerous shipyards, ports and terminal faculties, ship services and a plethora of other companies and institutions with maritime oriented activities and become essential components of the Malaysia's maritime clusters. Issues such as underutilised intermodal terminals, uneven proportions in the freight transport infrastructure and road and seaport congestions prevent Malaysian seaports from achieving their full potential in serving their respective hinterlands. The key factors to improve Malaysian dry port or intermodal terminals are transport network; container planning; competition; location and, externalities. The paper does not only present the critical challenges faced by Malaysian intermodal terminals especially dry ports and the implications for seaport competency but it also provides strategies to utilise the Malaysian freight multimodal system to amplify seaports' performance in serving their hinterlands. As such, this may warrant policy makers to devise a comprehensive national master plan for the maritime sector in order for Malaysia to further develop her maritime industry and economies.

Keywords: Malaysia, Maritime Cluster, intermodal transport, hinterland port, seaports

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I. Introduction

The sea has always played an important role in Malaysia, which has been a maritime nation for over a thousand years. The shipping architecture, creativity and the intelligence of the sea masters are well noted in many Malay states and countries. They successfully described the trade, political ties and the history of the legendary Malay conquerors through the water route, in which the Malacca Sultanate era is an excellent example of how Malacca carried out global trading activities in distant places as early as the fifteen century. This tradition has continued into modern times, with large merchant ships being involved in global trade. Even today, shipping represents nearly 90 percent of trade and the shipping industry aims to generate RM 6.35 billion in Gross National Income (GNI) and thus creates an additional 55,500 jobs for Malaysia by 2020 (MIGHT, 2014).

The development of Malaysia as a maritime nation started in the 1970s. During this period, seaport infrastructure was developed, and new shipping lines were initiated to support the nation in coping with current trends in international trade (Third Malaysia Plan, 1976). Besides concentrating on seaport infrastructure, the enhancement of multimodal transport infrastructure, especially road and rails, were given priority in order to increase the strength of hinterland connectivity with the seaport (Valautham, 2007). Therefore, the volumes of containers handled as well as the establishment of new seaports to cater for these increased volumes have evolved simultaneously since the 1980s (Tenth Malaysia Plan, 2011). Although the era of containerisation in trade started in 1956, it took almost 17 years to reach Malaysian waters, with the first container vessel berths were established at Port Klang in 1973. The dramatic change in world trade as a consequence of the evolution in transport infrastructure has brought a substantial impact for Malaysian maritime business. Besides maximum land exposure to maritime waters, the strategic geographical location of Malaysia between the Pacific and Indian Oceans as well as owning the seventh longest coastline in the Asian region (WFB, 2015) have made this coastal country to become an important continent to influence the world economic trade. Economic liberalisation and globalisation have prompted Malaysia to aggressively participate in international trade. As a result, the proportion of container throughput in Malaysia has recorded as Asia's third largest container generator after China and Singapore (Lavigne, 2014).

The logistics sector is important to support the maritime industry in Malaysia, which is one of the best known globally due to the Straits of Malacca and the fact that it is a nation surrounded by the sea. Moreover, Malaysia has a substantial maritime industry consisting of numerous shipyards, ports, terminal facilities, ship services and a plethora of other companies and institutions involved in maritime oriented activities. Thus, logistics and multimodal transportation system becomes the pillar of the future maritime industry. The logistics sector is an important component for any modern economy that wishes to take advantage of the challenges resulting from globalization. Roads, seaports, airports, railways and maritime transport are key infrastructure factors that influence the efficiency of the supporting processes. As a result of its ideal geographical location, Malaysia is emerging as the trade hub between the East and the West. Trans-shipping through this strategic location allows for cost and process efficiency gains, reducing the times along the supply chain. Malaysia currently has half of the world's oil and a quarter of the world's trade passes through its waters (the straits of Malacca). With its open economy and increasing integration in the ASEAN, Malaysia is well placed to take advantage as a regional logistics hub. So, how good the country's logistics and supply chain system is?

To assist seaports to increase their level of competitiveness and to excel in the competition, this paper aims at identifying the challenges faced by Malaysian seaports. Moreover, it also provides significant strategies to overcome those challenges, thereby minimising the negative impacts on seaports. These strategies include the development of a multimodal transportation system, development of rail capacity, improvement of road infrastructure and also improvement in container management during border transactions. A particular focus will be made on identifying the challenges in the intermodal transport infrastructure and their implications for seaport competencies. The results offer new directions for the future development strategies of seaports and intermodal transport infrastructure development for managing the expected trade growth and thus sustaining optimum level of competitiveness. Hence, recommended strategies will be formulated as an initial proposal to overcome the impediments caused by intermodal terminals in the seaport system. This paper is organised as follows. Section 2 provides a brief introduction to intermodal transport systems and distribution of logistics and maritime companies. Then, Section 3 presents the development of the maritime industry in Malaysia, while Section 4 gives an overview of the Malaysian dry port system. Accordingly, Section 5 presents the Methodology and conceptual framework, while Section 6 Results and discussion and finally, a conclusion are provided in Section 7.

II. Malaysian maritime cluster and Intermodal transport systems

In general, multimodal transport infrastructure is defined as an optimal integration of different transport modes enabling an efficient and cost-effective use of the transport system through seamless and customer-oriented door-to-door services (European Commission 2000, p. 2). Transport infrastructure provides the means for goods carriage by at least two different modes of transportation (Kanafani & Wang 2010, p. 4). The terms 'multimodal transport' and 'intermodal transport' are used interchangeably in the context of cargo movement from its origin to destination. Although these two terms have similar meanings in the movement of goods from their origin to destination by at least two different modes of transport performed under contract (UNCTAD, 1995), there is a difference between them. UNCTAD (1995) distinguishes them by providing unambiguous definitions. In brief, the major difference between them is the 'loading unit'. The term intermodal is used to indicate that the movement of goods is in 'one and the same loading unit', while 'unit loads or cargo' are the units of handling used by a multimodal system when changing the mode of transport (Schramm, 2012). Therefore, intermodal transport is a particular type of multimodal transport.

According to the aforementioned definition of intermodal transport, dry ports will be taking into account the current situation of intermodal terminals in Malaysian freight or container transportation while serving seaports as well as their respective hinterlands. Intermodal transport infrastructure is the crucial component in dry port operations and normally, this type of terminal is referred to as an integrator of various modes of transportation (Kapros, 2003). Moreover, based on UNESCAP (2009), dry ports are specific terminals under the umbrella of intermodal terminals which encourage the application of modal shift through intermodal transportation activities. Based on this criterion, it is evidently indicated that intermodal transportation and dry ports are well connected through interoperability to provide significant advantages to their stakeholders including seaports, freight forwarders, shippers, shipping lines, rail operators, hauliers and also manufacturers (Jeevan et al., 2015a). Hence, this paper reveals the current conditions and challenges of intermodal transportation including road, rail and dry ports while serving seaports and their hinterlands. Moreover it also provides policy and strategic recommendations to improve the efficiency of intermodal transportation in the complex seaport system.

Identification of the geographical distribution of logistics and maritime companies by using data from the reports of the Malaysia Maritime Industry, Logistics and Transport Directory for the year 2014/2015 and Population data in the year 2010 from the Department of Statistics has given way to an analysis on the overall general distribution of maritime and logistics companies based on population in the maritime cluster areas. Results in the Table 1 and 2 shown the total of 4579 players or registered company units in the Malaysian Maritime Cluster. Maritime cluster areas highlight the impact of maritime activities and logistics sector on population in the maritime cluster areas. Maritime cluster which is mainly located in the coastal regions accounts for 27% of the Malaysian population. The share of the state's regional population living in the maritime cluster areas was highly concentrated especially in the West Coast Peninsular Malaysia. Basically, maritime cluster areas reflect the attractiveness and influences of the maritime activities and logistics sector, which are located along the coastal areas. They directly affect 4579 maritime related companies and logistics and more than 8 million peoples located along coastal areas.

III. The maritime industry in Malaysia

The sea has always played an important role in Malaysia, which has been a maritime nation for over a thousand years. In 2014, nearly 90 percent of trade and the shipping industry aimed to generate RM 6.35 billion in Gross National Income (GNI) and create an additional 55,500 jobs for Malaysia by 2020 (MIGHT, 2014). In the global scenario, the world fleet reached a total of 1.69 billion DWT in 2014. Bulk carriers accounted for 42.9 percent of the total tonnage, followed by oil tankers (28.5 percent) and container ships (12.8 percent) as reported by UNCTAD in 2014. Shipping is an activity that is closely related to trade as the bulk of the world's trade is carried via the sea. As such, developments in the shipping sector are sensitive to changing patterns of trade and economic activities and have a huge bearing on shipping industry's development.

The geographical distribution of the maritime firms shows that there is a total of 4,579 players' or registered company units in the Malaysian Maritime Cluster. The maritime cluster, which is mainly located in the coastal regions, accounts for 27 percent of the Malaysian population. The share of the state's regional population living in the maritime cluster areas is highly concentrated especially in the West Coast Peninsular Malaysia. Basically, maritime cluster areas reflect the attractiveness and influences of the maritime activities and logistics sector along the coastal areas. They affect 4,579 maritime-related companies and logistics and more than 8 million people located in this maritime nation (Othman, 2011). Based on the Malaysian seaport recent scenario, in general, seaports in this region are categorized as federal seaports and state seaports. The ministry of transportation governs federal seaports and some examples of federal seaports are Port Klang Authority (PKA), Penang Port Commission (PPC), Johor Port Authority (JPA), Kuantan Port Authority (KPA) and Bintulu Port Authority (BPA). State seaports are normally administered by the state governments with Lumut Port, Sabah Port Authority (SPA), Rajang Port Authority (RPA) and Miri Port Authority (MPA) being some of the examples of state seaports (MIMA 2014). In this paper, only dominant container seaports, Port Klang, Penang Port and Port of Tanjung Pelepas (PTP) will be used as a case study.

Firstly, PKA is operated by two different operators consisting of West Port and North Port, with each of them contributes to 67 percent and 33 percent respectively of container throughput for this main seaport (Salisbury, 2014). In world ranking, PKA achieved almost 10.35 million twenty-equivalent units (TEUs) and was ranked 12th among 50 container seaports in the world in 2013 (Salisbury, 2014). This seaport is well connected by dry ports to facilitate its operations from the hinterland, including Padang Besar Cargo Terminal (PBCT) and Ipoh Cargo Terminal (ICT) in the northern region of peninsular Malaysia, Nilai Inland Port (NIP) in the central region and also Segamat Inland Port (SIP) in the southern region of peninsular Malaysia (Jeevan et al., 2015a). Secondly, PTP is governed by Johor Port Authority and this seaport is located at the southern tip of peninsular Malaysia. In 2012, almost 800 000 TEUs were recorded with 4800 ship calls (JPA, 2014). PTP is recognised as the second largest container seaport in Malaysia after PKA. In the world ranking of container throughput, PTP recorded 7.63 million TEUs and was ranked 20th out of 50 container seaports around the world in 2013 (Salisbury, 2014). This seaport is well connected to all three dry ports including ICT, NIP and SIP (Jeevan et al. 2015a). Penang Port is the third largest seaport in Malaysia and the landlord for this seaport is the Penang Port Commission (PPC, 2014). This seaport is strategically located at the northern tip of the Straits of Malacca which is one of the busiest shipping lanes in the world (Lee & McGahan, 2015). In addition, this seaport is located in the northern region of peninsular Malaysia and is adjacent to an economic hub including the Indonesia-Malaysia-Thailand Growth Triangle (IMT-GT) which encourages trade development between these countries (PPC, 2014). This seaport is well connected to PBCT and ICT and the main intermodal terminal connecting this seaport with domestic and international stakeholders.

In terms of container throughput development, all three Malaysian container seaports indicated a developing trend in the past 23 years from 1990 until 2013. For example, in Port Klang, the number of TEUs handled in 1990 was 496 526 TEUs and this volume expanded to 10.3 million TEUs in 2013. The same trend happened to PTP whereby it started with 20 698 TEUs until 7.4 million TEUs were recorded in 2013. Meanwhile in Penang Port, the trend is parallel with other seaports but with only a minimum margin of containers. The Strait of Malacca is considered as the international passage for travelling between Europe and Far East by sea and vice versa with total the total vessel plying the Malacca Strait is 380,455 vessels for the period of 5 years (2010-1014). When we look at the combination of road and rail network is the main multimodal option in peninsular Malaysia for freight transportation and this affects the growth of seaports (Anor et al., 2012). The reliability, timeliness and cost-effectiveness of the transportation system is crucial for development of new economic growth or planning for economic transformation. Thus, integrating the rail-road system for port-hinterland freight in Malaysia is important. Modern transportation and transport system in Malaysia were developed during the British colonial rule and have been further improved now to cater for freight transportation from seaports to their respective hinterlands via strategic dry ports. In this paper, intermodal transport systems will be assimilated with key freight transportation modes and dry ports to explore a specific angle in container transportation in the supply chain.

Basically, the length of railway track is 1641 km which consists of 80 percent single track and the remaining double track (20 percent), connecting from the border with Thailand in North Peninsular Malaysia to the south of the peninsular with a maximum speed of 70 km/hr (Naidu, 2008). Most of the Malaysian rail track is dominated by narrow gauge which diminishes opportunities for double-deck container loading on the wagon (Malaysia Freight Transport, 2012). Nevertheless, the double-track railway network was extended to 774 km (47 percent) after the completion of the electrified double-track project from Ipoh to Padang Besar in November 2014 (AJTP, 2015). The Malaysian rail link is connected to the major seaports and other intermodal terminals including some dry ports. Moreover, to provide just in time (JIT) services and also to retain the just in sequence (JIS) concept, this railway system has established a subsidiary road haulage agency called Multimodal Freight for effective final leg delivery (Valautham, 2007). Although the container volume contributed by the Malaysian rail freight system is far smaller than that of road freight, this mode of transportation is still used to carry cement, containers, petrol, processed food and other minerals from one destination to another. There are three trends identified in cargo transported by rail in Malaysia which are increase, decrease and stagnant (Table 3). Cement and clinker, as well as processed food and drinks, show positive flow whereby the volume of these cargoes had increased from 2004 until 2013. Conversely, landbridge, petrol and mineral oil, as well as ore and other minerals, showed a very sharp decrease in a ten-year time period. Moreover, containers and chemicals showed stagnant flow from 2004 until 2013 (MITI, 2013). The volume of load by rail recorded increment from 2004 until 2008, then started to decrease onwards until 2012. After 2012, the volume of cargoes transported by rail showed an increment from 2013.

Road linkage in Malaysia covers 210 658 kilometres, of which 79 percent is paved and 1969 km are expressways (PWD, 2014). Almost 79 percent of this length is paved with flexible or rigid pavement (PWD, 2014). Penang, Klang and Johor, being the main cities for Malaysian seaports, share a common identity as they are located in the most congested states in Malaysia. This occurs because the Malaysian road system facilitates almost 80 percent of freight logistics with the remaining portion being for general purposes (Masriq, 2012). Port Klang, PTP and Penang Port are connected by road networks to and from the hinterland. Port Klang has a sufficient road network to connect it with every region in Malaysia such as the North-South Expressway, Klang Valley Expressway and Federal Highway 2 (PKA, 2015). PTP is connected to Singapore and the main capital of Malaysia through the North-South Highway Link and Malaysia-Singapore Second Link respectively (PTP, 2015) while Penang Port can be accessed through the North-South and East-West highways (Aziz & Mohammad, 2013).

IV. Malaysian dry port systems

In general, a container seaport system is not complete without inland freight facilities to close the gap with the stakeholders' network in order to amplify the existing resources to support efficiency in the supply chain, strengthen seaport competitiveness and promote regional growth. In line with this strategy, Malaysian container seaports are equipped with four dry ports which are located perpendicularly connecting Thailand-Malaysia-Singapore. Padang Besar Cargo Terminal (PBCT), Ipoh Cargo Terminal (ICT), Nilai Inland Port (NIP) and Segamat Inland Port (SIP), which actively operate dry ports in Malaysia (Jeevan et al., 2015b). PBCT, which is a mid-range dry port for Penang Port and a long-distance dry port for Port Klang is well connected to the seaports via road and rail transport networks (Jeevan et al., 2014). Next, ICT is a mid-range dry port for Penang Port and a long-distance dry port for Port Klang and PTP. This dry port is connected with all Malaysian container seaports by means of road and rail links. NIP is the third Malaysian dry port and is considered as a short-range dry port for Port Klang and a long-distance dry port for PTP. Finally, SIP, which is located in the southern part of peninsular Malaysia, is a mid-range dry port for PTP and Port Klang (Jeevan et al., 2014). All Malaysian dry ports support container seaports' transloading activities by splitting the seaports' function in inland locations (Arvis et al., 2010). Functions such as interface nodes linking production zones with seaports, customs services, space for container storage and customised services are greatly demanded by stakeholders. In addition, these dry ports also contribute to supply continuity of container volume to seaports, providing additional capacity and acting as a connecting point for intermodal transportation systems (Jeevan et al., 2015a). Figure 1 depicts the major components of the Malaysian container seaport system consisting of container seaports, dry ports, transportation network and economic hub in each state (city).

The multiplicative location quotient (LQ) is used as a measure of the location attractiveness of certain regions or countries for certain types of industry (Miller, 1991). Specialisation or concentration of related industries is a widely recognised economic phenomenon and plays an important role in 'branding' cities, regions and states. Location quotients are used in this paper to show and compare concentrations of industries in a particular area, and they are critical to understanding an area's economic strengths and weaknesses. Location quotients compare an area's business composition to that of a larger area (i.e., nation or state) and are measured on a simple numerical scale. Basically, maritime cluster areas reflect the attractiveness and influence of the maritime activities and logistics sector. They are located along the coastal areas and the concentration distributions of the shipping industry are mostly located in the east-coast of peninsular

Malaysia. The container seaport and dry port are well connected by rail and road links as shown in Figure 1. The railways overcome the carrier inland accessibility problem and the cost of the rail mode service is cheaper compared to other land mode of transportation.

V. Methodology and Conceptual Framework

A qualitative approach was selected as a medium to achieve the main aim of this paper. Semi-structured face-to-face interviews have been conducted to gather information on the issues arising from the Malaysian intermodal systems and their implications on seaport competency. Therefore, a total of 14 prospective interviewees at middle and higher managerial level and with adequate experience and knowledge were invited for the interview session (Table 4). They were selected from various organisations which are involved in the seaport-dry port operations such as Malaysian dry port operators, container seaport authorities and operators, and respective government agencies. All the respondents were selected by means of convenience sampling which is highly suitable for choosing eligible and potential participants who are willing to be interviewed. This sampling strategy is carried out by identifying potential respondents who meet the specific criteria and then selecting them on a first come, first served basis (Klassen et al. 2012).

The interview sessions involved 4 seaport managers, 4 dry port branch managers, 2 government managers from the Ministry of Transportation and the Malaysian Marine Department respectively, and a logistics and distribution manager. Each interview session took approximately 30–40 minutes. Grounded theory was employed to analyse all the collected data which greatly matches for case study research and also enhances the validity of qualitative research through an evidently specified operation procedure (Parker & Roffey, 1997). Moreover, a systematic design is used to generate themes from data analysis steps consisting of familiarisation, reflection, open coding, axial coding and selective coding process (Creswell, 2008). Grounded theory proceeds through systematic procedures of data collection, categories or themes identification, connecting the themes and forming a theory that explains the process (Corbin & Strauss, 2008). In general, there were sections in the interview session. The aim of the first section was to understand the role and functionality of Malaysian intermodal terminals in the container seaport system. The second section was to gather information on the challenges that these intermodal terminals faced during their operations to serve their respective seaports and clients in the hinterland. The final section gathered data on the implications for seaports due to deficiencies in the intermodal system. As mentioned earlier, this paper analyses the challenges faced in the Malaysian intermodal system and the implications for the container seaport systems. Therefore, challenges, particularly from the intermodal system, consisting of Malaysian road, rail and dry port operations systems and their implications for container seaports are revealed through interviews with professional respondents. This paper shows that the Malaysian intermodal system becomes the main interface between seaports and hinterland. Therefore, any impediments that occur in this intermodal system may result in substantial consequences for the whole container seaport competitiveness.

VI. Results and Discussion

From the result, all respondents indicated that transportation is the crucial issue in the intermodal system, followed by container management (73 percent), competition (55 percent), location (55 percent) and externalities (45 percent).

6.1. Transportation infrastructure

In Malaysia, rail freight is less important than road freight since the proportion of container transported by road freight is 19 times higher than that of rail freight (MOT, 2013). This imbalance of freight transportation between road and rail is of relative insignificance during modal shifting from the seaport to the hinterland. High dependency on a single mode of transportation affects just in time delivery (JIT) and just in sequence delivery (JIS), distracting from the container consolidation and deconsolidation process. All Malaysian seaports are connected to the rail network, but the low frequency of this mode affects the efficiency of this particular mode compared to road transportation. Malaysian rail freight has the ability to carry 60 TEUs/trip which is lower than the world mean capacity which is 66 TEUs/trip (Woodburn, 2011). According to all participants during the interview sessions, the low capacity of the Malaysian rail system becomes another factor that influences the stakeholders, causing them to neglect this mode in the transportation of containers. Availability and quality of rail connectivity is considered as a key factor for a greater share of rail in the ports (Ghaderi et al., 2015a).

Therefore, all participants agreed to encouraging modal split by focusing on rail infrastructure development such as double-deck rail facilities which can improve rail freight capacity from 60 TEUs to 120 TEUs thus reduce container transit time from 7 hours to 4 hours. Sufficient rail infrastructure will also improve the reliability of the rail service thereby making it more attractive to freight customers (Ghaderi et al., 2015c). The rapid development and urbanisation of the country over the last two decades has not been fully matched by similar development in transport infrastructure, especially mass forms of transport, i.e. rail transport. Intercity travel has continued to be served by road-based transport which has led to monopolistic issues in freight transportation. This is rather costly and has resulted in urban congestions and the degradation of urban life. Malaysia has not yet developed a comprehensive rail network that can act as the backbone for transporting freight. There is no comprehensive inter-urban connectivity by rail between various towns and cities (Roza et al., 2013). The over-reliance on road transport for these types of journey must be reduced and transferred to the rail mode of transport which is more environmentally friendly, cheaper, reliable, cost effective and sustainable in the long run. The comprehensive rail network through major rail should be properly planned, especially accessibility to the facilities. They must be and adequately designed to cater for future demand and use.

6.2. Container management

The next significant issue other that transportation is the container management. About 73 percent of the participants expressed that container management issues were significantly affecting the operation of the intermodal terminals as well as preventing optimum competencies in the container seaport operations. For example, in PBCT, most of the containers are not organised according to the rail deck plan. Limited customs facilities and heavy congestion caused by hauliers at the Malaysian-Thailand border prevent fast clearance by customs and dry ports personnel. At present, containers are placed on railway decks with the aim of clearing the congestion, essentially disregarding the rail deck container plan which was initially proposed by PBCT. In addition, space and infrastructure limitations in PBCT and some policies at the border also contribute to the circumstances. The mobility of hauliers from Thailand to Malaysia is restricted to within two kilometres of the Malaysian border. In this case, the choice for modal shift is limited (only rail) and it is causing congestion in PBCT. As a consequence, inefficiency in container arrangement on the rail deck occurs. The situation is different in Thailand because hauliers from Malaysia can navigate more than 55 kilometres from Thailand's border thereby significantly reduce the congestion at Thailand's borders because there are more options with reference to modal shift. Dry ports in Malaysia should create their network links between different ranges of intermodal terminals. For example, there is a container yard which is located only 44 kilometres from PBCT, called Bukit Kayu Hitam container depot. Location pooling between dry ports and container yards creates a new strategic collaboration in freight distribution and container management systems. Hence, location pooling with container yards to accommodate containers such as in the case of PBCT provides an alternative when dealing with space restriction. Such collaboration will facilitate the accommodation of a high volume of containers from the seaport both now and in the future. In general, this strategy will effectively reduce congestion, dwelling time and over utilisation of existing facilities in seaports. It also diverts stakeholders from the seaport to such freight facilities, as well as increases connectivity between seaport and hinterland.

Less than effective container management on the railway deck in PBCT causes a significant challenge to Penang Port whereby this seaport has to spend more than two hours to relocate and rearrange the containers from PBCT. The implications are also felt by the vessels at this seaport because they have to wait until seaport personnel manage to find the right container and load it onto the vessels. Low capacity, efficiency and frequency as well as delay in rail freight from the northern region to Penang Port causes more empty spaces on vessels, affects seaport schedule integrity and increases the vessels' turnaround time in the seaport. In this case, accurate information sharing between these nodes is urgently required to reduce ineffective procedures at the seaport (container relocating). Moreover, it is also proposed that the territory at the border should be extended so that the hauliers from Thailand will not only depend on the rail service at PBCT but would also be able to utilise Bukit Kayu Hitam inland clearance depot for container transportation to Penang Port. This would in turn attract more stakeholders from southern Thailand and promise an adequate volume of containers to Penang Port.

6.3. Competition

Competition between intermodal terminals and between seaports and dry ports has become another issue in Malaysian intermodal operations. Almost 55 percent of the participants agree with this statement. In general, competition between seaports is common and mainly happens when seaports expand their jurisdiction to the hinterland market (Notteboom & Winkelmans, 2001). However, the scenario is different in Malaysia's case because not all dry ports and seaports are cooperating to expand seaport services in the hinterland. For example, most of the respondents agree that SIP is facing severe competition from seaports, especially PTP. In PTP, dedicated shipping lines have invested in this particular seaport and intend to attract the hinterland market by providing their own haulier services. These haulier services are comparatively 30 percent cheaper than haulier services in SIP. Price competition makes more clients attracted to the haulier service provided by PTP compared to SIP. This situation prevents SIP from providing an effective service to the clients, including seaports and subsequently causes assets in this particular dry port to remain underutilised and less attractive among the stakeholders.

In addition, dry ports in Malaysia are also facing some competition with other modes of intermodal terminal such as the inland clearance depots in Bukit Kayu Hitam, Penang and Klang. This situation diverts the attention of seaports in this particular region to use these types of intermodal terminal because they are a perfect buffering zone due to their location near to seaports and are easily accessed by road rather than rail. Currently, none of Malaysia's dry ports are categorised as seaport-based dry ports and as a result of this, seaports tend to use these inland clearance depots only for customs clearance without any other extensive value-added services. Therefore, providing more value-added services, implementing modal shifting to increase their competency as well as increasing the awareness of stakeholders that they are real replications of seaports in inland areas are crucial to overcome this competition either from inland clearance depots or seaports. The ability of dry ports to attract the attention of seaports enhances the perimeters of seaport services beyond its borders. As it has acquired shares in SIP, it is less relevant for PTP to compete with its own subsidiaries. Hence, PTP has to change its strategy to venture in the hinterland market by channelling investment to dry ports instead of haulier services in PTP. This will generate effective coordination between and provide a better future for these nodes.

6.4. Location

Location is the critical factor in determining dry ports' success and their development parallel to the container seaports (Hanaoka & Regmi, 2011). Unfortunately, not all Malaysian dry ports are located in a very strategic location to assist their stakeholders, including seaports. During the interview session, almost 55 percent of the participants agree that the location of these dry ports affects the competencies of seaport operations. For example, SIP is located away from the manufacturing zone which creates some difficulties for stakeholders to utilise this terminal. Consequently, they deal directly with seaports which cause some additional issues such as congestion and increased dwelling time at PTP and Port Klang. In this case, shifting the dry port to a productive zone is not new in intermodal transportation as it has been implemented in Amal dry port in Sweden due to many obstacles in accessibility, financial aid and low attractiveness

(Woxenius & Bergqvist 2010). Hence, SIP could be shifted to Gemas because of its high connectivity and also high concentration of local manufacturers.

Secondly, the location of ICT is less effective for short-distance delivery because most hauliers at this dry port show less interest in this particular operation. The implication of this situation is that it causes delays for short-distance container delivery. Short-distance customers from ICT who are normally time and cost oriented find this particular dry port as ineffective in the container transport chain. As an implication, the stakeholders tend to move from this dry port and re-route the containers to gain cost and time advantages. This situation does not only affect the reputation of ICT but it also affects the continuity of container volume to seaports that are connected with ICT. Although ICT is connected to all seaports, which contribute 35 percent, 10 percent and 5 percent of container to Port Klang, Penang Port and PTP respectively, the intention of stakeholders to pick other dry ports or other intermodal terminals for their daily operations will affect the percentage of container volume contributed by each seaport. For example, the re-routing procedure by the stakeholders might change focus to Port Klang, thereby avoiding Penang Port and PTP which in turn reduces the container volume in these two seaports. Continuity in container flow is important in every seaport because it determines the integrity in container flow as well as improves confidence among the stakeholders with regard to seaport performance (Roso & Lumsden, 2010). In this case, the respondents' advice to this dry port is to provide their own haulier services as one of their services. This may reduce the delays in hiring an appropriate haulier operator for short-distance transportation.

6.5. Externalities

Finally, almost 45 percent of the participants agree that externalities become another contributor for the seaport incompetency. For example, the introduction of Barter Trade Port (BTP) to assist trade activities with the opposite shore of Straits of Malacca near to the seaport increases the number of illegal immigrants, smugglings and spread of diseases. The transactions in BTP also affect the reliability of safety procedures during container transportation from BTP to the respective clients. As well as the issues in the inland area, these BTP operations also affect feeder vessel navigating along the straits (Joshua, 2009). Hence, the less restricted operation of BTP does not only aggravate congestion in the seaport zone but also affects freight vessels' navigation as they are heading to their port of destination. Merging BTP with one of the Malaysian dry ports' roles would provide more benefits to seaports, BTP and dry ports. Multimodal transportation in dry ports and the strict documentation procedure in dry ports improve quality in trade as well as improving the volume of containers from this inland terminal to seaports. Moreover, continuity in container volume to seaports also can be expected.

The dominance of road transportation in freight transportation causes some significant issues for the road facilities in peninsular Malaysia. The noise and vibration from freight vehicles generally creates an unwanted situation for society. Moreover, land infrastructure, especially roads, flyovers, road dividers and traffic lights are extensively exhausted and damaged by the pressure caused by road freight vehicles. The unhealthy road conditions and weak road infrastructure reduce the effectiveness of seaport hinterland connectivity. This encourages haulage to clear all the documentation procedures at an inland location, transferring non-maritime activities to inland and immediately upgrading road infrastructure and shifting or fully utilising to rail services so as to reduce the number of accidents, prevent congestion and increase accessibility to and from seaports

VII. Conclusion

This study concludes that there are a few important factors that influence Malaysian dry port operations, consisting of transport infrastructure, dry port capacity, service features and information systems as well as prolific government policy. Therefore, the key points to improve Malaysian dry port or intermodal terminals have been identified and implementation of those strategies needs to be well executed to ensure the competency of dry ports as well as seaports in the Malaysian maritime cluster. Seaports are highly dependent on intermodal terminals to ensure the flow of cargoes to their respective hinterland by means of transport that provides time and cost benefits to the clients. On the other hand, intermodal terminals depend on seaports for the continuity of cargoes, building their reputation as a co-location of seaports and improving their competitiveness. Therefore, the dyadic relationship between seaports and intermodal terminals needs to be further explored, especially with emphasis on their coordination, collaboration and significant requirements that seaports need from intermodal terminals and the main necessity that intermodal transportation is required from the seaports to ensure effective operations. This symbiotic relationship between seaports and intermodal terminals needs to be clearly understood to ensure competency is not only skewed to the main nodes but can provide mutual benefits to intermodal terminals as well. This is a worthwhile area for further empirical research.

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Appendices

Table 1 Frequency of Malaysian Logistics until 2014

Sector categories:	Frequency	Percentage of Total
• Shipping services	573	12.51
• Ship industry	150	3.28
• Ports and terminals	59	1.29
• Sea freight	395	8.63
• Land and Rail	1696	37.04
• Airfreight	212	4.63
• Supporting Industries	1494	32.62
Total	**4579**	**100**

Table 2 Malaysian Maritime Companies and Population

Geographical locations:	Maritime Sector	Logistics Sector	Population in 2010 (Person Per Square KM)
West Coast Peninsular Malaysia			
• Selangor	219	1960	1,155,283 (674)
• Johor	95	576	575,645 (174)
• Kuala Lumpur	50	350	1,588,750 (6,891)
• Penang	31	334	1,526,324 (1,490)
• Kedah	19	11	281,260 (205)
• Perak	17	49	657,892 (112))
• Negeri Sembilan	10	36	200,988 (153)
• Melaka	6	33	305,251 (493)
• Perlis	NR	2	225,590 (282)
East Coast Peninsular Malaysia			
• Terengganu	36	12	337,553 (79)
• Pahang	23	193	427,515 (42)
• Kelantan	NR	4	313,964 (102)
East Malaysia			
• Sabah	164	24	793,963 (44)
• Sarawak	75	132	436,161 (20)
• Labuan	37	81	83,920 (955)
Total	**782**	**3797**	**8,604,808**

NR = No Record.

Source: Malaysia Maritime Industry, Logistics and Transport Directory for the year 2014/2015 and Population data in the year 2010 from Malaysia Statistics Department.

Figure 1: Malaysian container seaport systems
Source: Authors

Type of cargo ('000 Tonne)	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Cement & Clinker	942	1026	1220	1355	4654	1704	1814	2224	2353	2594
Containers	2887	1876	2074	2222	2272	2603	2588	2702	2691	2864
Landbridge	216	184	164	122	105	55	39	26	19	19
Petrol & mineral oil	72	57	62	75	45	-	-	-	-	-
Processed food & drink	288	358	363	421	433	476	487	459	417	413
Ore & other minerals	90	58	21	10	11	6	2	0	-	-
Chemicals	346	309	370	386	347	259	298	287	337	341
Total	4841	3868	4274	4591	7867	5103	5228	5698	5817	6231

Table 3 Type of commodities carried by rail from 2004 to 2013
Source: MITI (2013)

Table 4 Profiles of interviewees

Designation of respondents	Organisation
Executive Admin-Container	Seaport
Corporate manager	Intermodal terminal
Operation manager	Intermodal terminal
Assistant manager	Intermodal terminal
Assistant manager- Shipping and port division	Government agency
Branch manager	Intermodal terminal
Advisor - Planning and Development	Seaport
Manager	Intermodal terminal
Assistant manager- Shipping and port division	Government agency
Marketing manager	Seaport
Operation executive- Container	Seaport