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The Sustainable Port Classification Framework for Enhancing the Port Coordination System

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ABSTRACT

The port classification framework is not only beneficial for highlighting the background of the ports, but can also be utilized in the benchmarking and comparison of port coordination systems. In Malaysia, the lack of concrete justifications in the existing port classification process had resulted in a debatable framework of port classification development and consequently, confusion among the port stakeholders. As such, this study is conducted with the aim of revising the Malaysian ports' classification framework according to the global perspective of a sustainable port classification framework through the enhancement of its national port coordination system. By using a qualitative approach of descriptive analysis, the background of the port classification systems was not only analysed according to the Malaysian and global perspectives, the segregation of three different ports classes was also emphasized in the enhancement of the country's port coordination system. Apart from being a comprehensive reference that aids the academicians and stakeholders in the improvement of the existing loopholes in the Malaysian port coordination system, this paper had also offered a sustainable classification framework guideline for decision and policy-makers in the expansion of port competitiveness through a reclassification of the national port operations.

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1. Introduction

Malaysia is a country with more than three quarters of total land mass that is exposed to maritime waters (Jeevan et al., 2015a). Known as a

maritime nation, Malaysia not only has strategic interests in the seas surrounding it, but is also strategically located along the world's key shipping routes (Othman et al., 2016). Malaysia's maritime industry has proven to be an important industry for the national economy (Jeevan et al., 2015a), where the development of ports, which are seen as the backbone of international and local trade via seaborne transports, can offer potential competitiveness and advantages of the hinterlands (Lam and Yap, 2006; Jeevan et al., 2015a). The geographical location of Malaysia is shown in Figure 1.

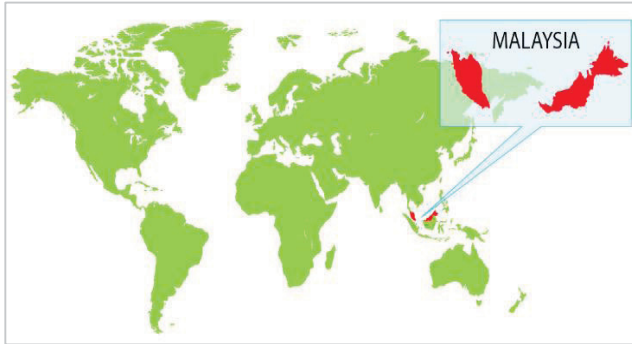


Fig. 1. Geographical location of Malaysia

Source: IEEE Power & Energy Society (2018)

Ports are economic catalysts for the regions they serve, where the aggregation of services and activities generates benefits and socio-economic wealth (Bichou and Gray, 2005). In the context of being a trade-driven nation, the maritime sector should complement the nation's drive of enhancing trade competitiveness. For this reason, it is important to highlight the issues faced by the ports and shipping segments of the maritime sector since they are regarded as crucial trade facilitators for protecting and enhancing the trade interests of the Malaysian economy (Khalid, 2005a).

A variety of classification frameworks with their respective terminologies, which are used to portray and emphasize the roles of the ports in fulfilling its operational function and contributing to the growth of national economy (Bichou and Gray, 2005), had been introduced in the segregation of the ports. However, the complexity of the ports background had made it difficult to define a general framework context that can be used by the global port industry as a whole. The present applications of port classification frameworks had also become debatable due to the evolution of the global port industry as a result of the vague definitions given on the ports background as well as their operational functions. Therefore, the objective of this study is to revise the Malaysian port classification framework according to the global perspectives of a sustainable port classification framework through the enhancement of its national port coordination system.

2. Literature Review

2.1. Global Perspective in the Development of Port Classification Terminology

Ports are locations that are attached with infrastructures and technical facilities to the sea, ocean or river via waterways connections. Ports not only manage a variety of loads for which they are specialized in (Roa et al., 2013), their basic functions also include providing shelter for ships,

allow the transfer of goods from one means of transport to another as well as functioning as nodes that link the sea to the land (Tarantola, 2005).

Without a doubt, the development of ports is very much associated to the development of the economy since the functionality of the ports can vary according to the dissimilarities of economic development (Adhitama and Tan, 2009). As such, port classification is seen as important for creating a basis of comparison, where ports with similar and comparable backgrounds are identified and a comparison on their development and potential are made with those that had undergone the same conditions (Adhitama and Tan, 2009).

For that reason, a global comprehensive framework of port classification can assist in addressing the operating advantages or disadvantages of the respective ports in terms of their functional and operational backgrounds (Sahu et al., 2014). A clearly outlined port background that is generated from a well-defined classification framework may help in the sustenance of the port's future development by driving the port operation to its functional roles (Dwarakish and Salim, 2015). Also, classifying the ports according to a proper classification framework is seen as important for cargo services operation, streamlining of the ports operational functions, improving the ports identity, assisting decisions on freight rate as well as enhancing the service quality benchmarking performance (Sahu et al., 2014). By using this method, the port managers or decision makers will not only be able to undertake effective benchmarking analyses and performance comparisons on both the competing and non-competing ports on a global scale, but also with other potential competitors that are located outside the port sector such as the inland intermodal terminals or regional distribution centres (Bichou and Gray, 2005; Sahu et al., 2014).

The port classification frameworks that are generally known worldwide had composed of the different classification frameworks practiced by several countries in their ports segregation. In Ireland for example, the ports are classified into large, medium and small ports (Mitchel, 1970; Ding et al., 2015), where the large ports are given the task of handling an annual cargo volume of over 1,000,000 tonnes, the medium-sized ports with an annual cargo volume of between 150,000 and 1,000,000 tonnes, while the small ports are assigned with annual cargo volumes of under 150,000 tonnes (Ding et al., 2015). As for India, although the ports had been based on administrative significance and are classified into major, intermediate and minor ports accordingly, the terms had absolutely no relations with the cargo volume throughput of the ports, but were based on the temporal cargo volume variations that serve as a standardized basis for several transportation functions such as the collection of port traffic data as well as the planning, design and operation of port facilities (Sahu et al., 2014). In the United Kingdom, the Department for Transport Statistics United Kingdom (2016) had classified the ports into major and minor ports, where the major ports are defined as ports with annual cargo volumes of at least 1 million tonnes and the minor ports are those managing annual cargo volumes of less than 1 million tonnes. On the contrary, the characteristics of terminologies that are used in segregating the European ports into small, medium, large and extra-large ports had basically referred to the size of the port area, their core activities, the port business (i.e. goods, container, passenger), number of employees, geographical location, ownership of the ports as well as the port capacities (Catala, 2011), while for the Bohai Sea Economic Rim (BER) scenario, the ports are segregated according to its characteristics, namely the Small-Medium Sized Ports (SMPs) and Gateway Ports (Feng and Notteboom, 2011; 2013) that are shown in Table 1.

Table 1

Classification Characteristics of the Ports located along the Bohai Sea Economic Rim

Characteristics	SMPs	Gateway ports
Port size	Medium size: cargo volume of 150-300 million tonnes Small size: cargo volume of less than 150 million tonnes	Cargo volume of over 300 million tonnes
Port classification	Domestic trade driven	International trade driven
Cargo	Bulk	Container
Market share	Increasing	Stable to decreasing
World spoke & hub system	Less connected	Connected
Port-city	Less correlated	Correlated
Logistics system	Inland port connection	Logistics park
Port networking	Co-petition	Competition
Intermodality	Less connected	Connected

Source: Feng and Notteboom (2013)

With regards to the involvement of the public and private sectors, the framework can thus be classified into the four main models of public service port, tool port, landlord port and the fully privatized or private service port (World Bank, 2007). According to the framework provided by the World Bank (2007), while the focus of the service and tool ports is mainly on the realization of public interests, the landlord ports on the other hand, had been set up to maintain a balance between the port authority's (public) and the industry's (private) welfare. As for the fully privatized ports, their motive is solely based on the interests of the shareholders (World Bank, 2007). Although the models were distinguished by how they differ with respect to several characteristics such as; 1) Public, private, or mixed provision of services, 2) Local, regional, or global orientation, 3) Ownership of infrastructure (including port land), 4) Ownership of superstructure and equipment (particularly ship-to-shore handling equipment, sheds, and warehouses) and 5) Status of dock labour and management (World Bank, 2007), Bichou and Gray (2005) however, had highlighted the apparent weaknesses associated within the application of the abovementioned models (Bichou and Gray, 2005; Vieira and Kliemann Neto, 2016).

There were also other numbers of terminologies that were introduced along with their respective frameworks such as the continental ports (Sujatha, 2002); regional ports (De Monie, 1997); the main regional or national gateways (Lam and Iskounen, 2010; Notteboom, 2010); feeder ports (Lam and Iskounen, 2010); peripheral ports (Monios and Wilmsmeier, 2012; Wilmsmeier, and Monios, 2013); inland ports (Jarzemskis and Vasiliasukas, 2007; Ng and Gujar, 2009; Dasgupta, 2016) and dry ports (Roso et al., 2009; Jeevan et al., 2015b). According to De Langen (2002), port classification is generally constructed based on its multiple dimensions (such as size, hinterland access, location, etc.), while the determination of the multiple dimensions in which the ports are classified into would depend on how the classification is used. As shown from their studies, De Langen, Nijdam and Van der Lugt (2012) had introduced and classified the global pivots, load centres, regional and minor ports according to specific characteristics such as the port locations, hinterland as well as the service aspects. The justifications for using each of the aspect in the port classification are described in Table 2 (See Appendix 1).

Based on the dimensions indicated in Tables 1 and 2, some of the terminologies that had been determined by their respective characteristics may be seen as totally different or overlapping with each other since they can be utilized in similar market areas, in the handling of similar range of vessel sizes and cargo volumes or exhibiting a similar role and function. For this reason, the overlapping of the ports' roles and functions with a variety of terminologies will not only result in confusion for the stakeholders (i.e. professionals and academics), but will also impede them from fully comprehending the real concept of the system as well as the terminologies used (Bichou and Gray, 2005).

In their study, Bichou and Gray (2005) had indicated the usage of traditional spatial concepts of port hinterlands and forelands along with the related port-marketing terminology such as captive, dominant, competitive, uncompetitive, etc., to be of a lesser relevance in the current port industry since the terms had provided a lack of economic significance. Despite the various suggested approaches, there is still no conclusive description made in defining the port categories for global practices (Abdul Rahman et al., 2018). As such, a comprehensive framework of an enhanced port coordination system is seen as important for the port stakeholders and the government in conducting benchmarking analyses and performance comparisons between the ports.

According to Pinnock and Ajagunna (2012), Sahu et al. (2014), Wilmsmeier et al. (2014a) and Abdul Rahman et al. (2018), the ports can be classified into three different groups namely the primary, secondary ports and tertiary ports. Based on the authors' analysis, the various ports backgrounds can be streamlined through the wider classification concept albeit the different key concepts used in the respective regions or countries. As seen from the global overview made in several literatures, the concept was highlighted in the ports classification of some countries or regions such as in Latin America (Wilmsmeier et al., 2014a; 2014b; Wilmsmeier and Monios, 2016), Caribbean (Pinnock and Ajagunna, 2012; Wilmsmeier et al., 2014a), France (Guerrero, 2014), Unites States (Bailey and Wellesley, 2017), Black Sea (Bailey and Wellesley, 2017) and Indonesia (Mooney, 2017). However, according to Bichou and Gray (2005) and Sahu et al., (2014), the conventional terminologies that were used in the international shipping and logistics context can sometimes be vague as none of the existing frameworks in the available literature had been implemented on a global scale. For that reason, a comprehensive review and re-examination is required to reflect the background of the ports as well as their significance to the respective nation or region.

It could be observed that a cohesion of literatures had existed in the definition of the ports classification systems, which were shown by the number of elements or characteristics highlighted in the global context of the port classification systems such as the port's role and function, its size and ownership, the handling of cargo capacity, vessel traffics, infrastructure, facility, port waterway allowance, handling of vessels sizes, type of trade and annual cargo throughputs. These elements were also emphasized as indicators for segregating the background of the ports.

2.2. The Practice of Port Classification Frameworks in Malaysia

Similar to other countries, Malaysia also practices certain terminologies and classification system in the coordination of the nation's port operations. As shown in Figure 2, the harbours in Malaysia are generally classified into federal, state, private, major, minor, primary and secondary ports.

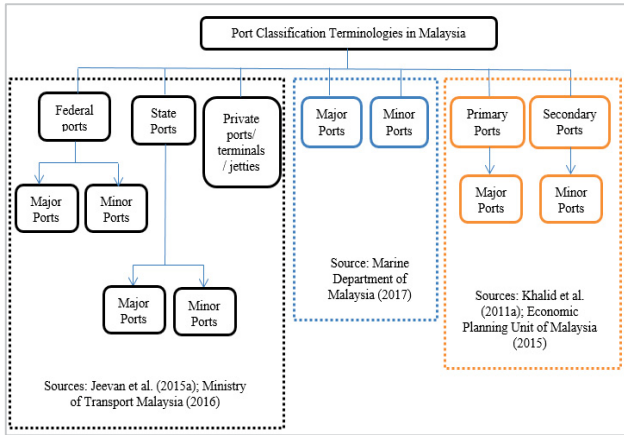


Fig. 2. Port Classification Terminologies in Malaysia

The terminologies that were used in the segregation of ports had been based on the ownership and port management models (Ministry of Transport Malaysia, 2016; Labuan Liberty Port Management, 2016; Vieira and Kliemann Neto, 2016), and are used to represent certain classification frameworks with respective significances. The federal, state and private ports/terminals/jetties for example, are usually used by the federal government to indicate the jurisdiction of respective governments or institutions owning the ports. While federal ports are harbours that are owned and governed by the Federal government under the supervision of Ministry of Transport Malaysia, the state ports on the other hand, are waterfronts that are owned and governed by the State Statutory Bodies that had been appointed by the State government. As for the private ports/terminals/ jetties, these are waterborne facilities that are privately owned and operated by either oil companies, beach resorts or fishermen (Labuan Liberty Port Management, 2016). Although the ports are owned by the federal or state governments, most of the ports had been privatized to several licensed port operators as a way of fulfilling the operational function and development of the ports (Ministry of Transport Malaysia, 2017). Some examples of the federal, state and private ports/terminals/jetties are shown in Table 3.

Table 3

Examples of Federal, State and Private Ports/Terminals/ Jetties in Malaysia

Federal Ports	State Ports	Private Ports/Terminals/ Jetties
Bintulu Port	Lumut Port	ATT Tanjung Bin (ATB)
Kuantan Port	Tanjung Langsat Port	Teluk Rubiah Maritime Terminal
Kemaman Port	Tawau Port	
Johor (Pasir Gudang) Port	Kuching port	
Port of Tanjung Pelepas	Miri Port	
Penang Port	Rajang Port	
Teluk Ewa Port	Kota Kinabalu Port	
Malacca Port	Sapangar Bay Port	
Labuan Port	Sandakan Port	
Port Klang	Dermaga Tanjung Lembung (Langkawi Port)	

Source: Ministry of Transport Malaysia (2017)

In Figure 2, the major and minor ports are the terms used for indicating the ports' importance in contributing to the national seaborne trade. The two terms are also used to separate the jurisdiction of the ports to the respective authorised bodies in the coordination of the port's operation and development (Marine Department of Malaysia, 2017). While the operation of the major ports is coordinated under the jurisdiction of

several federal bodies, the operation of the minor ports on the other hand, is coordinated under the jurisdiction of the state statutory bodies or the Marine Department of Malaysia (Marine Department of Malaysia, 2017). According to Alken and Barla (2001), the differentiation between the major and minor ports is determined based on their operational performance in handling the cargo traffic volume of a particular nation, where the major ports are those dealing with an annual high port traffic distribution, while the minor ports are those handling a lower percentage of port traffic distribution (Alken and Barla, 2001). As illustrated in Figure 2, the federal or state ports in Malaysia can also be segregated into major and minor ports according to their operational performance, which are used to establish the status and identity of the wharves (Khalid, 2005b). The major and minor ports in Malaysia that are under the jurisdictions of several federal bodies (major ports) and the state statutory bodies or Marine Department of Malaysia (minor ports) are shown in Table 4.

Table 4

Malaysian Ports that are based on the Categorisation of Major and Minor Ports

No.	Major Ports	Minor Ports
1.	Bintulu Port	Dermaga Tanjung Lembung (Langkawi Port)
2.	Kuantan Port	Lumut Port
3.	Kemaman Port	Linggi Port
4.	Johor (Pasir Gudang) Port	Port Dickson
5.	Port of Tanjung Pelepas	Sungai Udang Port
6.	Penang Port	Kertih Port
7.	Teluk Ewa Port	Tanjung Langsat Port
8.	Malacca Port	Kuching Port
9.	Labuan Port	Tanjung Manis Port
10.	Port Klang	Samalaju Industrial Port
11.		Rajang Port
12.		Miri Port
13.		Kota Kinabalu Port
14.		Sapangar Bay Port
15.		Kudat Port
16.		Sandakan Port
17.		Kunak Port
18.		Tawau Port
19.		Lahad Datu Port
20.		Kuala Perlis Port
21.		Kuala Kedah Port
22.		Teluk Intan Port
23.		Bagan Datoh Port
24.		Sungai Langat Port
25.		Sungai Rambai Port
26.		Johor Bharu Port
27.		Muar Port
28.		Batu Pahat Port
29.		Kukup Port
30.		Sungai Rengit Port
31.		Mersing Port
32.		Endau Port
33.		Sungai Benut Port
34.		Tanjung Gemok Port
35.		Pulau Tioman Port
36.		Tanjung Agas Port
37.		Kuala Besut Port
38.		Kuala Terengganu Port
39.		Setiu Port
40.		Kota Bharu Port
41.		Tok Bali Port
42.		Pengkalan Kubor Port

Sources: Ministry of Transport Malaysia (2017); Marine Department of Malaysia (2017)

The primary and secondary ports as shown in Figure 2 are the two terminologies that had been recently introduced into practice and were used by the Economic Planning Unit of Malaysia in the 11th Malaysia Plan (2016-2020) during the planning of the national port development. While the concept of the primary and secondary ports is similar to the concept of major and minor ports, they are however used to indicate if the ports are part of the main national gateways or supporting gateways to the global seaborne trade (Economic Planning Unit of Malaysia, 2015). These terms are also used to indicate the economic significance of the ports, where they can be classified as primary economic contributors and secondary economic contributors to the nation, respectively (Marine Department of Malaysia, 2017). The primary ports basically represent the major ports that are regulated under the established federal port authorities, while the secondary ports denote minor ports or other ports that had been declared by the federal government (Ministry of Transport Malaysia, 2017; Marine Department of Malaysia, 2017).

The lack of a comprehensive discussion on Malaysia's port classification framework in portraying the significant function of their implementation had however, resulted in a debatable issue concerning the classification process of the ports. Although the initial classification framework had been based on the ownership and governance structure of the ports itself (Ministry of Transport Malaysia, 2017) as well as its annual cargo traffic distribution (Marine Department of Malaysia, 2017), the justifications used were proven to be baseless and misleading since a major port of a state government could be treated as a national major port and vice-versa.

In one of their studies, Khalid et al. (2011a) had briefly described the size, capacity and throughput of the ports for distinguishing the primary and secondary ports in Malaysia. Although the secondary or minor ports are considered to be smaller or lesser in size, capacity and throughput handling as compared to the major ports (Khalid et al., 2011a; 2011b), this description however, is subjected to dispute since the question of what actually constitutes a primary and secondary port had still remained.

The present Malaysian port classification framework is also subject to debate for referring all intermediate and small sized ports such as the single terminals, jetties and landing areas as 'minor and secondary ports' since each of these docks had been shown to possess a totally different background than that of a port (Dwarakish and Salim, 2015).

As shown in Figure 3, although the existing port classification frameworks in Malaysia had used several characteristics for classifying the ports into their respective groups (Marine Department of Malaysia, 2017); there had been dissimilarities of characteristics observed between the perspectives of a globally established port classification system and those that were applied in Malaysia. The characteristics that were used in segregating the ports in Malaysia were not only found to be limited to the port's size, capacity, its roles, ownership and annual cargo throughput, the application of the characteristics was also found to be inconsistent with the classification systems used by the Malaysian government bodies. As a result, this will create more confusion to the port stakeholders as well as to those from the academic and related fields since its effectiveness will be compromised by the vague function of the system.

For this reason, it is important to establish a comprehensive background of a port classification framework in Malaysia so that a concrete reference and the enhancement of the existing port coordination system can be achieved

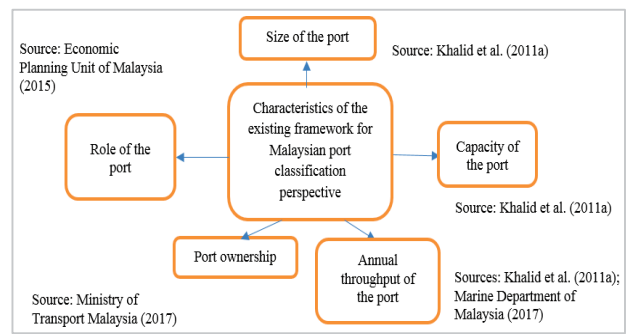


Fig. 3. Characteristics of the existing framework for Malaysia's port classification

3. Methodology

3.1. Assessment of the port classification framework in Malaysia based on the global port classification perspectives

An exploratory study that uses a systematic methodological step had been conducted to study the port classification framework practised in Malaysia and those from the global perspectives. After the information had been obtained from a combination of the primary and secondary data sources, a descriptive method was then incorporated in the systematic steps to analyse and interpret the information gained from both sources. Figure 4 shows the systematic methodological approach that had been developed to explore the development of the port classification system.

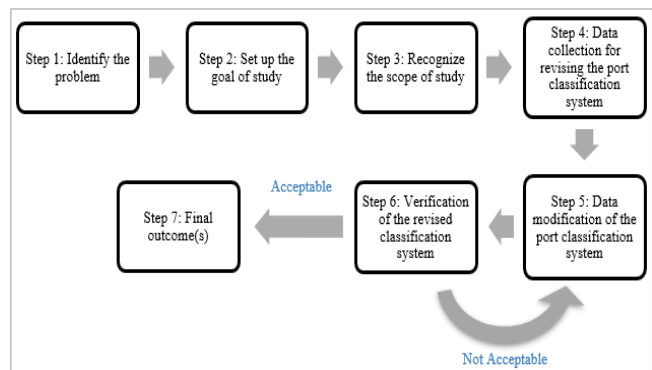


Fig. 4. A systematic step for exploring the development of the port classification system

The seven steps that are involved in the explanatory study of the issue investigated are shown in Figure 4, where each step had incorporated the global perspective of port classification development in the analysis of the port classification development in Malaysia. A further description on each of the step is elaborated below:

3.1.1. Step 1: Problem identification

The problem that was identified in this study had been the incomplete definition and justification used in the Malaysian port classification framework. The lack of a comprehensive research on port classification framework in Malaysia had not only caused the lack of concrete references in the discussion of the ports operational background, the impact had also led to misconceptions between the theoretical background of the ports and the actual classification framework implemented on the ports. Also, these misconceptions may degrade the

identity of the ports and their potential in assisting the national major ports that are operating in the global trade. As such, these gaps had formed the investigation basis of this study.

3.1.2. Step 2: Setting up the study goal

The goal of this study is to revise the Malaysian ports classification framework by enhancing the national port coordination system according to the global perspectives of a sustainable port classification framework. A comprehensive study is therefore conducted to provide a concrete definition and reference for the Malaysian port classification framework, one which is not only fitted according to the Malaysian context, but is also universally accepted.

3.1.3. Step 3: Recognising the scope of study

This study had only focused on the marine facilities that are gazetted as water-related-ports by the federal or state governments of Malaysia. The other facilities that are not listed as the gazetted ports such as the single private terminals, landing areas or dry ports had been excluded from this study.

The current practice of the port classification framework in Malaysia that was mentioned earlier in Section 2.2, had described the terminologies used in the Malaysian port classification framework to be of specific functions, hence leading to the questionable background and the port classification system process.

Although various port classification frameworks had been established in the global port coordination system as a way of enhancing the port's identity and operational network, the port industry in Malaysia however, had still segregated the ports based on the ownership and governance structures. With the exception of those that had implemented otherwise, the reason for the implementation of this type of segregation could be due to the complex background of the ports as well as the lack of comprehensive study in assessing and developing a sustainable port classification framework. The current classification method had not only proven to ineffectively differentiate or segregate the ports based on a proper definition, it had also led to a vague knowledge concerning its roles and circumstances.

As a result of the vague background provided in the current port classification framework, a small port may be regarded as a major harbour regardless of its ownership, size, capacity and annual throughput, which would be deemed as impractical since such classification would lead to a confusion of the ports circumstances. An example of this can be seen in the case of "Teluk Ewa Port", where it had been classified as one of the nation's major federal port/primary ports by the Ministry of Transport Malaysia although its size had been relatively smaller than the other national major ports sharing the same level of status. This situation had therefore indicated the importance of revising the port classification framework by taking several of the crucial aspects into consideration.

3.1.4. Step 4: Data collection for revising the port classification framework

In this step, surveys and discussions were conducted with qualified port experts as a way of collecting information and opinions that are related to the background of ports classification in Malaysia. In-depth information and a wider insight of the port classification framework were attained from the primary and secondary data sources, while the essential aspects required for the study were obtained from the guided open-ended questionnaires given to the selected Malaysian participants. As shown in

Table 5, apart from their experiences and backgrounds in dealing with the operation and management of Malaysian ports, the experts were also chosen from a pool of active decision or policy-makers in the Malaysian port industry. These experts and the organisations they are associated with were provided with pseudonyms as a way of preserving the anonymity and confidentiality of the respondents.

Table 5

Details of the experts

Experts	Designation	Organisation	Background/ Experience	Years of experience
Expert 1	Operation Manager	Organisation A	Manage, Operate and maintain the operation of the port	17 years
Expert 2	Chief Operating Officer	Organisation B	Manage, operate and maintain the operation of the port	-
Expert 3	Senior Admin Officer	Organisation C	Engage in planning and development of the port	-
Expert 4	Assistant Head of Marine Assurance	Organisation D	Engage in the standardization and compliance of the port	8 years
Expert 5	Marine Manager	Organisation E	Manage, operate and maintain the operation of the port	17 years in Marine and Port Operation
Expert 6	Port and Terminal Manager	Organisation F	Manage, operate and maintain the operation of the port	7 years in Port Operation
Expert 7	Admin Officer	Organisation G	Act as liaison between the customers and port manager	-
Expert 8	Marine Superintendent	Organisation H	Engage in the planning and marine operation of the port	20 years in Port Operation
Expert 9	Operation Manager	Organisation I	Manage, operate and maintain the operation of the port	2 years as an Operation Manager of the current port
Expert 10	General Manager	Organisation J	Manage, operate and maintain the operation of the port	-
Expert 11	Senior Executive, Marketing & Customer Service	Organisation K	Engage with the corporate group planning and development of the port	4.5 years in the Port Marketing & Customer Service department
Expert 12	Senior Manager, Planning and Development	Organisation L	Development and operation planning of the port	35 years in the Port Operation department
Expert 13	Operation Manager	Organisation M	Development and operation planning of the port	More than 10 years in the Port Operation department
Expert 14	Assistant Operation Manager	Organisation M	Development and operation planning of the port	5 years in the Port Operation department

As depicted in Table 5, the first part of the data collection process had involved a review on the existing port classification framework as well as the characteristics used for differentiating the Malaysian ports through surveys and discussions with the selected participants.

The existing port classification terminologies in the Malaysian port classification framework (see Figure 2) and their characteristics (see Figure 3) had been reviewed by the experts with their responses recorded in Figure 5.

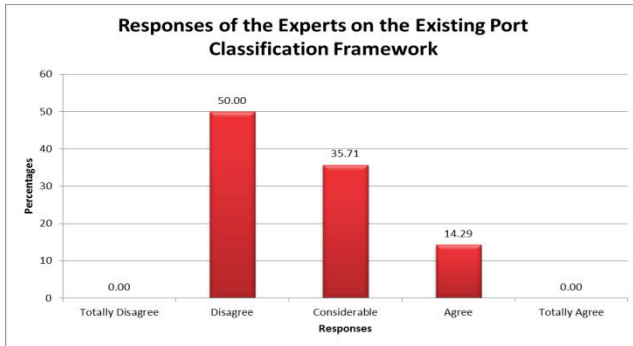


Fig. 5. Responses given by the experts on the Existing Port Classification Framework

Based on the responses given by the participants, about 50% of them were of the opinion that the provided characteristics had been insufficient in describing the background of the ports and had agreed for an overhaul of the classification framework and the terminologies used. The wider port characteristics such as its role and function as well as the infrastructures and facilities should also be taken into consideration when establishing a port classification definition. The experts had also suggested segregating the intermediate and small-sized ports from the current ‘minor ports’ description in the current classification framework since to combine both in one respective group would lead to the potential and identity degradation of those belonging in the former group. Therefore, as a way of overcoming the confusion and misconception of the ports’ operational capabilities, these harbours can be segregated according to their impacts or contribution to the national economy. In this way, the background, identity as well as the operating advantages and disadvantages of the ports can be clearly recognized and improved on when deemed necessary.

Although 35.71% of the respondents had a general acceptance of the terminologies and characteristics used, they had however, suggested for a comprehensive revision on its classification definition, particularly the concept of the national port classification framework for the stakeholders’ benefit. While the rest of the experts had agreed with the existing port terminologies used in the present port classification in Malaysia, they had also proposed for a revision on the existing terminologies as a way of ensuring its prominence and efficacy.

3.1.5. Step 5: Data modification in the port classification framework

In this step, the responses and opinions from the experts were considered under the modification process and a framework of the port classification definition was developed to revise the existing classification framework and terminologies. Apart from reviewing the discrepancies of the existing port classification development in Malaysia, the modification process had also involved the usage of literature surveys on the various literatures through a review on the global perspective of the port classification development. As a result, several of the elements and their respective justifications were used to develop an ideal framework in the definition of the port classification and terminology, which is not only universally accepted, but also can be fitted into the Malaysian context.

The revised framework on the port classification and terminology definition in establishing the sustainable Malaysian port classification framework is shown in Table 6.

Table 6

The revised conceptual definition for port classification framework that is based on Malaysian perspective

Characteristics of the ports / Class of port	Primary port	Secondary port	Tertiary port
Port size	Large	Intermediate	Small
Function of the port	<ul style="list-style-type: none"> Act as the main node of the multimodal transport network Serving a large industrial estate 	<ul style="list-style-type: none"> Act as a secondary node for the hinterland transport network Serving an intermediate industrial activity or for a specific industry Complements or assists in the operation of the primary ports 	<ul style="list-style-type: none"> Act as the transfer point for hinterland or industrial area with a specific purpose Serving in a small or specific industry or for a specific purpose
Role of the port	Primary economic contributor to the nation	Secondary economic contributor to the nation	Tertiary economic contributor to the nation
Port Ownership	Can be owned by the federal or state government	Can be owned by the federal or state government	Can be owned by the federal or state government as well as a private organisation
Capacity of cargo handled	Large	Intermediate	Small
Vessel traffic	High	Intermediate	Low
Infrastructure	Equipped with large-sized storage, processing and transfer spaces for various cargoes	Equipped with intermediate-sized spaces for specific storage, processing and transfer of specific cargoes.	Equipped with limited or specialized spaces for storage, processing and transfer of specific cargoes.
Facility	Equipped with a large number of advanced technological handling facilities	Equipped with a specific number of advanced technological handling facilities	Equipped with a small number of advanced technological handling facilities
Waterway allowance (draft of the channel)	More than 10 metres	6 to 7 metres	Less than six metres
Vessel size	Ranges from small to large sized vessels - May exceed 200 meters in vessel length.	Ranges from small to medium sized vessels - Usually not more than 200 metres.	Ranges from small to medium sized vessels - Usually not more than 100 metres.
Type of trade engaged	Domestic, International (Intercontinental trade, Inter-regional trade, Intra-regional trade)	Domestic, International (Intercontinental trade, Inter-regional trade, Intra-regional trade)	Domestic, International (Intra-regional trade)
Annual throughput of the port	More than 10 million tonnes	Between 1 million to 10 million tonnes	Not more than 1 million tonnes.

The relevant information gained from the secondary data sources and the opinions from the experts are summarized in Table 6. The new conceptual definition of the revised port classification framework is then constructed on an improvised present classification framework, where the primary and secondary ports are further segregated into the primary, secondary and tertiary ports.

3.1.6. Step 6: Verification of the revised port classification framework

The verification process was conducted upon the completion of the modification process. In this stage, the revised conceptual definition was reviewed and verified by the same experts, where the commonality and collegiality for decision-making is required for finalising the final outcome of the study. Based on the verification process, some of the justifications had been improvised to suit the Malaysian perspective. The newly revised Malaysian port classification framework will then be finalised once the verification process had received a favourable review from the experts.

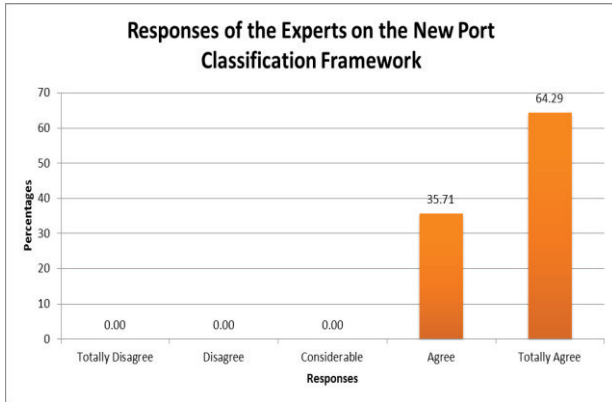


Fig. 6. Responses given by the Experts on the New Port Classification Framework

A summary of the responses given by experts who were involved in the verification process is shown in Figure 6. As depicted from the results, 64.29% of the respondents had demonstrated very favourable feedback, while 35.71% had generally agreed to the proposed revised classification framework. The vast difference exhibited by these two groups had been mainly due to certain respondents who had thought that better results could have been achieved with quantifiable characteristics. Since the data on all the related ports are classified, it had not been possible to retrieve and quantify the detailed information on all the Malaysian ports. Although some of the information could not be justified in a quantifiable form, the overall responses provided by the respondents had indicated that the newly developed framework of conceptual definition and terminology had been clearer in addressing the initial background of the ports.

3.1.7. Step 7: Final outcome(s)

Based on the comprehensive study conducted on the background of the Malaysian ports with the involvement of the port experts, a conceptual definition of the port classification framework was then finalised by incorporating several of the crucial aspects that were indicated in Table 7. The revised classification framework in this case had consisted of three different classes, namely, the primary, secondary, and tertiary ports, with each class possessing a different set of background and characteristics. This conceptual definition was developed by referring to the global perspective of port classification framework in various literatures as well as the opinions gathered from the Malaysian port experts, where the new framework had contributed to the segregation of ports according to their specific class and proper justification as shown in Table 7.

Table 7

The finalised new conceptual definition proposed for port classification framework that is based on Malaysian perspective

Characteristics of the ports / Class of port	Primary port	Secondary port	Tertiary port
Port size	Large	Intermediate	Small
Function of the port	<ul style="list-style-type: none"> Act as the main node of the multimodal transport network Serving in a large industrial estate 	<ul style="list-style-type: none"> Act as a secondary node for the hinterland transport network Serving in an intermediate industrial activity or for a specific industry Complements or assists in the operation of the primary ports 	<ul style="list-style-type: none"> Act as the transfer point for hinterland or industrial area with a specific purpose Serving in a small or specific industry or for a specific purpose
Role of the port	Primary economic contributor to the nation	Secondary economic contributor to the nation	Tertiary economic contributor to the nation
Port ownership	Can be owned by the federal or state government	Can be owned by the federal or state government	Can be owned by the federal or state government as well as a private organisation
Capacity of the port	Large	Intermediate	Small
Vessel traffic	High	Intermediate	Low
Infrastructure	Equipped with large-sized storage, processing and transfer spaces for various of cargoes	Equipped with intermediate-sized spaces for specific storage, processing and transfer of specific cargoes.	Equipped with limited or specialized spaces for storage, processing and transfer of specific cargoes.
Facility	Equipped with a large number of advanced technological handling facilities	Equipped with a specific number of advanced technological handling facilities	Equipped with a small number of advanced technological handling facilities
Waterway allowance (draft/width of channel)	Subject to the port's development and geographical characteristics		
Vessel size	Ranges from small to large sized vessels - May exceed 200 meters in vessel length. (Subject to drafts and width of the waterways)	Ranges from small to medium sized vessels – Usually not more than 200 metres but some may have the potential of going beyond the stipulated limit. (Subject to drafts and width of the waterways)	Ranges from small to medium sized vessels – Usually not more than 100 metres but some may have the potential of go beyond it. (Subject to drafts and width of the waterways)
Type of trade engaged	Domestic, International (Intercontinental trade, Inter-regional trade, Intra-regional trade)	Domestic, International (Intercontinental trade, Inter-regional trade, Intra-regional trade)	Domestic, International (Intra-regional trade)
Annual throughput of the port	More than 10 million tonnes	Between 1 million to 10 million tonnes	Not more than 1 million tonnes
Example(s)	Port Klang	Lumut Port	Kuala Kedah Port

The differences that were observed between Tables 6 and 7 had been those concerning the justifications on the 'waterway allowance' and 'vessel sizes' elements. During the modification process of the finalised framework, the elements had been amended to a subjective form instead of a quantifiable number as those shown in Table 6. This was because a consensus had been made among the experts on the difficulty of determining the characteristics subjectivity during the preliminary stage since they would be influenced by the development and geographical features of the ports. For this reason, an in depth study can be conducted by the port authorities in determining the acceptable range of these elements.

4. Discussions

The findings that had been described in Step 7 were basically generated according to the Malaysian port industry perspective with the incorporation of several elements extracted from the global port classification perspectives. As shown in Table 7, this study had highlighted the initial background of the ports as well as their identities through the emphasis on three port classes that reflect their roles in assisting the national seaborne trade activity as well as their contribution to the economy. The roles that had been set forth in this study were based on the ports characteristics and operational function irrespective of the cargo types managed by the ports.

Throughout the study, the 'Port size', 'Port function', 'Port role', 'Port ownership', 'Port capacity', 'Vessel traffic', 'Infrastructure', 'Port facility', 'Waterway allowance (draft/width of channel)', 'Vessel size', 'Type of trade engaged' and the 'Annual throughput of the port' elements were considered crucial in segregating the introduced port classes. Based on the experts' opinions, the abovementioned characteristics were regarded as potential aspects for improving the port identity and perception of the port customers in determining their port calls since the characteristics would not only reflect the operational background and potential of the ports, but also their capability in the receiving and managing of cargoes.

According to the experts, the lack of comprehensive references provided to the port stakeholders would not only result the policy makers and investors to overlook the potential development of the ports, the vague descriptions may also result in the port stakeholders having a limited insight on the port's capability in the global trade. As a consequence, not only the so-called primary ports will experience congestion and limitation of space due to the concentrated cargoes, the secondary and tertiary ports will also be underdeveloped because of its inability in sustaining its operations with the global competition.

Due to the heterogeneity of the port's background as well as the limited access to the detailed port information, some of the port characteristics that were shown in Table 7 such as the range of the port sizes, the port capacity and waterway allowances were indicated in subjective forms rather than in a quantifiable form. These characteristics, however, can be determined by the port authorities during the implementation of the classification definition in the national port coordination system. Although each of the countries or regions may have its respective viewpoints for determining the background and characteristics in segregating the ports, the frameworks should still be subjected to a comprehensive justification, otherwise the purpose of its development will be defeated.

5. Conclusions

5.1. Conclusions

In conclusion, the objective of this study, which is to revise the ports classification development in Malaysia according to the global perspective of a sustainable port classification development, had been achieved through an improvised conceptual definition of the port classification framework.

A comprehensive review on the port classification framework was developed with the purpose of streamlining the functions of all the related ports and jetties. It had also contributed to the enhancement of port efficiency and identity through the introduction of a commonality and collegiality approach, where the port community is encouraged to complement rather than competing with each other. In this way, the port community of a nation will not only be strengthened, but the competitiveness of the national logistics chain can also be improved with stronger alliances among the stakeholders. Therefore, the newly improvised port classification framework in this study had been introduced with the intention of it being implemented on a national and a global level.

5.2. Contributions and implications of study

This paper had not only contributed in the filling of literature gaps through a comprehensive review and a wider reference of Malaysia's port classification framework, it had also contributed to the current body of knowledge through an improved port classification framework in the Malaysian context.

The results that were obtained from this research could also be used as a guideline for the policy-makers in re-examining the current national port classification framework as a way of streamlining the functions of all ports and jetties as well as improving the port handling efficiency by the federal government. Moreover, the port authorities can consider re-classifying the Malaysian port operations according to their respective categories, while enhancing the national port coordination system. With a better establishment of reputation, there is also a potential for ports in capturing the businesses of the national seaborne trade.

Since this study had been a ground breaking research, it had still lacked generalization in terms of its findings and results. As such, a detailed research can be conducted by classifying the ports according to the national classification framework as well as studying the impacts of its implementation on the national port industry.

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Appendix

Appendix 1: Table 2

Aspects of Classifying the Ports

Aspect	Characteristics	Global pivot	Load Centre	Regional port	Minor port
Location	Maritime network	Located strategically nearby (intersection of) major shipping routes	Peripheral in maritime network	An insignificant position in the maritime network.	An insignificant position in maritime network
	Hinterland network	Limited natural hinterland	An extensive and voluminous hinterland	A substantial industrial/ metropolitan hinterland	Local traffic base
Hinterland role	Transshipment	More than 60% (sea/sea) transshipment	Less than 40% transshipment	Hardly transshipment	No transshipment
	Hinterland modes	Limited local hinterland	More than 60% direct to hinterland substantial share (at least 10%) of origins/destinations more than 300 km	At least 90% of the volumes with origin/ destination less than 500 km	Direct local hinterland, at least 90% of the volumes with origin/ destination less than 100 km
	Intermodal connections	Intermodal connections of limited importance	Intermodal connections important to modal split	A limited number of intermodal services	Hardly any intermodal facilities
Service	Vessel size	Largest vessels with at least 5,000 TEU	Largest vessels with at least 4,000 TEU	Largest vessels between 2,000 and 4,000 TEU	Largest vessels of up to 1,000 TEU
	Service calls	Frequent calls of major services, in some cases dominate one of the shipping lines	Frequent calls of major services with a number of shipping lines	Calls of secondary services (shortsea, feeder and secondary intercontinental services) with a small number of calls of major services	Feeder and shortsea services
	Minimal annual volume	More than 600,000 TEU	Less than 1 million TEU	More than 150,000 TEU	Less than 200,000 TEU

Sources: De Langen (2002); De Langen, Nijdam and Van der Lugt (2012)