The Performance of Ports on the Periphery: The Impact of Port Supply Chain Integration, Sustainability Advantage and Spatial Characteristics

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By

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ABSTRACT

Due to intense competition, ports are desperately searching for new ways to increase performance and gain a sustainable edge into today's dynamic and competitive business environment. Literature has deeply discussed the performance of large and established ports that hold hub status; however, studies on the performance of small and medium-sized ports (SMPs) are scarce. Even though there are studies pertaining to SMPs, it is more from the port development perspective. Thus, the aim of this study is to investigate the competitive performance of SMPs that are not on the main maritime shipping lanes and face challenges in attracting port users to make port of calls; nevertheless, they are proximate to large hinterland markets, and are thus called ports on the periphery. In particular, this study intends to seek, identify and explore the appropriate potential strategies (identified as spatial characteristics, port supply chain integration strategy, and sustainability advantage) that are able to bring continuous prosperity to the business performance of ports on the periphery; to synthesise the presence of the causal theoretical relationships between identified potential strategies and the performance of ports on the periphery; and to investigate to what extent the identified potential strategies are able to continuously contribute to the performance of such ports.

The research philosophy on which this study relies is the positivism paradigm and a questionnaire survey was identified as the most appropriate instrument by which to gather data and information from participants. Port stakeholders such as port/terminal operators, port authorities, shipping lines and freight forwarders that are experts in the port business operations were identified as the relevant individuals or organisations to receive the questionnaire. To analyse the data, standard Multiple Regression Analysis (MRA) in SPSS version 22 was employed. In particular, Exploratory Data Analysis (EDA) or preliminary analysis was then conducted in sequence to determine the right statistical analysis technique to be employed, and standard MRA analysis was used to conduct the inferential analysis of the current study.

The results show that the spatial characteristics of peripheral ports and the integration strategy of a port into the supply chain play a significant role in adding more sustainability benefits to the transportation supply chain and subsequently contribute to the performance of peripheral ports. The results can be used by peripheral ports as a guideline to promote themselves as a sustainable supply chain network in association with spatial characteristics and the strategy of port supply chain integration. This advantage can be a huge and attractive springboard for such ports to strengthen their performance since regulation on environmental issues has become an important agenda not only among government sectors (regulatory pressures) and non-government organisations (NGOs-communities pressures) but also among suppliers and customers (market pressures-port users) in contending with greenhouse gas (GHG) emissions, in particular carbon emissions by logistic activities and operations.

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ABBREVIATION

ABP	Association of British Port
ANCOVA	Analysis of Covariance
ANOVA	Analysis of Variance
BER	Bohai Sea Economic Rim
BIFA	British International Freight Association
CEO	Chief Executive Officer
CO2	Carbon Dioxide
COO	Chief Operating Company
COSCO	China Cosco Holdings Co
CSCL	China Shipping Container Lines
DEA	Data Envelopment Analysis
DP WORLD	Dubai Port World
ECT	European Combine Terminal BV
EDA	Exploratory Data Analysis
EDI	Electronic Data Interchange
FDI	Foreign Direct Investment
FMFF	Federation of Freight Forwarder
FMPOC	Federation of Malaysia Port Operating Company
FTA	Freight Transport Association
GDP	Gross Domestic Product
GFP	Global Facilitataion Partnership for Transport and Trade
GHG	Greenhouse Gas
GRT	Gross Registered Tonnage
GTO	Global Terminal Operator
HGV	Heavy Goods Vehicle
HIT	Hong Kong International Terminal
HPH	Hutchison Port Holdings
ICS	Information and Communication System
IT	Information Technology
IMO	International Maritime Organisation
KPI	Key Performance Indicator
LCRS	Logistics Carbon Reduction Scheme
LRA	Logistic Regression Analysis
M&A	Merger and Acquisition
MANOVA	Multivariate of Analysis of Variance
MAPA	Malaysia Asean Port Association
MIMA	Maritime Institute of Malaysia
MMO	Multimodal Operations
MNC	Multinational Company
MOT	Ministry of Transport
MRA	Multiple Regression Analysis

NGO	Non-Government Organisation
NPA	Nigerian Port Authority
NRT	Net Registered Tonnage
NYK	Nippon Yusen Kaisha Lines
NWA	New World Alliance
MOL	Mitsui O.S.K Lines
OECD	Organisation for Economic Cooperation and Development
OOCL	Orient Overseas Container Line
OSC	Ocean Shipping Consultants
PSA	Port of Singapore Authority
PSCI	Port Supply Chain Integration
PTP	Port of Tanjung Pelepas
RDC	Regional Distribution Centre
RDT	Resource Dependence Theory
RBV	Resource Based View
RWSCA	Relationship With other Supply Chain Actors
SCIP	Supply Chain Integration Practice
SCM	Supply Chain Management
SCP	Structure-Conduct-Performance
SME	Small Medium Enterprise
SMP	Small and Medium-Sized Port
SPSS	Statistical Package for the Social Science
TEU	Total Equivelent Unit
TOC	Terminal Operating Company
UK	United Kingdom
UNCTAD	United Nations Conference on Trade and Development
UKMPG	United Kingdom Major Port Group
USA	United State of America
VAS	Value Added Service
VIF	Variance Inflation Factor
3PL	Third Party Logistics
3BL	Triple Bottom Line

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CHAPTER 1

INTRODUCTION

This chapter depicts the commencement of this research. It begins with the background of the research, which targets investigating the performance of ports that are not on the main maritime shipping routes but proximate to hinterland markets, known as ports on the periphery. In addition, the research objectives, which were identified after a thorough literature review, are presented in section 1.1. Moreover, in order to give readers a clear view, this chapter provides a specific section (1.2) to briefly explain the scope of the study, respondent sample, and methodology. Meanwhile, the structure of the thesis is briefly explained in section 1.3. To recapitulate this chapter, a summary is provided in section 1.4.

1.0 BACKGROUND OF THE RESEARCH

The maritime transportation industry has shown incredible growth over the years and has given benefits to many countries, despite the economic recession that took place in late 2008. In the maritime transportation context, shipping and port industries, for instance, have proven to be the most important economic activity because they are essential contributors in facilitating trades and have an indirect impact on the economy (Rahman, Ismail, & Lun, 2016). This indirectly translates into the fact that the performance of a port is an important element for the prosperity of a country's economic development. In addition, it is viewed that the performance of a port and terminal is also important because it could affect a country's competitiveness (UNCTAD, 2015). The container shipping industry, in particular, plays a crucial role in global supply chains and competition between ports and shipping lines in the transport supply chains is an extremely important problem in the sector (Fransoo & Lee, 2013). According to Lorange (2009), this intense competition is due to some of the drivers that have changed the shipping industry globally, including globalisation, dispersed manufacturing, increased global demand for commodities and consumers, world trade, demographic shifts, uneven economic growth and turbulence, geopolitical scene, technology, environmental and safety concerns, rebalancing the competitive edge between developed and emerging shipping nations, a more capital-intensive industry, capital: abundant and non-abundant, financial markets, and accelerated professionalism.

The changing economics in the global marketplace with powerful and relatively footloose players, extensive business networks and complex logistics systems (Notteboom, 2007) have resulted in ports having to desperately search for new ways to increase competitiveness and subsequently performance and gain a sustainable edge in today's dynamic and competitive business environment (Almotairi & Lumsden, 2009). The pressure from intensified inter- and intra-port competition is not only affecting large and established ports but also SMPs (Ng, 2012). Given that the competition between ports is intensifying, many authors have deeply studied or investigated the performance of ports – either quantitatively or qualitatively – from various perspectives, such as the factors or determinants that are able to continuously contribute to this performance of ports. In addition, studies pertaining to the performance of ports that have been put forward in the literature are not limited to a particular country but have also been broadened to regional and international perspectives. Unfortunately, the current discussions in the literature are prone to focusing on large and established ports that hold hub status without realising that ports come in many sizes, ranging from small, to medium, to large. In particular, previous studies have failed to balance the attention given to the size of ports when investigating their performance. This imbalance in attention is simply because the importance of these SMPs is quite often unnoticed and they are not as interesting as the larger ports to many researchers (Margarino, 2014).

Feng (2013) and Feng and Notteboom (2013) claim that there are several other reasons that cause the SMPs to be overlooked. Firstly, peripheral ports have some disadvantages in the area of competition, particularly the limited calls from shipping lines, due to their location and lack of management efficiency. In addition, ports of smaller size are perceived as having disadvantageous locations in the maritime transportation industry; therefore, their presence has received far less attention from researchers because their resource availability is seen to be inadequate to support their development. Moreover, the economic function and their roles in the logistics chains are not completely recognised (Margarino, 2014). Fourthly, these SMPs also suffer from lack of visibility and their voices are often weak (Margarino, 2014). Furthermore, the profits that these SMPs are generating are too small for them to make investments (Myszka, 2011). This is due to the lack of diversity in cargo-handling activities as some (if not all) SMPs are commonly associated with a niche market or specialised cargo which also means that they are relying on commodity prices. Thus, it is viewed that these disadvantages are what often place the SMPs in a difficult situation. What is more, these

disadvantages not only make the development of such ports continuously stagnant, but they also affect a port's competitiveness and performance in many ways.

Preliminary work pertaining to the SMPs revealed that few studies have been dedicated to investigating the performance of such ports. Although there are studies of SMPs in the literature (see Brooks, McCalla, Pallis, & Lugt, 2010; Feng, 2013; Feng & Notteboom, 2013; Olesen, Dukovska-Popovska, Hvolby, & Jensen, 2014), these studies are focusing on other aspects of peripheral ports, such as the development of small-medium sized ports. A study pertaining to SMPs is worth carrying out as these ports are seen as able to be the catalyst to economic development and to secure growth not only at the national level but also at regional and international levels. In addition, with the global challenge of climate change and customers' increasing interest in environmental sustainability, greater opportunities may be seen for smaller and medium-sized ports that have been peripheral, which can add environmental benefits to the customers' supply chains. **Table 1.1,** for instance, shows the strengths and opportunities that SMPs in Europe have in order to stay relevant in the industry. The business activities and economic development of these SMPs can possibly be generated from their utmost strengths and opportunities including the spatial characteristics – being proximate to major metropolitan/hinterland area, the land availability, flexibility in the business environment as well as less pressure from government and non-government sectors on environmental sustainability issues (Langen, 1998). This indirectly indicates that, even though these ports are relatively smaller in size compared to large ports that have hub status, it is argued that their presence is seen as able to underpin the local economy, offer worthwhile job opportunities, assist greatly in local regeneration, and serve and support the dominant ports in the multi-port gateway regions in many ways (Margarino, 2014).

The aforementioned has shown that there is lack of studies pertaining to the performance of SMPs, in particular the strategies that could be a useful tool or mechanism and platform for these ports to succeed in business. This indicates that further work needs to be carried out in order to investigate the performance of these ports, in particular the ones that are not on the main maritime shipping lanes and which face challenges in attracting port users to make ports of call; nevertheless, they are proximate to large hinterland markets, and thus called ports on the periphery. Building on this capacity, this study therefore focuses on the SMPs (ports on the periphery) and aims to investigate the competitive performance of such ports under the intensified competition in the new business environment. Specifically, it intends to seek,

identify and explore the potential and relevant strategies that could be emanating from their strengths and opportunities and which could contribute to the performance of ports on the periphery, and to what extent the identified potential strategies are able to continuously contribute to the performance of such ports.

Table 1.1: Strengths and opportunities of SMPs

Strengths	Opportunities
• Existing reliable links • Opportunity to serve more isolated communities • Port's versatility and adaptability to structural transformation • Agility to specialise in niche markets • Some unutilised space due to concentration on major economic development areas • Knowledge of the sea • Knowledge of maritime logistics • Proximity to major metropolitan areas	• Identification of niche markets, specialisation and/ or investment in non-traditional activities/ sectors (e.g. energy, eco-innovation) and develop better connectivity for emerging industries • Innovative shared marketing between connected ports • Cross-border sharing of information and best practices for resource and time saving • Use of land space for businesses to generate revenue • Temporarily serve as support facilities for primary ports in case of slowdowns and/ or stoppage due to natural or man-made events, thus providing a more resilient transport network • Relieve pressure and congestion when other nearby larger ports approach capacity limits • Operational connectivity, improve energy efficiency and reduce emissions • Opportunity to access new technologies that can enhance infrastructural/ operational connectivity, improve energy efficiency, and reduce emissions • Development of long term strategies that take into account inter-dependency of ports across the sea • Investments (e.g. larger berth) to mitigate effects of Sulphur Directive

Source: Margarino (2014)

1.1 RESEARCH OBJECTIVES

The aim of this research is to investigate the competitive performance of ports on the periphery. In order to achieve this aim, the objectives are listed as below:

1. To identify and explore the appropriate potential strategies that are able to bring continuous prosperity to the business performance of ports on the periphery.

2. To synthesise the theoretical relationships that might be present between spatial characteristics through situation and site elements, sustainability advantage, and the performance of ports on the periphery.

3. To synthesise the theoretical relationships that might be present between port supply chain integration strategy, spatial characteristics through situation and site elements, and sustainability advantage.

4. To construct a conceptual strategic business model that could continuously contribute to the business performance of ports on the periphery.

5. To examine the direct and indirect impact of the causal relationships of spatial characteristics through situation and site elements on the sustainability advantage and subsequently on the performance of ports on the periphery.

6. To assess the direct and indirect impact of the causal relationships of the port supply chain integration strategy on the relationship between spatial characteristics through situation and site elements and the sustainability advantage.

1.2 SCOPE OF THE STUDY, RESPONDENT SAMPLE AND METHODOLOGY

The seaport sector is the main scope of this study. Many types and sizes of seaports can be found in the literature, but ports on the periphery are the main concern of this study. The study focuses on potential strategies that could contribute to the performance of such ports in conditions of intense competition, in particular, the direct and indirect effect of spatial characteristics, supply chain integration strategy, and supply chain sustainability benefits on the performance of peripheral ports.

To achieve the study's aim, a questionnaire was distributed to port stakeholders in three different regions, Europe (UK), Asia (Malaysia), and Africa (Nigeria). It has been explained that this study is focusing on specific ports, namely ports on the periphery, which can be found in any place in the world with similar geographical features; thus, it is envisaged that they can be assessed as a unique phenomenon regardless of where they are located. Hence, it is anticipated that the scope of the sampling location can be broadened to more than a single country or region. Given that it is a phenomenon that occurs at some (if not all) part of the world, focusing only on a single country or region would limit the view and not reflect the issue that this category of port is facing. Hence, it would not be possible to generalise the results to other countries or regions. It is also viewed that the sampling location will not be an issue in the data collection, as the study focuses only on the geographical issue and does not involve other factors such as politics, culture, policy, etc., as these are beyond the scope of the study.

In this study, the term 'port stakeholders' refers to port operators, port authorities, shipping lines, and freight forwarders. Decision-makers in top management are the main targets for participation in the study because they are the ones who are involved in making the critical analysis and deciding on the appropriate strategies that need to be considered and implemented in determining the road map of their business. EDA and a standard MRA statistical technique were adopted in analysing the data.

1.3 ORGANISATION OF THE THESIS

This thesis contains seven chapters. Chapter One introduces the background of the study. In particular, the sub-topics covered in this chapter are the introduction, background of the study, research objectives, scope of the study, respondent sample and methodology, research contributions, and the structure of the thesis. Meanwhile, Chapter Two elaborates the trends that are currently taking place in the maritime transportation industry where issues such as ship size, bunker fuel price, slow steaming speed, and the changing of supply chain structure are discussed in detail. In addition, the performance of ports, in general, is discussed in detail, and the chapter ends with a summary section.

Chapter Three further explains the literature review concerning the PSCI strategy, sustainability advantage, spatial characteristics of peripheral ports, and port performance. To be more specific, their concept, characteristics, and attributes will be explained in detail. On

the other hand, Chapter Four is about the development of a strategic business model for peripheral ports and subsequently contributes to the hypothesis development.

Research methodology is explained in Chapter Five. This chapter consists of several sections including research design and data analysis technique and interpretation. The chapter summary recaps the flow of the research methodology. Chapter Six presents the data analysis and findings that have been generated from the standard MRA technique by employing Statistical Package for the Social Science (SPSS) version 22. It begins with an introduction, and is followed by preliminary analysis findings, inferential analysis findings, and ends with a summary of the chapter. Last but not least is Chapter Seven, which discusses the findings from the MRA, research novelty, draws the conclusions of the study, and provides limitations and recommendations for future research.

1.4 SUMMARY

This chapter has briefly explained the process in executing the study. It began with a brief introduction to the background of the study. This was followed by the research objectives of the study. Subsequently, a brief explanation of the research scope and respondent sampling was provided. To achieve the research objectives, the data collection and data analysis methods were explained. Finally, the organisation of the thesis has also been presented in this chapter, in order to give a brief view of the whole study. The next chapter will explain and discuss the trends and challenges in the maritime transportation industry that have influenced the intense competition between ports around the globe.

CHAPTER 2

CURRENT TRENDS AND CHALLENGES IN MARITIME TRANSPORTATION INDUSTRY

This chapter begins with a brief introduction of the current trends that are taking place in the maritime freight transportation industry which contribute to the intense competition between ports. Secondly, each trend that has been identified will be discussed in detail in each specific given section. This will be followed by an analysis of the consequences of those identified trends on the competitiveness and performance of ports, particularly ports on the periphery. Fourthly, the competition between ports in the industry will be discussed. Fifthly, this will be narrowed down to the studies that have been conducted pertaining to the competiveness and performance of ports in general. Finally, the last section of this chapter will cover the concept of ports on the periphery. In particular, this study will identify and discuss the previous studies of ports on the periphery and subsequently gaps will be identified and revealed at the end of this chapter.

2.0 INTRODUCTION

Transportation has been recognised as one of the most important human activities on earth. It represents the medium of movement of people and goods between different locations. Transportation is not only important for physical movement; it can also influence the social structures (access to healthcare, welfare and cultural or artistic events), political tool (national accessibility or job creation), economic development (production of goods and services) and environmental consequences (Rodrigue, Comtois, & Slack, 2009). They added that its importance becomes apparent when empirical evidence shows that the demand is growing, the expansion of infrastructures can be obviously seen and the cost of transportation is getting cheaper. Theoretically, five different types of transport have been recorded and used around the world: air, road, water, rail and pipeline.

Of the five types of transportation, air and water are the main modes of transportation that connect two different countries that are unable to be connected via rail and road due to geographical terrain. In addition, separation by ocean and long distances is also a significant

reason for the use of aviation and water transport. Even though aviation transport is able to connect different countries in different regions and on separate continents, it does not have the capability to transport goods in large-scale volume. Unlike aviation, water transport is able to transport goods in large-scale volume and at low cost, although the time taken is longer than for aviation. The economies of scale offered by water transport have made it one of the most important transportation industries in the world.

Theoretically, the development of seaborne trade is significantly influenced by the rapid development on international trade which was driven by the globalization phenomenon that took place in the 20th century. Since then, the transportation industry has witnessed a remarkable growth in seaborne transport. This can be seen from a report provided by the United Nations Conference on Trade and Development (UNCTAD) in 2013, which demonstrated a significant growth in seaborne statistics within 42 years (1970 to 2012) (**Table 2.1**). Each of the commodities handled through maritime transportation is continuously increasing, even after the economic recession that struck in 2007 and 2008.

Due to the amount of commodities handled, the containerisation sector has shown an incredible growth within four decades from 102 million TEU in 1970 to 1578 million in TEU 2013 (UNCTAD, 2013). Of the three main maritime transport routes, both Asia-Europe and Europe-Asia were recorded as having the busiest and highest containerized cargo flow in 2012 (with 13.7 and 6.3 million TEU respectively), followed by Transpacific – Asia-North America and North America-Asia (with 13.3 and 6.9 million TEUs respectively) and Transatlantic – Europe-North America and North America-Europe (with 3.6 and 2.7 million TEU respectively). This is due to the economic boom in Asia, particularly in China and India, and the South American countries, which are the main sources of imports from European and North American regions. The low cost of production offered to international businesses has substantially influenced many multinational companies (MNCs) to penetrate these new markets, outsourcing their business and even re-locating their factories, which could give enormous advantages. It is expected that the containerization flows will continue to be nurtured at a rapid pace in the future, not only because the demand from consumers is increasing but also because of its popularity, as it is safe, cost-effective, and supports inter-modal transport.

Table 2.1: The development of international seaborne trade, selected years (Millions of tons loaded)

Year/ Cargo	Oil & Gas	Main Bulks	Other Dry Cargo	Total (all cargoes)
1970	1440	448	717	2605
1980	1871	608	1225	3704
1990	1755	988	1265	4008
2000	2163	1295	2526	5984
2005	2422	1709	2978	7109
2006	2698	1814	3188	7700
2007	2747	1953	3334	8034
2008	2742	2065	3422	8229
2009	2642	2085	3131	7858
2010	2772	2335	3302	8409
2011	2794	2486	3505	8784
2012	2836	2665	3664	9165

Source: UNCTAD (2013)

In addition, as a container box is durable and reusable for a significant period of time, it is considered as one of the methods that is friendlier to the environment. Based on the container orderbook statistics provided by Alphaliner (2015), 40 shipping lines in the world have placed massive container ship orders where the highest leading order is for 44 container ships with the total carrying capacity of approximately 581,534 TEUs. China Cosco Holdings Co (COSCO), for instance, has placed an order 11 ultra-large container ship worth $1.51 billion which can carry for 19, 000 TEUs per sailing, which will be in fully operating mode in 2018 (Zhen, 2015).

2.1 MARITIME TRANSPORT

Maritime transport as explained under the GFP (The Global Facilitation Partnership for Transportation and Trade) is the shipment of goods or cargo and people by sea and other types

of waterway from one location or another. Commodities that are carried by water transport usually have odd shapes and are of large volume in quantity. Some of the commodities are liquid and dry bulk, break-bulk, dangerous cargo, containerization, and livestock, to name but a few. Different types of commodity will be carried by different types of ship, will be berthed at different types of berth, and will be handled by different types of equipment. Of the commodities mentioned above, over 50% are carried by containers (Ramanakumar & Srinivas, 2013).

It is widely indicated in the literature that 90% of global and international trade (in volume) is carried by maritime transport (IMO, 2012). This is because maritime transport is the most effective mode by which to move large volume or quantities of cargo over a long distance because the physical properties of water confer buoyancy and limit friction (Rodrigue, Comtois, & Slack, 2013). Ports therefore are important for the functioning of the world's economy, specifically for the connection of water transport between countries (OECD, 2011). It is said that the port sector has been recognised as one of the factors that contribute to the development and subsequently the competitiveness of a country.

Ports as described by Alderton (2011) are areas where there are facilities for berthing or anchoring ships and other modes of transportation and where there is the equipment for the transfer of goods from ship to shore or ship to ship, and which are capable of providing logistics services that create added value (Paixao & Marlow, 2003). Simply put, ports are the temporary transit point that link different modes of transportation before they reach their final destinations. Theoretically and practically, in maritime transportation, ports are heterogeneous and they are considerably different from each other in many ways, such as function, size, and location. Some ports are known as seaports (major port, minor port/feeder port), inland ports (through a canal, river or lake), transshipment hubs (through hub-and-spoke, relay, interlining and feeder-feeder), and hinterland ports (focus on moving freight from ship to hinterland), to name but a few.

However, nowadays port activities have moved beyond their traditional business scope in which they have been considered as one of the logistics systems linked with the supply chain, where they have to actively interact with other supply chain actors in order to provide an effective and efficient performance. Thus, ports nowadays play an important role in the management and coordination of materials and information, as transport is now considered as

an integral part of the entire supply chain (Nam & Song, 2011). As one of the elements in the value-driven supply chain, ports are claimed to be moving towards the new phase of port development, known as the fourth generation of ports. It is found to be true that the development of ports since late 1950 falls under four generations, and being integrated within the supply chain is the latest generation confirmed in the literature. The first generation of ports seemed to be conservative, which only concentrated on the loading and unloading activities between different modes of transportation, and the only cargoes handled during those days were general cargoes, which were extensively based on human capital.

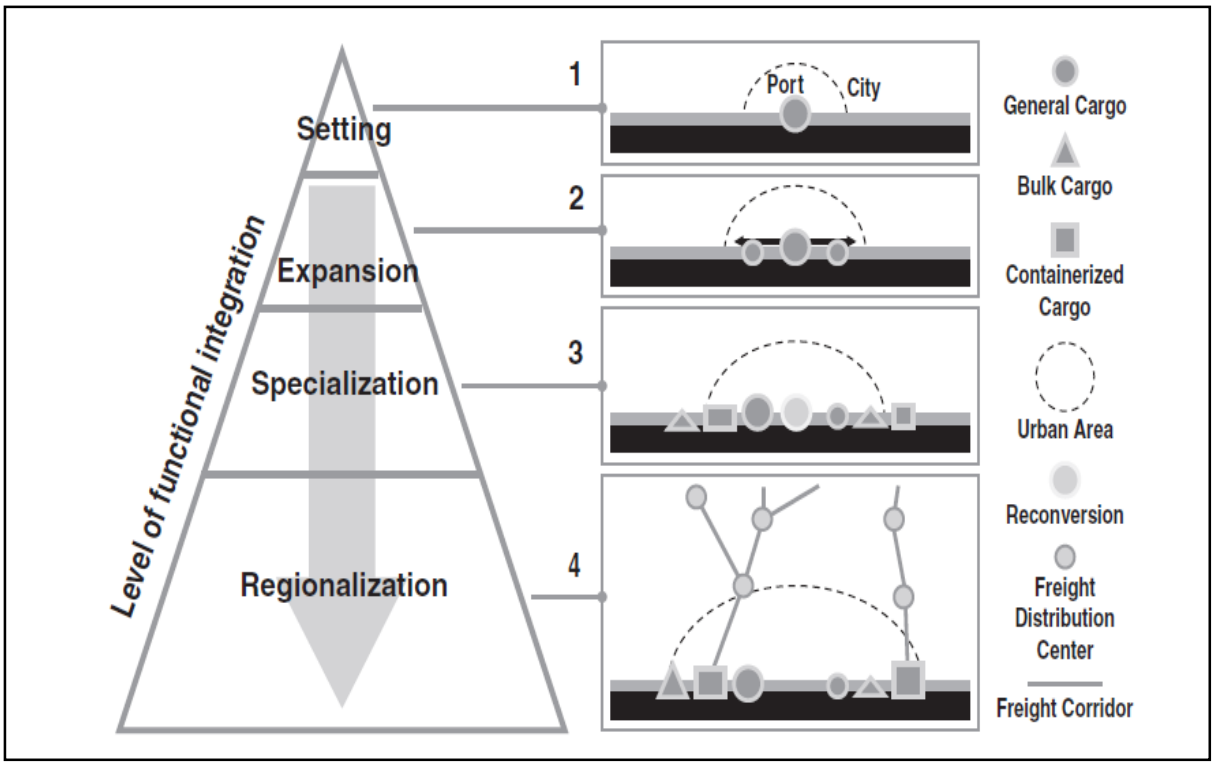

Figure 2.1: Port developments

Source: Notteboom & Rodrigue (2005)

Port expansion or the second generation of ports was caused by the evolving of maritime technology and improvements in cargo handling. The scope of activities also gradually evolved to have a closer relationship with port users and industrial activities. Meanwhile, the third

generation of port development can be seen from the cargoes handled – a variety of cargoes, from break-bulk to unitized. In addition, ports at this stage were commercially oriented. Port regionalization to date is the current generation of port development, which concentrates on integration with the supply chain. Additionally, at this stage of port development, ports are more focused on the utilization of sophisticated information and communication system (ICS) and having greater control of environmental aspects. **Figure 2.1** above illustrates the said generations of port development that have been discussed and recorded (Notteboom & Rodrigue, 2005).

2.2 PORT COMPETITION

It is widely recognised that the competition between ports around the world is intense. Ports nowadays are no longer enjoying the monopoly of business that they once had; instead, they are required to broaden their business scope in order to stay competitive in the business sector. It has been identified that the severe competition between ports recently derives from many factors that have recently taken place in the maritime industry. The literature clearly discusses that factors such as: (1) the increasing size of ships from merely 2,000 TEUs to 19,000 TEUs, (2) the fluctuation of bunker fuel price due to crude oil instability in the market, (3) the slow steaming speed of ships to mitigate the higher fuel costs and environmental effects, (4) the changing of supply chain structure such as the horizontal and vertical collaboration between shipping lines, ports and shipping lines and between ports as well as consolidation between shipping lines through merger and acquisition (M&A) are some of the keys that accelerate and contribute to the competition between ports. These key factors will be discussed in detail in further sections below.

2.2.1 Up Scaling Ship Size

In 1955, a trucking entrepreneur, Malcom P. McLean (known as the 'Father of containerisation), came up with the brilliant idea to convert a World War II tanker into a container ship known as Ideal X when he bought a steamship company (Horse, 2011). The idea struck when he wanted to minimise the transporting process that used to be the basic procedure by which to transport goods from one destination to another. The whole truck would be loaded onto a ship so that the entire goods would still be inside the vehicle and it would be transported it as close as possible to their destination. This new process was found to be simpler and quicker

than the previous method, as it is more efficient in terms of time, space and cost. The Ideal X was the first ship that carried 58 aluminium truck bodies and 15,000 tonnes of bulk petroleum on April 26th in 1956 from Newark, New Jersey, and five days later safely and successfully arrived at Houston, Texas (Levinson, 2006). Then, the bodies of the trucks were left behind and only the containers were transported to other destinations by container ship. This is the emerging point where the containerisation industry successfully begins and its legacy continues to flourish.

To date, containerisation is still an important medium for goods shipment from one country to another. The demand for container boxes is increasing spectacularly due to their effectiveness and efficiency. They have had numerous impacts on many sectors in maritime transportation. The most obvious impact that can be seen from containerisation is the size of ships. The maritime sector has witnessed the dramatic up-scaling of ship size since the existence of Ideal X. Records in 'The geography of transport systems' by Rodrigue, Comtois, & Slack (2009) show that there are six generations of container ships and the detail of those ships can be found in **Table 2.2**. The first generation of container ship (1956-1970) was a bulk converted ship with a speed of 18 to 20 knots and able to carry 1,000 TEUs, known as 'Ideal-X'. It carried on-board cranes since most of the port terminals do not have the facility to handle the containers at berth. The second generation of containership (1970-1980) has speeding capability of between 20 to 24 knots and was composed of cells lodging containers in stacks of different height depending on the ship's capacity and cranes were removed from the ship design so that more containers could be carried.

Economies of scale rapidly pushed for the construction of larger containerships in the 1980s. The size limit of the Panama Canal, which came to be known as the Panamax standard, was achieved in 1985 with the capacity of approximately 4,000 TEU. Once this limit was achieved, it was expected that a new generation of containerships would appear within a decade. The APL C10 class containerships were introduced in 1988 and were the first containerships exceeding the 32.2-metre width limit of the Panama Canal. At the same time, Panamax containership designs were evolving to take maximum advantage of the limitation in beam. By 1996, the fourth generation of containerships had been introduced and the carrying capacity reached up to 6,600 TEU. This represented a market risk since a ship above the Panamax size required a substantial amount of cargo to make the journey financially viable; however, by the late 1990s the rapid growth of global trade made such a ship class a marketable proposition.

Once the Panamax threshold was breached, ship size quickly went into the fifth generation (post-panamax plus) with carrying capacity reaching 8,000 TEUs ('S Class'). Going beyond Panamax was perceived as risky in terms of the configuration of the networks, and the additional handling infrastructures as well as draft limitations at ports. Each subsequent generation of containership is facing a shrinking number of harbours able to handle them. Containership above the third generation requires deep-water ports (at least 43 feet of draft) and a highly efficient, but costly, transshipment structure. By 2006, the sixth generation of containership came online when the maritime shipper Maersk revealed the largest container vessel, with a length of 400 meters and which could carry approximately 15,000 TEU, named Emma Maersk (E-Class: Economies of scale, energy efficient and environmental improvement). In 2011 Maersk placed a massive order with Korea's Daewoo Shipbuilding & Marine Engineering Co., Ltd. for approximately 30 Triple-E ships which could carry about 18,000 TEU and which have been identified as the largest and most efficient container vessels in the world (Ng, 2012).

Nevertheless, it seems that this is no longer the case, as the bigger size of ship has been operated since November 2014 by China Shipping Container Lines (CSCL) with 18,270 TEUs capacity for a single sailing (Quick, 2014). Preparations to build the biggest container ships in the world are gearing up and it is expected that, within two years (expected to be in 2016), as forecasted by Ocean Shipping Consultants (OSC), ships with carrying capacity reaching approximately 24,000 TEU per sailing will be plying the Asia-Europe route (Shaw-Smith, 2014). This contradicts what has been debated about 12 years ago amongst researchers over the container ship size limit. A reliable source, OSC project director, Andrew Penfold, stated that, nonetheless the current maritime shipping has not reached the limits of ship size, there are some benefits that can be achieved from the said ship size enlargement, particularly for shipping lines and shippers (Shaw-Smith, 2014).

Based on comprehensive studies, it has been shown that the 24,000 TEU ships are able to generate cost efficiency where costs are approximately 23.1% lower than for a 12,500 TEU ship and 17.4% less when compared to a 16,000 TEU ship by adding features to the ships such as one longer hold, two additional rows to the width and one additional tier to the height (King, 2014), so that the overall approximate size would be 430 meters long x 62 meters in height and the draught of the ships would remain at 16 meters deep. In addition, it is predicted that utilising bigger container ships is (1) able to reduce fuel consumption by reducing the number of ships

deployed and subsequently the number of sailings, and (2) the slot cost would remain competitive despite the existing excess of supply as the demand for the bigger container ships continued to be strong. This is where the cost per TEU can be reduced significantly when using this gigantic ship for transport and shippers consequently will be able to reduce the final price that they charge to their end customers.

Table 2.2: The development of container ships (in TEUs)

Generation of vessels	TEUs
Feeder	100-500
Feedermax	500-1000
Handy	1000-2000
Sub-panamax	2000-3000
Panamax	Over 3000
Post-panamax	Over 4000
Super post-panamax	Over 10000

Source: Wijnolst & Wergeland (2009)

However, the great development in the vessel size comes with a downside, particularly the size of the current terminals. Looking at Maersk Line, for instance, although they announced that their vessels are friendly in every aspect, some scholars feel doubt over the sustainability of the massive size of their vessels. The bigger the sizes of the vessel, the more problems arise, mainly the concern over the environmental issues, implication of the oil crisis and the physical limitations of the ports themselves. Such a ship was designed to fit exactly into the locks of the expanded Panama Canal which was expected to be opened in 2014. The larger size of vessels definitely requires more proper port facilities and competitive ship-to-shore performance such as the terminal crane outreach (Tirschwell, 2014).

The current standard cranes at port quays find it difficult to reach the containers on these larger ships, and extra time needs to be allocated to complete the loading and unloading process. This consequently will affect the ship turnaround time and simultaneously increase the delivery lead

time. In addition, the increasing ship height would be a main problem to some ports such as the port of Hong Kong, Hamburg or Osaka, as the bridges at these ports would hamper ships gaining access to the ports. As a consequence, ships have to deviate or switch to other ports that are free from any physical constraints that could disallow their movement into the port area.

Other than port operation activities, the 24,000 TEU container ship capacities also could affect those ports or channels that have shallow water tide or draft. Some ports are naturally deep and some are not. Therefore, the increasing ship size would be a disadvantage to those ports that are not naturally deep and at the same time they would have to rely on dredging activities in order to deepen the water level to allow the mother ship to be berthed there. Taking the port of Hamburg as an example, it might have difficulty in accommodating the bigger ships as it has to rely on the dredging process in order provide more room for larger ships.

In addition, although the 24,000 TEU container ship size is able to fit into the Suez Canal, however, there is a bridge that spans the canal and the ships would likely find it difficult to pass under it (Vogdrup-Schmidt, 2014). He added that the development and usage of the giant ships might cause another problem, which is insurance and safety issues, when the two things are tied together. In addition, based on the economic perspective, the deployment of larger ships would provide an economic opportunity for shipping liners and shippers as the container cost per TEU could be reduced significantly but it would not benefits the port sector.

Table 2.3: Average ports of call between Far East and Europe trades

Year	Ports of Call
1989	4.9
1998	3.84
2000	3.77
2006	3.68
2009	3.35

Source: Ducruet & Notteboom (2012)

Furthermore, the increasing size of the container ship will lead to transshipment hub concentration. As the transshipment activities become greater in certain ports that are strategically located in the middle of main maritime transportation networks or routes, other ports will witness a significant decrease in ports of call made by shipping lines. This will contribute to the growth of hub-and-spoke activities between ports. Nevertheless, this claim has been denied by Andrew Penfold, as he stated that people have been saying over the years that as the size of container ships keeps growing there will be a reduction of port of call hubs, but this has never happened to date.

On the other hand, he did mention that port productivity is decreasing when the size of ships is getting bigger and transshipment hubs will compete between each other in order to remain competitive. However, a study that has been conducted recently supports the decline of the ports of call on the Far East to Europe route since the increase in container ship size. As can be seen in **Table 2.3** above, the number of ports of call from 1989 to 2009 has reduced from 4.9 to 3.35; this reduction is due to the transshipment hubs' concentration among bigger and main shipping lines. Therefore, the location of a port plays a significant role in determining its competitiveness and performance as the percentage of port of call from shipping lines is getting slimmer when the 24,000 TEU container ships start their sailing activities between Asia-Europe routes. It seems that many ports in Asia and the Mediterranean will be impacted by these new super mega carriers.

Prior to the ship size, some ports have found it difficult to respond competitively to these changes due to their site and situation, so that some that were once leaders have lost much of their attractiveness and importance to shipping lines; whilst others that were previously minor have grown into major ports and container hubs. It is ports on the periphery that have suffered most due to being too far from the main shipping lines or their hinterland cannot sustain the capacity of larger vessels. This is compounded by fierce competition in the market that drives on competitors with better sites and situations. Thus, it is viewed that the increasing of ship size has not only begun to concentrate on larger or transshipment hubs and reduced the ship call but also has dramatically increased the intense competition between ports around the globe, in particular those ports that have location disadvantage and are relatively small in size.

2.2.2 The Fluctuation of Bunker Fuel Prices

In maritime transportation, petroleum is the main source of energy to move a ship from one location to another. Similar to the demand for seaborne trade, the demand for marine fuel is primarily driven by the growth of international trade and the level of activity in the marine transportation industry, in particular the number of active ships at sea. In the marine bunker fuel market, it is recognised that container ships, bulk ships and general cargo ships and tanker ships are the end users of bunker fuel, which account for approximately two-thirds of total marine fuel consumption (see **Figure 2.2**). Meanwhile, the rest is split between passenger ships such as cruise and ferry, fishing, naval and small ships as these categories of ships only operate occasionally and do not have fixed and frequent sailing activities between countries. The demand for bunker fuel in maritime transportation is increasing every year, not only as a result of the globalisation phenomenon but also due to the escalating container ship size.

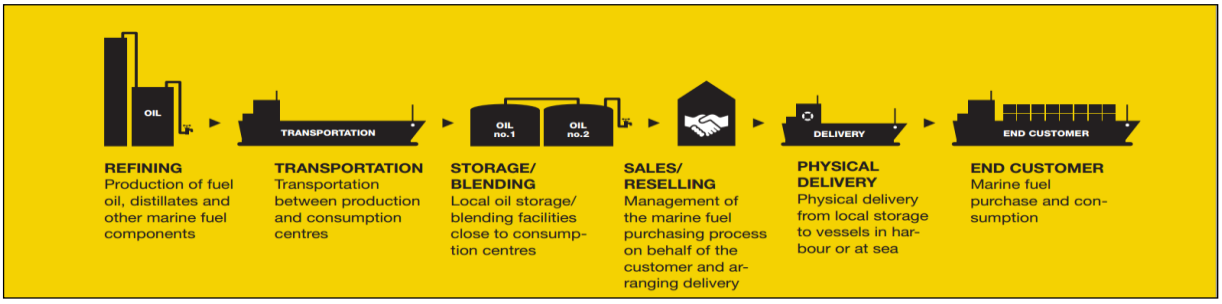

Figure 2.2: Marine fuel distribution value chain

Source: Bunker (2014)

Not only is the bunker fuel demand increasing but so are the overall costs of fuel consumption that have to be paid by shipping lines as the bunker price per ton keeps increasing. Economically, the increasing fuel price is due to the current demand and supply of the bunker fuel between shipping lines and bunker suppliers. Nevertheless, Curtis (2009) indicates that the increasing of bunker fuel price is mainly due to the crude oil market. He added that the processes of refinery or extraction and turning crude oil into bunker fuel are costly. Moreover, geopolitical and event-driven risks are other factors that play a major role that contributes to the higher price of bunker fuel (Afonja, 2013). An increase in bunker fuel price will not greatly affect the total cost of transportation for a ship if the crude oil price only moderately increases,

but if the prices are significantly high this will definitely have a great impact on the total cost of a ship, not only to carriers but also to shippers (Curtis, 2009).

However, the maritime transport sector has shown a fluctuation of bunker fuel prices over the last few years. The volatility of bunker fuel price per barrel can be clearly seen in the period from 2003 to July 11, 2008 where the oil price sharply increased from $28 per barrel to $147.27 per barrel and then, in November 2008 to January 2009, the price of oil per barrel fell to $53 and $40. However, in 2011 the oil price mounted back up to over $100 per barrel (Curtis, 2009). Container shipping is the industry that has been impacted the most as the overall operating costs also massively increased. In the meantime, as the economic recession took hold, overcapacity in the shipping market reduced freight rates and compounded carriers' woes (Gray, 2014). The increase in bunker fuel prices in maritime transport has been widely discussed by both researchers and practitioners. In order to reduce bunker fuel cost and the overall operating costs, shipping lines begin to search for the best solutions to maintain their business in difficult times.

Therefore, the slow steaming ship speed approach has been introduced as a major measure to reduce the operational cost and at the same time save fuel by optimising consumption. Maersk has been identified as the first shipping line to initiate the slow steaming approach. Many shipping lines have followed this approach and slowly its benefits have been recognised. As a consequence of the slow steaming approach, the demand for bunker fuel decreased due to measures taken by shipping lines to reduce the consumption of fuel. Singapore bunker fuel supply, for example, stated that its bunker sales dropped six per cent in September 2012 to 3.33 million metric tons; the lowest sale recorded was 3.09 million metric tons (Nee & Jaganathan, 2012). Nevertheless, bunker fuel operators are optimistic and believe that the demand for bunker fuel will increase despite the slow steaming initiative undertaking by container ships because the speed reduction will not be decreased beyond the current level.

Nevertheless, after a seven-year phase when prices were very high, the bunker fuel price slowly dropped in 2014. Speculation concerning reversion to full speed ships has been rife amongst researchers. On the other hand, container shipping lines have insisted that they will remain with the current approach and they do not have any intention to revert to full ship speed although the bunker fuel price has declined recently. This is because container shipping lines continuously suffered from losses over a few years ago and the only promising way to regain

and return to profitability is through utilising the slow steaming ship speed for a longer period of time. Shippers seem to be continuously impacted by this situation, although they hope that their burden will be reduced when the slow steaming speed is eliminated. However, if shippers insist that shipping lines revert to full speed ships, they will have to dig into their 'pocket money' in order to pay extra freight rate, stated Mr. Adrian Jones, MOL's European managing director (Marle, 2014).

2.2.3 The Slow Steaming Ship

The implementation of slow steaming speed by many carriers is due to the effect of the increasing bunker fuel price on the market and the economic recession. The economic recession in late 2007 and 2008 has had a significant impact on shipping lines' business in which the volume of containers handled declined. In addition, the increase of the bunker fuel price in transporting the shipments has made the business become tough, particularly with larger ships size given that they required large fuel consumption (see **Figure 2.3**). Moreover, the substantial global orderbook for new tonnage, the global financial crisis, the sudden fall in ship values, increasing operation costs (lube oil, manning, maintenance) and the declining of freight trade are some of the additional factors that contribute to the implementation of the slow steaming speed (Wiesmann, 2010). In order to balance these issues, carriers have to find a brilliant solution in order to maintain their business and remain in business. This is where the concept of slow steaming speed came up, with a desire that the strategy could offset the higher fuel cost and low container volumes.

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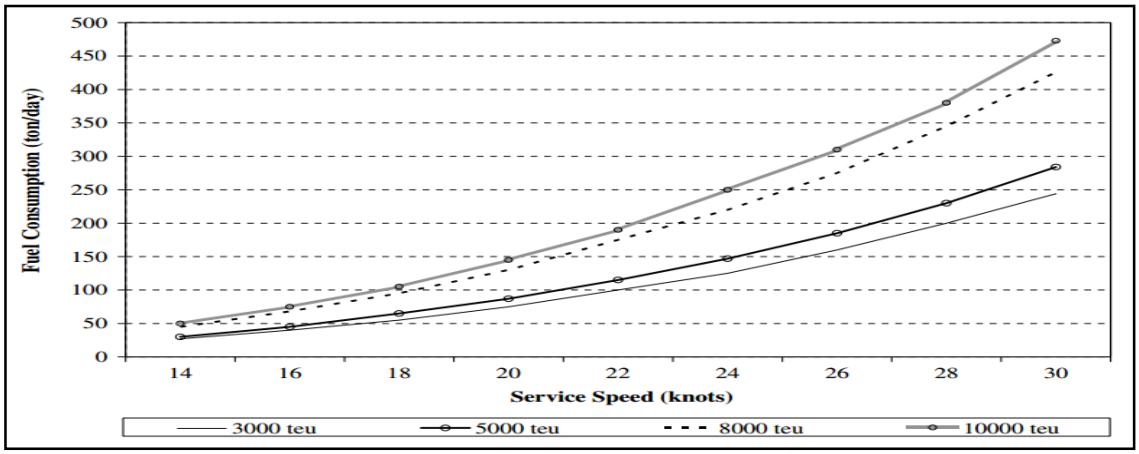


Figure 2.3: Fuel consumption and ship speed with different sizes of container ships

Source: Notteboom & Vernimmen (2009)

Typically, the standard speed of a container ship is between 24 and 25 knots; after the adoption of slow steaming, three slow steaming sailings have been introduced and adopted by carriers: slow (21 knots), extra slow (18 knots) and super slow (15 knots). In addition, some of the carriers even go for the lowest sailing speed of 12 knots (approximately 14 mph) (Vidal, 2010). It is said that slower speeds improve ship fuel efficiency, allowing carriers to save on bunker fuel through the slower fuel combustion, and subsequently reducing the costs of the items carried on board the ship (Maloni, Aliyas, & Gligor, 2013). This approach seems promising in allowing carriers to maintain their businesses for both the short and long run. In fact, it is believed to be one of the solutions to help shippers reduce their carbon footprint and reinforce their green image. Nevertheless, this approach has received mixed views both from practitioners and researchers, particularly in the sense of its advantages and disadvantages to port stakeholders. The apparent advantage as a consequence of the speed reduction implementation is the reduction of cost. Sailing a carrier under the slow steaming speed approach does indeed reduce the fuel consumption as it uses less fuel and the ship's engine can work effectively and efficiently. Millions of dollars can be saved with this slow steaming speed compared to higher speeds. Hailey (2013) indicates that ocean carriers can save approximately $67 million through the slow steaming speed and another $6 million can be added if the ship's speed could be lowered to 15 knots. Maersk, for instance, saved approximately $1 million (equal to 3,500 tonnes of fuel) after utilising a super slow steaming speed on their post-panamax container ships since 2007.

A second benefit from the slow steaming speed approach is the reduction in carbon emissions, particularly CO2. Since the concept of slow steaming itself indicates slower fuel consumption combustion, it also means fewer carbon emissions are emitted from the ship. This is one of the fastest means in reducing the carbon emissions released into the air without the presence or installation of new and costly technology. The only technique is slowing the ship speed from 24 knots to 21, 18 and 15 knots. Cariou (2011) in his study reveals that the slow steaming speed of container ships on multi-trade routes has reduced emissions by around 11% within two years (2008 to 2010). In addition, Zanne, Počuča, & Bajec (2013) indicate that a 10% reduction in fleet average speed results in a 19% reduction of carbon emissions, even after considering the additional number of ships needed to deliver the same amount of transport work and the emissions associated with building the necessary additional ships.

The third advantage from the slow steaming approach is reliability. Practically, no shippers want to wait for longer transit times; nevertheless, it could help shippers (albeit in small numbers) in terms of schedule reliability. Retailers Boots and Asda admitted that, although they were impacted in terms of supply chain efficiency and cash flow, it did show a positive effect on schedule reliability (Wackett, 2013), as slow steaming gives better flexibility than regular steaming as there is still space for speed increase if the ship is delayed (Kloch, 2013). Nevertheless, there are mixed views in the literature about the impact of slow steaming speed on shippers.

In late 2011, a survey carried out by MAN PrimeServ indicates that approximately 68% of shippers have a positive reaction about the slow steaming speed as long as it does not affect the schedule reliability, as long as it means lower rates and as long as without reservation. Meanwhile, 31% of shippers indicate a different reaction, stating that there is a negative impact as they have to reschedule the distribution planning and do not know how to respond to the issue. However, this cost-effective, environmentally friendly and reliable approach is seen as only being reliable in the short run (Corbett, Wang, & Winebrake, 2009) while the bunker fuel price is high, and it is expected that carriers will revert to normal ship speed when the bunker fuel price declines in the future.

Even though the ship speed reduction helps many carriers to reduce their operational costs, nevertheless, it does have downsides for their customers. For example, the total journey time for a particular route is increasing due to the slower speed, and the sailing time between ports of departure to ports of destination is getting longer. In a study conducted by Psaraftis, Kontovas, & Kakalis (2009), it was found that a speed reduction of 1 knot (approximately five per cent) will contribute an additional 25 minutes of voyage time between two ports. The slower the speed of a ship, the longer sailing time will be allocated between two different ports. Hapag-Llyod, for instance, a well-known shipping company, reduced its speed from 23½ knots to 20 knots for a round trip from Hamburg to ports in the Far East (Kirschbaum, 2008). However, the voyage takes longer when the speed is reduced: previously it only took 56 day for a round trip but now it is about 64 days. Nonetheless, it pays off to have a longer voyage and extra days rather than putting a lot of money into higher bunker fuel consumption. Since the implementation of the slow steaming ship speed, carriers have managed to save millions of dollars on fuel consumption costs; however, the freight rates charged to shippers are approximately still the same (Lee, Lee, & Zhang, 2015) even though it is generally accepted

that the actual freight rate cost per TEU can be reduced once the slow steaming ship speed implemented. In addition, longer voyage means more operating costs, charter costs, interest costs and other monetary losses (Kirschbaum, 2008).

This indicates that shippers are the ones that are not entirely enthused by the carriers' strategy in reducing its cost through the implementation of slow speed. One of the reasons is due to longer or extended transit time. Slower speed of ship means longer journeys need to be added into the schedule. In addition, Berman (2011) identifies some of the impacts on supply chains such as (1) inventory level, (2) customer service, (3) production scheduling, (4) cash flow, (5) competitive position, and (6) freight rates. Moreover, this situation generates massive pressure and creates a number of problems for sellers when it comes to sensitive goods. Perishable goods, for instance, are one type of goods that can be considered to be time sensitive. The shipments of perishable goods need to be transferred within a short period of time in order to maintain their freshness. Failure to fulfill this process might end up with the loss of their value and, as a consequence, the shipper will have to bear the financial losses. As a consequence, shippers will lose the target sales and the probability to increase the inventory levels for their customers is higher.

Shippers are indeed not pleased with this situation as higher costs will be incurred as they need more inventory to feed the entire and longer supply chain (Kloch, 2013). In addition, Psaraftis & Kontovas (2010) recently disclosed that the implementation of slow steaming speed might have a side-effect on the modal split in which shippers might be shifting to more environmentally intrusive land-based modes. This is still due to the longer transit time and its effect on inventory level. They further gave an example of the cargoes that move between the Far East and Europe, which have shifted to the trans-Siberian railway or trucks, as the distance between the two continents is only about 10,000 km compared to the ocean route, which can be 43,000 km, plus 2000 km from a port to Moscow. The modal split between the continents has already saved 35,000 km in distance and approximately 14 days, compared to the ocean route. Thus, shippers might consider changing the route and mode of transportation in response to the disadvantage of slower sailing times.

The aforementioned has shown that the slow steaming approach have been identified as the main motives by shipping lines to save in fuel consumption. Even though this approach has helped shipping lines to save millions of dollar, it does increase the travel time between port of

departure to port of destination and subsequently disrupt the supply chain activities. Shippers (customers) are unhappy with these longer journey times, as they have had to build up their inventory levels and adjust their supply chains resulting in higher costs (Faber et al., 2012). Given that, ports on the periphery are resided away from the main maritime shipping route, it is viewed this situation makes shipping lines even more reluctant to go to ports on the periphery as the long distances deviated from the main shipping routes would make journey times even longer. This subsequently led to the intense competition not only between larger or transshipment hubs but also to ports that are relatively small in size in order to capture more calls from shipping lines.

2.2.4 The Changing of the Maritime Supply Chain Structure

Meeting the seaborne trade commodity demand is considered to be a great challenge for ports as they have to satisfy shippers, freight forwarders and carriers, to name but a few, that have become sophisticated and demanding with respect to the quality of the transportation services (Panayides, Wiedmer, Andreou, & Louca, 2012). This is due to the principle challenge that the seaports face, which is from the structural change of their main customers, especially shipping lines as they are becoming more powerful with stronger bargaining power, and competition between ports is more intense in both inter and intra port levels (Woo et al., 2012). In addition, the number of carriers being served is declining due to the rapid consolidation activities that are taking place between shipping lines. The phenomenon that is currently taking place in the industry has made the competitions between seaports become much fiercer.

Each port is struggling to maintain and sustain its competitiveness and operational performance. To ensure that their presence is still desired by users, ports have to come up with a great strategy that could benefit not only themselves but their users as well. Strategies such as cooperation through horizontal and vertical integration have been introduced and adopted to mitigate the intense competition. Cruijssen, Cools, & Dullaert (2007) mentioned that cooperation in the supply chain is characterised by its structure, which is horizontal, vertical and lateral. Horizontal integration involves cooperation with competitors in the same industry, while vertical integration is the collaboration of a firm with the other related businesses in the supply chain. On the other hand, lateral integration is the combination of both horizontal and vertical strategies adopted by firms. Nevertheless, both vertical and horizontal integration occur not only between ports but between shipping lines. On the other hand, apart from the above

cooperation, the port sector has also encountered a great challenge from the consolidation activities that are massively undertaken between shipping lines. This consequently imposed intense competition between ports that are struggling to attract more shipping lines or carriers. These challenges will be discussed in detail in the next section.

2.2.4.1 Cooperation between Ports and Shipping Lines

Since the involvement of the private sector in the port operation, eventually followed up by the privatisation of ports all over the world, the structure of the businesses between shipping lines and stevedore companies has been completely distorted. Traditionally, port operations were managed and handled solely by port authorities which are publicly owned by the government. Due to the incompetent management and bureaucracy, and the high financial costs necessary to maintain the services to customers, in order to mobilise private sector funds for port infrastructure investments and operations, to ensure a competitive market within the globalised environment, governments requested the involvement of the private sector purposely to smooth and at the same time guarantee effective and efficient port operations.

When the globalisation phenomenon erupted in early 2000, the changing demands of customers all over the world changed the way shipping lines and ports operate their businesses. One of the obvious changes is the involvement of the shipping lines in the terminal activities, particularly in the stevedoring operation (**Table 2.4**). Shipping lines are obviously determined to have a dedicated terminal for themselves in order to cater exclusively for their own container vessels. Having dedicated terminals at selected ports around the globe would benefit them, especially in terms of capital outflow, and fulfil the concept of door-to-door delivery to their customers. For example, AP Moller-Maersk group operates approximately 50 container terminals around the world. The growing size of the ships, so-called mega ships and super-ships, in maritime transportation has accelerated the involvement of the shipping lines to penetrate the terminal operating activity at selected ports, particularly those ports that are strategically located at the main maritime transportation networks.

The larger size of ships definitely requires more appropriate port facilities and competitive ship-to-shore performance. Studies (see Parola & Musso, 2007) have identified a few other factors such as financial (cost stabilisation), economic (economies of scale and scope), strategic (enter to the new markets) and operational (better productivity, schedule reliability, reduce the turnaround times) that influence the decision taken by many shipping lines to have dedicated

terminals and become more competitive. By taking over the handling operations at the container terminal, shipping lines are no longer relying on the port operator companies but now are able to follow all the required procedures themselves and be accommodated at the right berth to load and unload the container that were previously managed by the terminal.

Table 2.4: The involvement of shipping lines in port operations

GROUP	*SHIPPING LINE*	*PORT HANDLING*
AP Moller Group	Maersk	APM Terminal
CMA-CGM Group	CMA-CGM	-
China Shipping Container Lines	CSCL	China Shipping Terminal
Neptune orient lines	APL	APL Terminals
NYK Group	NYK	Terminal & Harbor Services
Mitsui Osk Lines	MOL	-
Hanjin	Hanjin Shipping	-
Orient Overseas International	OOCL	Terminal Operations

Source: Frémont (2008)

In this way, shipping lines are now free to come and go and able to schedule their own arrival and departure at their own dedicated terminal without any specific controls from former stevedore companies. The dedicated terminal is able to reduce the waiting time and the turnaround time of vessels as the terminal is solely occupied by the named shipping line and it does not have to wait for days to load and unload the containers. The vertical integration approach today offers them a way of gaining comparative advantages over their competitors, particularly through the development of logistic services, for two fundamental reasons: reducing the maritime costs by using larger vessels, which is believed able to help the shipping lines drop the freight rates when a new massive capacity is brought into operation, and the provision of door-to-door services directly to their customers.

It not only helps shipping lines to spread the maritime costs and control the non-maritime costs, but also to consolidate their position as logistics operators in their own right so that they could

gain comparative advantages, hence sustain competitive margins, on land when it seems impossible for them to do so at sea (Frémont, 2008). In fact, in the current circumstances, cooperation is a necessary strategy for shipping lines. The involvement of shipping lines in dedicated terminals could be by using different strategies in order to obtain the exclusivity of a container terminal at a particular port. The involvement of the global carriers in the terminal operations can be classified into four degrees (Parola & Musso, 2007): either through (1) a special agreement between terminal and carrier based on the TEU throughput, (2) the liner holds a minority share (usually less than 20%) in the terminal only, (3) a 50:50 joint venture between carrier and terminal and (4) a dedicated terminal owned by a shipping line (more than 50%) and operated by the line, which can even attempt to cater for third-party traffic.

Though it is said that a dedicated terminal could provide positive prospects for their business, however, there is a vague decision that bothers shipping lines in deciding upon the approach taken to the terminal – whether it needs to be exclusively dedicated to be used by a single carrier or to make it non-exclusive in which other carriers (competitors) are eligible to be berthed at the dedicated terminal for a determined fee. This approach is supported with a recent finding that revealed that a shipping line that builds its own terminal attains higher profits with a non-exclusive terminal than with a dedicated terminal. Nevertheless, some of the port terminal operators are reluctant to collaborate with shipping lines over the dedicated terminals. This is because dedicated terminals owned by shipping lines would threaten their businesses as pure or existing stevedoring companies see them as their closest competitors.

In addition, some of the port operating companies prefer multi-user terminals as they will gain more profit from the many and various carriers that arrive and depart from their terminals. Having a dedicated terminal, according to port operating companies, would lock in the potential customers (other than the exclusive ships) to use their terminal, although the terminals are empty during the peak seasons. This situation would absolutely lower the incomes that can be obtained from the dedicated terminal. Port of Singapore Authority (PSA), for instance, took a strong stand to maintain its terminals as multi-user terminals and rejected all sorts of degrees of involvement of shipping lines in its terminals when Maersk Sealand and Evergreen tried to persuade PSA to collaborate in managing the operations of the terminals. Disappointed with the rejection and the reluctance to collaborate made them divert their business to the Port of Tanjung Pelepas (PTP) in the southern region of Malaysia.

2.2.4.2 Cooperation between Shipping Lines

The partnership strategy that is rapidly escalating in the maritime shipping industry is actually not a new trend in the industry. In fact, the origin of the cooperation among shipping lines in strategic alliance date can be traced back to the 1870s when ocean shipping companies formed the first co-operative agreement in an effort to eliminate cut-throat competition by protecting and fixing the freight rate (Panayides & Wiedmer, 2011). However, the formation of the current strategic alliances among shipping lines started aggressively at the end of 1995. The formation of this strategy in the shipping lines industry is due to the high pressure from severe competition among shipping lines and the fact that combination of the shipping lines would secure the capability to maintain their competitiveness and performance in exploiting the new markets by sharing the risks and profits with other partners. Song (2003) suggests that, to avoid the harsh competition, both competitors need to work together in considering the win-win strategy rather than win-lose. Although the cooperation suggested by Song is more from a port perspective, the concept can still be applied to any other disciplines as long as it does not have any harmful effect on either firm involved in the cooperation.

In general, the win-lose concept is prevalent in any business discipline, particularly if the market or industry is crowded with competitors and the competition is getting fierce. Nevertheless, the win-lose approach is only for a short term and it is very difficult remain stable in a market that is full of competitors. Therefore, win-win theory is seen as the most appropriate strategy to maintain the performance of a firm and it is for the long run between two or more firms. In addition, it is a highly compatible and mutually beneficial strategy with different objectives and can be strengthened when players closely work together (Song, 2003). The creation of a strategic alliance between shipping lines basically helps to fulfil the main aim of the collaboration in which the shipping lines cooperate with the other shipping lines and compete against the non-cooperating shipping lines.

Main activities that have been involved in this cooperation comprise agreements in sharing fleet and route services. Strategic alliance in the maritime transportation industry could occur in any market players in the industry; however, it commonly takes place between shipping lines. Despite the instability of the alliance itself in the first generation due to many internal factors concerning members of the cooperation, many shipping lines believed in its ability and capability to contribute a massive reduction of costs and higher profits rather than working single-handedly in the industry. Currently, there are three major global strategic alliances in

liner shipping: CYKHE Alliance, Grand Alliance and New World Alliance (NWA). They each include more than two shipping lines from different countries and regions, in particular to achieve mutual business objectives (**Figure 2.4**).

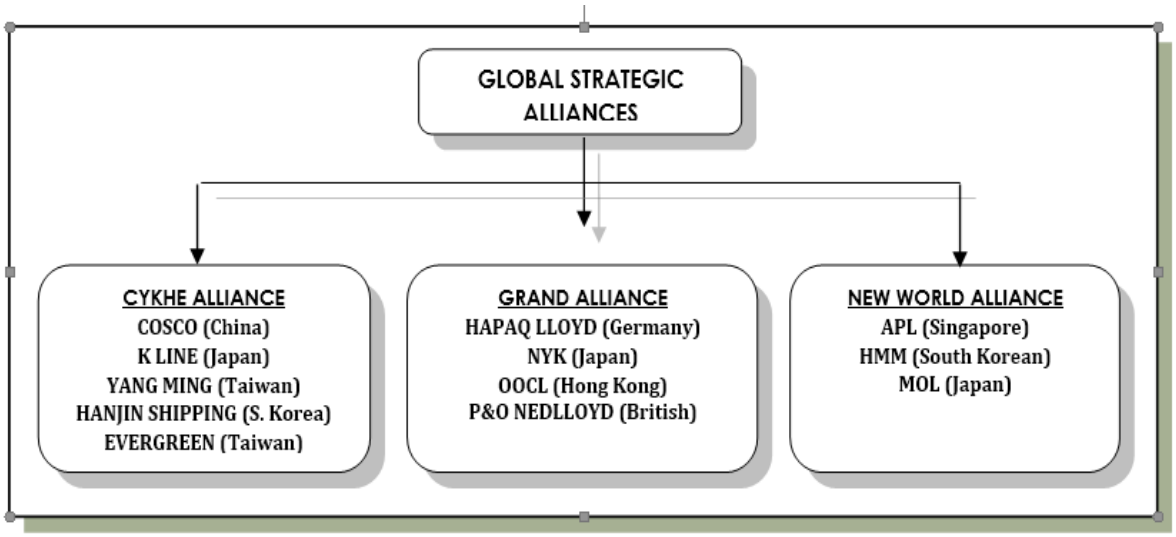


Figure 2.4: Recent strategic alliances

Source: Panayides & Wiedmer (2011)

The CYKHE Alliance frequently serves the Europe-Asia route followed by the Transpacific one. The Grand Alliance, which consists of Hapaq Lloyd, NYK, OOCL and P&O Nedlloyd, focuses more on the Europe-Asia route, whilst most of the service routes offered to its partners are in the Transpacific. Statistics indicate that the highest total TEUs recorded for the NWA are in the Europe-Asia route. Although these global carriers are involved in the formation of global strategic alliances, they cannot be regarded as closed corporate-like entities because every service is arranged individually and under specific conditions (Panayides & Wiedmer, 2011).

2.2.4.3 Cooperation between Stevedores

The strategic alliances in the maritime transportation industry not only take place between container shipping lines, but also occur between other market players in maritime

transportation industry such as terminal operation companies (TOCs). The public sector's incompetence in managing the operations and the high financial costs has led to the increasing involvement of the private sector in the port industry. In addition, the liberalisation of the government sector in the port industry has accelerated the dynamic growth of ports. The rapid privatisation of ports has opened wide opportunities to TOCs to operate their businesses effectively and efficiently.

It should be noted that the TOCs involved in the maritime transportation can be classified into two categories by their parent companies (Midoro, Musso, & Parola, 2005). The stevedoring companies are known as pure stevedores and integrated global carriers. The former is the firm that manages a port operation or stevedoring company as its parent. Their main activity is giving services to the shipping lines such as PSA and Dubai Port World (DP World). The latter refers to shipping lines that are involved in container terminal operations such as Maersk-Sealand and Evergreen. The integration approaches adopted by shipping lines are generally cooperating with stevedoring companies (sharing equity for dedicated terminals) or owning the container terminal. Traditionally, stevedore firms in the maritime industry concentrated on their own businesses in the domestic market. However, as the competition of ports is becoming severe, many stevedores are in pursuit of other alternative strategies to sustain their competitiveness and performance. One of the strategies adopted by many stevedore firms is entering other regional and international markets.

PSA, for instance, expanded its business to other markets after Maersk Sealand and Evergreen marine re-located their transshipment hub from Singapore to a neighbouring port in Malaysia, the PTP (Yahya, 2003). The movement of their two biggest customers to PTP resulted in PSA losing 2 million 20-foot equivalent units (TEU) from Maersk Sealand and 1.2 million TEU from Evergreen to PTP, respectively. These huge losses have made PSA devise two remarkable strategies to counterbalance the attack made by the PTP. One of the strategies is to embark on overseas ventures and invest in foreign ports. In 2002, PSA had stakes in 13 overseas ports, such as ones in Belgium, Brunei, China, India, Italy, South Korea, Portugal and Yemen. The international investments initiated by PSA were purposely to increase its incomes despite the threat of rival regional ports in attracting shipping lines away from its own ports. A similar strategy was implemented by DP World when it opened its container terminal in a port in Vietnam and in the London Gateway port in the UK. In addition, to make PSA as the most effective and efficient port of call for ships, the then Transport Minister, Yeo Cheow Tong has

reviewed the PSA pricing structure and a range of other services. Of the S$80 million fund from the Ministry of Transport to boost its maritime sectors within five years (by developing specialist knowledge and expertise), S$30 million has been allocated to help shipping lines to reduce costs. Other range of services that being reviewed, including by offering dedicated terminals and shareholdings in PSA to shipping lines (Yahya, 2003).

The pattern or trend of the competition between stevedores in maritime transportation dramatically changes when shipping lines are racing to get involved in the terminal operation along with pure stevedores. Shipping lines claim that self-management of the container terminal for their own carriers is able to reduce the variety of costs, rather than using other third-party logistics providers. In addition, the increased size of ships and the severe competition in maritime transportation have triggered the adoption of collaboration activities by many stevedore companies in order to stay competitive in the uncertain market. Song (2003) suggests that, to avoid the harsh competition, competitors need to work together in considering the win-win strategy rather than the win-lose one.

The activities of partnership, M&A can be found in a few companies such as Hutchison Port Holdings (HPH), which acquired a minority share in the European Combine Terminal BV (ECT) (the biggest port of Europe in Rotterdam) and after two years successfully fully acquired the ECT. Meanwhile, the publicly owned BLG of Bremen and the privately owned Eurokai of Hamburg established a joint venture stevedore company called Eurogate. Other examples can be seen where PSA took over the Hesse Noord Natie, a stevedoring company that was formed through the merger of the two biggest Antwerp-based terminal operators, Hessenatie and Noordnatie. In addition, PSA acquired a 20% stake in Hutchison Port Holding's global terminal portfolio for a reported $4.93 billion and earlier it had purchased a number of Hong Kong terminals such as Hong Kong International Terminal (HIT), Cosco-HIT, Container terminal 3 and Container terminal 8.

Meanwhile, the latest case of horizontal collaboration in the stevedoring sector is DP World. The acquisition of the CSX World terminals and entire P&O Port networks came with a massive battle with PSA, particularly in the financial aspect. These two acquisitions have given DP World a significant presence on the container handling scene in China, Hong Kong, South (East) Asia, Australia, the Americas and Europe (Notteboom, 2007). However, the successful

acquisitions came at a price when the United States prohibited DP World from entering its market as a result of its purchasing of P&O (Parola & Musso, 2007).

2.2.4.4 Consolidation of Shipping Lines

The consolidation of shipping lines in the maritime transportation industry can be undertaken through M&A. Although generally M&A is the combination of two companies, it has different equity in ownership. To be more specific, the former is a combination of two entities into one (to form a new entity) through purchasing the name and identity and subsequently will acquire both assets and liabilities of the acquired entity (Achjari & Abdillah, 2015). On the other hand, the latter is the purchasing of one entity's assets, equity interests and stocks by another without forming a new entity (Achjari & Abdillah, 2015). Both of M&A in the maritime industry is not a new strategy; it was first recorded in the 1980s (Alexandrou, Gounopoulos, & Thomas, 2014). They added that it has been recorded in the literature and confirmed through empirical analysis in the maritime industry that there are four main reasons that contribute to the M&A activities between shipping lines.

Firstly, it is the fastest and quickest option to grow the business globally rather than grow it organically, which would result in slow and longer growth of the business. Secondly, the strategy of M&A is a warranted approach due to several reasons, such as the intense competition with other shipping lines and higher transport costs on international trade. Thirdly, when two or more shipping lines are involved in consolidation, whether through merger or acquisition, it helps the companies to broaden their economies of scale through having larger ships and bigger fleets. Other than that, the economies of scope can be gained through fleet composition, market coverage can be broadened and the route services can be extended. Lastly is the credibility of a new generation of ship-owners, who have a better understanding of the current market conditions and their future prospects, and know how to pursue and grab golden opportunities to increase their financial equity. Thus, M&As between shipping lines are increasing and recently a number of shipping liners have entered into negotiations to form such alliances.

Avoiding financial losses and subsequently bankruptcy has been identified as the most current factor that leads to consolidation activities between two and more shipping lines (MarEx, 2014); these losses result from the overcapacity vessels, slumping demand and low freight rates (Magnusson, 2013). For example, Horizon Line (see **Table 2.5**) is an American domestic

shipping company based in North Carolina which has entered into several negotiations with other shipping lines, such as Pasha Group and Matson, in order to sell its service operations. Continuous losses, negative prospects of future profitability on some of its services and uncompetitive machinery due to ageing vessels which were built in the 1970s are some of the factors that made Horizon Line decide to sell its services to other shipping lines. It is said that the consolidation between these shipping lines will be undertaken through acquisition in which Pasha Group will acquire the Hawaii services, which operate a weekly fixed-day round trip between three US West Coast ports and Honolulu, with connections to the Neighbor Islands. The negotiation is said to be worth $141.5 million and it is expected that the transaction will be closed in 2015 (Group, 2014).

Table 2.5: Recent M&A deals in the US

Target	Buyer	Status	Price
Horizon Lines - Alaska services	Matson	The transaction is expected to close in 2015.	$69.2m + outstanding debt
Horizon Lines - Hawaii services	Pasha Group	The transaction is expected to close in 2015.	$141.5m
Horizon Lines - Puerto Rico services	None	Discontinued irrespective of the outcome with above mentioned deals, effective end-2014.	N/A
OPDR (Bernhard Schulte Group)	CMA CGM	Subject to the approval of the relevant regulatory authorities.	Unknown
CCNI (container activities only)	Hamburg Süd	Scheduled to be executed by the latest on 31 December 2014.	Reported $160m
Merger between Hapag-Lloyd and CSAV	N/A	All regulatory approvoal granted, integration of CSAV's container business into Hapag-Lloyd expected to be completed by the end of 2Q15.	N/A

Source: Marex (2014)

Meanwhile, Matson is said to be going to acquire the Alaska services, which operates two weekly sailings from Tacoma to Anchorage and Kodiak and a weekly sailing to Dutch Harbor. The acquisition is worth $69.2 million plus the outstanding debt of approximately $387 million which will be paid by Matson (Matson, 2015). As a result, Pasha Group and Matson will acquire four Jones Act Containerships and three diesel-powered containerships including a

fourth steam-powered box ship for dry-dock relief. Other shipping lines are also said to be undertaking consolidation activities, such as those between CMA-CGM with OPDR and Hapaq-Lloyd with CSAV.

The consolidation activities between big and small shipping lines are said to be able to secure and improve the efficiency of the companies involved through the economies of scale or improve the management efficiency that will allow the companies to be more capable of surviving any further downturn in rates. In addition, the market concentration of the shipping lines can be broadened as the operations or services and customers already exist. Conversely, the consolidation activities in the shipping industry have resulted in the reduction of the number of shipping lines in the business sector. This smaller number of shipping lines has formed a few but bigger shipping lines and the competition between ports is getting becoming intense as they focus on capturing the smaller number of shipping lines in the business.

In addition, the business power of shipping lines is getting stronger as the competition between them is getting smaller or reduced. On the other hand, shippers are the ones that will be impacted the most with the M&A decisions undertaken by major shipping lines which could reduce options for shippers, who may be concerned that such deals will trigger higher freight rates or lead to other anti-competitive effects such as the unilateral increase in market power of a large player or a greater risk of collusion between operators due to reduced levels of competition (Fulbright, 2009).

2.2.5 Green Supply Chain Logistics

Environmental issues constitute the most serious problem in every part of the world. Global warming, for instance, has been continuously discussed among scholars and practitioners as the main effect of the carbon emissions from GHG. In addition, the transportation sector is said to be the biggest contributor in every country in the world. Of all the transportation modes, road transportation has the highest share of carbon emissions in the overall transportation sector. Problems such as congestion are frequently associated with road freight transportation networks, which result in delays (Bloemhof, Laan, & Beijer, 2011) or being stuck in traffic tailbacks due to road construction, accidents, and weather conditions, which have a significant effect on the surrounding environment. The congestion issues not only have an impact on the environment, they also have an impact on human beings, such as noise pollution and health

problems. Given that the transportation sector is the main contributor to the current environmental problems and as the awareness of the impact of carbon emissions on the sustainability aspect is increasing and with it the implementation of carbon emission policies, therefore, better transportation solutions and approaches will have a noteworthy sustainability impact not only on the environment but also on economic and social sustainability.

Non-government organisations (NGOs) such as environmentalists are among those active in urging both industries and governments to respond to the current issues. Businesses are advised to make a contribution through their management and operational activities in order to mitigate the environmental effects. In addition, government sectors are urged to respond to the environmental issues through the development of policies or schemes not only in the transportation sector but also in other sectors. Businesses and government sectors are not the only bodies concerned with environmental issues; in fact, at international level there are global conventions and treaties that aim to reduce the environmental impacts.

The Kyoto Protocol, for instance, has urged each of its members reduce the GHG emissions in order to prevent dangerous interference with the climate (UNFCCC, 2008). Despite recommendations and suggestions that have been put forward in tandem to minimise and subsequently reduce the carbon emissions, the issues have been widely debated with two contrary viewpoints that have been written, discussed and presented in literature in which one party sees the environmental issue as the opportunity for economic success whilst the other does not. Some say that environmental issues can be treated as business opportunities, if companies think outside the box and are more innovative on how to tackle the issues and make this a profitable activity. On the other hand, the negative views of the environmental issues are cost increasing.

2.2.6 Business Culture of Ports

Maritime transportation is known as one of the complex sectors not only because it involves many port stakeholders but also because of its business culture. ‘Business culture’ does not refer to the different cultures of countries; instead, it refers to how the business is being conducted in a port. Generally, a port (not all ports, e.g., PSA) is not solely handled by one organisation; instead, more than one organisation is involved in its operations. To be specific, traditionally, a port is owned by the public sector with the management and operations handled

solely by the government. However, after the involvement of the private sector, either local or international organisations, the structure of the port system has changed dramatically. To date, both public and private sectors are among the organisations that are actively involved in the whole port operations.

Whilst the involvement of the private sector is more in the handling operations, activities at the vicinity of a port such as loading and unloading, the public sector remains active as the body that has a statutory responsibility to manage the water and land-side domain (Verhoeven, 2010). In fact, according to an interview with one of the senior managers of the Nigerian Port Authority (NPA), handling a single container or cargo from seller to end user will involve more than one port stakeholder, such as container or cargo agent, shipping agent, freight forwarder, shipping line, port operator, stevedore, and port authority, to name but a few. Each of the port stakeholders is responsible for the delivery of the container or cargo from the port of departure to the port of destination. Given that the structure of ports has changed since the involvement of the private sector, the ownership structure of ports has also changed, from solely public to solely private organisations (see **Table 2.6**). This refers to the involvement of the landlord or the owner of port, the regulator or the government, and the operator of the port. **Table 2.6** indicates the different port ownership structures commonly adopted by ports in many countries.

There are four types of port ownership structure: pure public, PUBLIC/ private, PRIVATE/ public and pure private (Baird, 1995). A port is pure publicly owned when the landlord, regulator and operator are handled by the government; the PSA is one of the best examples under this port model. Meanwhile, the PUBLIC/ private port model is the owner and regulator of the port; however, the operations are outsource to the private sector, either local or international. The third port model is known as PRIVATE/ public as the landlord and operator are the private sectors but the responsibility for the manoeuvring of the vessels (such as towing and pilot) is still under public jurisdiction; countries that have adopted this port model include Malaysia, Nigeria and Indonesia. A port is considered to be a purely private port when everything is handled by the private companies; most of the UK ports are under this model and the Association of British Ports (ABP) is one of the biggest private companies, which owns and operates 21 ports. This is not to mention the involvement of the shipping lines, not only in the port and terminal operations but also in the hinterland network distribution in order to provide door-to-door services to its users, which is believed able to reduce costs.

The involvement of the private sector in the sector is said to be due to several reasons, among which are to the reduce the bureaucracy, to eliminate the financial burden, to enhance the efficiency and effectiveness of port operations, to mobilise the private sector funds for port infrastructure investment and enterprises, and to ensure the competitive market within the globalised environment, to name but a few (Gunaydin, 2006).

Table 2.6: Port ownership structure

PORT MODELS	PORT FUNCTIONS		OPERATOR/ UTILITY
	LANDOWNER	REGULATOR	
Pure public sector	Public sector	Public sector	Public sector
PUBLIC/ Private	Public sector	Public sector	Private sector
PRIVATE/ Public	Private sector	Public sector	Private sector
Pure private sector	Private sector	Private sector	Private sector

Source: Baird A. J. (1995)

2.3 STUDY ON PORT PERFORMANCE

It is known that the competition in maritime transportation is intense, particularly in the port industry. In addition, the aforementioned current challenges that are taking place in maritime transportation from various aspects – such as the enlargement of ship size, the fluctuation of bunker fuel prices, the slow steaming ship speed, the changing of supply chain structure, and the environmental issues, to name but a few – have intensified the competition in maritime transportation and have affected many ports, particularly with regard to their competitiveness and performance. Thus, the position and reputation of ports are envisaged as vulnerable in the current circumstances, particularly when the power of users is getting out of control. The number of carriers plying their trade between ports is shrinking because cooperation, consolidation and enlargement of ship size have reduced the number of shipping lines into fewer but larger shipping lines, and therefore increased the users' power. This has exacerbated

the competition between ports in order to secure and attract customers. Consequently, ports nowadays are said to be desperately searching for new ways to increase competitiveness and performance and gain a sustainable edge in today's dynamic and competitive business environment (Almotairi & Lumsden, 2009).

Prior to severe competition between ports in securing and attracting more customers, a variety of factors and strategies have been introduced and discussed by many scholars in order to identify the best factors and strategies that should be concentrated on by ports in order to guarantee their customers and subsequently their competitiveness and performance. Yeo (2007) in his PhD thesis has identified a number of studies that have been conducted in the 1990s. In addition, Feng (2010) in her PhD thesis added several studies on the performance of ports that have been conducted in early 2000 until 2008. Moreover, a further literature search has been carried out in order to identify the current studies on the performance of ports, and the present study added several more studies from 2000 until 2015 that were not identified previously by scholars. **Table 2.7** shows the studies that have been collected to date, from 1980 until 2015.

Even though the **Table 2.7** has indicated that the studies on competitiveness and performance of ports have been extensively carried out, it is interesting to note that generally, the attention given by many researchers is prone to large, established and well known ports such as Hong Kong, Singapore, Busan, Shanghai, Kaohsiung, Pusan, Shenzhen, Keelung, Long Angeles/Long Beach, Rotterdam, Hamburg, Seattle/Tacoma, Antwerp, New York/New Jersey, Felixstowe, Oakland/San Francisco, Charleston/ Savannah, Norfolk/ Baltimore, San Juan and Bremen/ Bremerhaven to name but a few (see also Fleming, 1997; Chou, Chu, & Liang, 2003; Yeo & Song, 2005; Tongzon & Heng, 2005; Yeo, Roe, & Dinwoodie, 2008; Acosta, Coronado, & Cerban, 2007; Yeo, Roe, & Soak, 2007; Choi, Park, Yoo, Kang, & Yoon, 2007; Yeo H.-J. , 2010; Yuen et al., 2012; Yeo, Roe, & Dinwoodie, 2011). These large ports are strategically positioned in a geographically suitable location that is sufficiently central to serving a large sub-region with minimum feeding cost, proximate location to trunk route where the deviation for ship is kept to a minimum short-haul transit time, and there must be an availability of feeder service to ensure the door-to-door movement for various origin/ destination cargo while remaining the cost and time competitive at the same time with alternative service options (Onyemechi, 2014).

Table 2.7: Studies on port competitiveness and performance

Author	Year	Components
Pearson	1980	Confidence in port schedules, Frequency of calling vessels, Variety of shipping routes and Accessibility of port
Willingale	1981	Navigation distance, Hinterland nearness, Connectivity to port, Port facilities, Availability of port and Port tariff
Collison	1984	Average waiting time in port, Confidence in port schedule and Port service capacity
Slack	1985	Calling frequency, Tariffs, Accessibility to the port, Port congestion and Inter-linked transportation networks
Brooks	1985	Port costs, Frequency of calling vessels, Port reputation and/or loyalty, Ship direct calling and Experience of cargo damage
Murphy et al.	1991 1992 & 1994	Has loading and unloading facilities for large and/or odd-size freight, Allow for large volume and shipments, Has low freight-handling shipments, Provides a low frequency of loss and damage, Has equipment available, Offers convenient pickup and delivery times, Provides information concerning handling, Offers assistance in claims handling and Offers flexibility in meeting special handling requirement
Peters	1991	Internal factors and External factors
UNCTAD	1992	Geographical location, Hinterland networks, Availability and efficiency of transportation, Port tariffs, Stability of ports and Port information system
Starr	1994	Geographic location of ports, Inland railway transportation, Investment of port facilities and Stability of Port Labour
Rimmer	1998	Door-to-door services, Lower price, Reliable, Safe, Prompt and Low cost transport system
Hoyle	1999	Good facilities, Efficient operations and Up-to-date technology
Bookbinder & Tan	2003	Political and Currency exchange stability
Lirn et al.	2003	Port basic physical characteristics, Port geographical location, Port management and Carrier's cost perspective
Chou, Chu and Liang	2003	Location, General assessment (facilitates of software and hardware), Port facilities, Future development, Throughput and Economy
Teng, Huang and Huang	2004	Labour quality, Financial liberalisation, Political, Social, Economic stability, Hinterland productivity, Ship mean service time in port, Loading and discharging cargo, Terminal movement capability,

		Operation of cost carrier, Port service charge, Impact of custom services and Inbound and outbound ration
Song and Yeo	2004	Cargo volume, Port facilities, Port location, Service level and Investment
Tongzo and Heng	2005	Port (terminal) operation efficiency level, Port cargo handling charges, Reliability, Port selection preferences of carriers and shippers, The depth of the navigation channel, Adaptability to the changing market environment, Landside accessibility and Product differentiation
De Langen	2003	Ship turnaround time, Wage, Throughput, Connectivity and Investment
Comtois and Dong Cullinane et al.	2007 2005	Price, Quality of service, Central government policies on regional development, Natural endowments, Inland transport infrastructure, Logistical systems and Cargo resources
Ng	2006	Accessibility of the port, Time efficiency, Cases of delay, Cost, Speed and Geographical location
Guy and Urli	2006	The quality of port infrastructures, Cost, Service, and Geographical location
Lee & Rodrige	2006	Competitive labour costs, The open market policy and A substantial amount of capital investments
Yeo and Song	2006	Cargo Volume, Port facility, Port location, Service level and Port expenses
Yeo	2007	Port Service, Hinterland condition, Availability, Convenience, Logistics cost, Regional centre and Connectivity
Tongzon and Sawant	2007	Cargo size, Connectivity, Efficiency, Infrastructure, Location, Port charges and Port services
Choi, Park, Yoo and Kang	2007	Gate Work, Yard Work and Loading and Unloading
Acosta, Coronado and Cerban	2007	Factor conditions, Competition in the Port, Demand conditions, Government or public sector and Support industries
Wiegman	2008	Handling speed, Cost, Reliability and Hinterland connection
Martino & Morvillo	2008	Activity, Resources and Inter-organisational relationship
Yeo, Roe and Dinwoodie	2008	Port services, Hinterland connection , Availability, Convenience, Logistic cost, Regional centre and Connectivity
Lam and Yap	2008	Government support, Good connectivity, Feeder services, More space, Lower cost and Acquisition
Song & Panayides	2008	Channel integration practices, Integration of transport modes, Relationship with inland transport operators, Value added services and Relationship with shipping line
Chang, Lee and Tongzon	2008	Local cargo volume, Terminal handling charge, Berth availability, Port location, Transshipment volume and Feeder network
Weigmans, Derhoestz and Notteboom	2008	Port physical and technical infrastructure, Geographical location, Port efficiency, Interconnectivity of the port, Reliability, capacity, frequency and cost of inland transport services by truck, rail and barge, Quality and cost of auxiliary services such as pilotage, towage, customs, etc, Efficiency and costs of port

		management and administration, Availability, quality and costs of port community systems, Port security/safety and environmental profile of the port and Port reputation
Tongza	2009	Frequency of ship visits, Port efficiency, Adequate infrastructure, Location, Port charges, Quick response to port users' needs and Port's reputation for cargo damage
Manzano, Nunõ, Lezlaxe, Valpuesta and Valo-Quijada	2009	Economic profitability, Dynamism of port activity, Specialisation in container, Investment in fixed capital, Strictly port business and Economic dynamism in hinterland
Ng, Lim, Leong and Cheng	2010	Market accessibility, Port performance, Government support and Port charges
Yeo	2010	Facilities factors, Hinterland accessibility and Service factors
Feng	2010	Availability of shipping services (destination, frequencies, etc.), Price of shipping services, Port/terminal handling, warehouses and other charges, Feeder connections to the deep-sea ports and the major shipping lines, Port/shipping service is on the cheapest overall route to the destination, Speed of the cargo handling, Congestion, delay and other risks, port/terminal security and safety, Technical infrastructure of the port (handling equipment, ICT, etc.), Proximity of the port to customers and/or sources of supply, Availability of skilled employees in the region, Quality of landside transport links (inter-modal links), Availability and quality of logistics services (warehousing, freight forwarding, cargo handling, etc.), Government supports for logistics activities and new developments in the region, Depth of navigation channel.
Ricardo, Adolf and Lorena	2011	Monetary cost, Time efficiency, Geographical location, Delays in loading/unloading containers, Record of damage during container handling, Customs procedures, Port authority policy and regulations, Accessibility of the port, Quality of port infrastructure in container handling, Quality of port superstructure in container handling, IT and advanced technology, Dedicated terminals and facilities for shipments, Supporting industries, Availability of professional personnel in port, Preference of shipping lines' clients/shippers, Relations between port operators and shipping lines, Port marketing efforts by port authority, Reputation of port within the region, Speed in responding to liners' new demands and requests.
Yuen, Zhang and Cheung	2012	Port location, Costs at port, Port facility, Shipping services, Terminal operators, Port information system, Hinterland connection, Customs and Government regulation
Cruz, Ferreira, & Azevedo	2013	Cost Perspective, Seaport management, Geographical location, and Physical and technical characteristics
Pardali & Kounoupas	2014	Market orientation: Intelligent generation, dissemination and responsiveness
Caldeirinha & Felicio	2014	Position-port, Hard-port and Soft-port
Langen & Heij	2014	Port corporatisation

Metalla, Vyshka, & Lumi	2015	Port conditions, Operational conditions, Equipment, Services quality, Management quality
Vaggelas & Pallis	2015	Must related to: Availability, Accessibility, Connectivity, Quality, Timeliness of services, Adequacy and Cost.

Source: Adapted from Yeo (2007) and (Feng, 2010) and amended by the author

These features of large ports become key attractiveness to shipping lines to make a port of call (Chang, Lee, & Tongzon, 2008) because they could achieve the economies of scale advantage that contribute to less cost per ton-mile and marine bunker saving (Onyemechi, 2014). Generally, there are many other key performance indicators (KPIs) that have also been discussed in association with the performance of large ports in Asia and Western regions (see Lirn, Thanopoulou, & Beresford, 2003; Tai & Hwang, 2005; Chou, 2010). However, these studies have only centred on the internal and external KPIs that are frequently associated with the strengths of these large ports such as the geographical location of ports - proximate to major maritime shipping network. Given that the competition is intense and much attention has been given to large ports (McCalla et al., 2005) as well as the KPIs, it is found that smaller ports, in particular ports facing geographical disadvantage, hereafter called 'ports on the periphery' are the ones that will suffer the most in order to stay competitive in a severe competition between the other small, medium as well as larger ports and often these ports have been overlooked by scholars from the radar. Given that, most of the KPIs listed in the **Table 2.7** are associated with large ports, it indicates that the smaller size of ports need to come up with innovative thinking on how to make their ports become more competitive and performed.

Ports on the periphery in this study are defined as ports that are not on the main maritime shipping routes (no intermediacy) and facing challenges in attracting port users to make a port of call, nevertheless, proximate to large hinterland markets (centrality) (Brooks et al., 2010). These peripheral ports are also known as assisting ports, secondary ports, and SMPs that have small to medium size of cargo throughput compared to gateway ports (Feng, 2013). It should be noted that not all ports on the periphery close to main hinterland markets but the main focus of this study is the ones that are proximate to hinterland markets.

In maritime transportation geography (seaports particularly) literature, it has been recognised that if a port wants to be competitive and successful it should have two important elements that determine its success: situation and site elements. These two elements have been identified in the geographical transportation discipline as the important elements that create the strategic commercial locations of a port, in particular the transshipment hub. Situation element has been identified as the most significant contribution to the prosperous of ports (McCalla, 2008). Intermediacy and centrality are two important characteristics that embrace a situation factor. The intermediacy characteristic refers to the proximity of a port to maritime shipping lane networks whilst centrality refers to the hinterland area or a catchment area that the port serves

(McCalla, 2008). On the other hand, site element refers to the spatial properties at that place, the vertical dimension. In particular, it refers to the local underlying areal conditions or characteristics and leads to defining the geography of the port area (McCalla, 2008).

In general, there are four port situations found in the maritime transportation industry: (1) successful ports, (2) ports on the periphery with lack of centrality, (3) ports on the periphery with lack of intermediacy and (4) struggling ports as shown in **Figure 2.5**. A port in the maritime transportation industry is said to be successful when these two important elements are met. The two elements contribute to the existence of international and regional hub ports around the world. However, it becomes apparent that some of the ports around the globe only enjoy one of those situation elements, either intermediacy or centrality. If one of these elements is not met, the port is claimed to be a port on the periphery. If both of the elements are not met naturally or through human engineering, the port is claimed to struggle in the business. However, to the best of the researcher's knowledge this latter port situation is hardly to be found anywhere to date.

		Centrality	
		Yes	**No**
Intermediacy	**Yes**	Successful Ports	Ports on Periphery
	No	Ports on Periphery	Struggling Ports

Figure 2.5: Situation of ports

Source: Brooks, et al. (2010)

Ports are said to be able to succeed or become a transshipment hub port and compete with other major ports if they reside close to the main maritime shipping network, although they are not

proximate to a large domestic market and have small number of population to be served. This is because most of shipping lines are more attracted to ports that are close to the main maritime shipping networks as it only involves a slightly small deviation to access the ports. On the other hand, it is claimed that, if a port is far from the main maritime networks, it seems difficult to re-position the port location to the vicinity of the main maritime networks. In addition, as the ship size changes dramatically, shipping lines operators prone to concentrate on large ports and proactively use hub-and-spoke approach because of the small deviation from port location and maritime shipping lane (**Figure 2.6**).

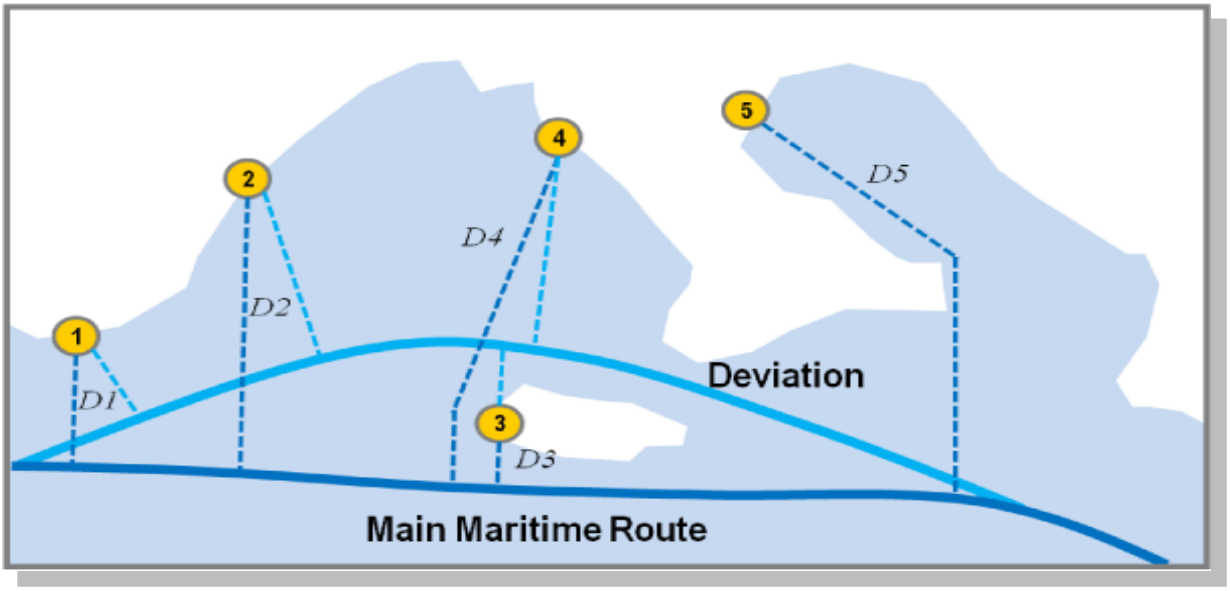


Figure 2.6: Maritime deviation

Source: Rodrigue, Comtois and Slack (2013)

Although studies of ports on the periphery can be found in the literature, for example (Slack & Wang, 2002; Brooks et al., 2010; Monios and Wilmsmeier, 2012; Wilmsmeier & Monios, 2013), they can be considered scarce and not as many as studies that have been carried out for established and well-known ports. Prior to the peripheral ports studies, Slack & Wang (2002) investigated the emergence of the peripheral ports in the Asia region, since many similar studies have been conducted in the western region, particularly North America and Europe. In the study, the authors examined the main factors such as (1) de-concentration, (2) obsolescence of

older facilities, (3) congestion and dis-economies at established terminals/ports, (4) access to shipping lanes, (5) search for new deep water sites, (6) difference in labour costs, and (7) environmental restrictions that have made some of the large shipping lines divert their ports of call to peripheral ports between the Port of Singapore and PTP, Hong Kong and Shenzhen Ports, and lastly Shanghai and Yangshan Ports. It is found that none of the above factors are compatible with the change of ports of call between Singapore to Tanjung Pelepas and Hong Kong to Shanghai; instead, it is because of the institutional factor. Nevertheless, in the case of Shanghai, the de-concentration factor partially supports the diversion of shipping lines to the said port.

Meanwhile, in 2010, Brooks et al., examined the current formal and informal initiatives of coordination and cooperation that had been undertaken to date at the strategic management level such as (1) marketing and business development, (2) operations, (3) administrative, and (4) regulatory initiatives in order to reflect practices elsewhere and lessons that have been or could be learnt from other partners in order to enhance competitiveness. To realise this study, peripheral ports in Canada were examined. Ports in Canada can be regarded as closer to main shipping routes in the North Atlantic Ocean between Europe and America; nonetheless, Canada's population and its consumption area are smaller compared to other closer market areas such as the United States of America. Through the case studies, they found that only marketing and business development strategic have initiated both formal and informal cooperation and coordination. On the other hand, most of the peripheral ports in Canada currently only have informal cooperation and coordination and no initiatives have been seen in either administrative or regulatory areas.

One of the current studies that has been carried out pertaining to ports on the periphery is by Monios and Wilmsmeier (2012), in which they discussed that most of the Scottish ports in Great Britain are naturally hampered by low water accessibility and, as a matter of fact, most of the development and competitiveness of ports in Scotland is hampered by the shipping lines' practices and preference to use southern ports of the UK such as Southampton and Felixstowe. In addition, the authors indicate that Scotland's ports are also suffering from lack of infrastructure and government initiatives to promote the direct link with other continents. To prevail over this predicament, the authors put forward and comprehensively discussed three different logistics strategies that are believed able to work brilliantly and bring success for ports in Scotland and generally other ports that have similar problems. Such strategies are port-

centric logistics, dry ports and offshore logistics hubs. These strategies are seen as able to secure and sustain the ports' business in future without relying on cargo and containers coming from southern ports in the UK.

In the following year, Wilmsmeier and Monios (2013) once again worked on a research paper that related to peripheral ports in the UK. They carried out an analysis of the current patterns that are taking place between ports in the UK. Specifically, they looked at the de-concentration pattern that ports in the UK have experienced related to the changing of gateway region market for the UK, the rise of continental ports rather than relying on the southern ports, and the shift of ports from gateways to transshipment hubs. Through their analysis, they found that the de-concentration trend is happening in the UK port system and this can be seen when ports such as Liverpool and Grimsby/Immingham are ranked in the top 10 and in fact will outweigh other main ports such as Southampton and London Tilbury within 10 years. The de-concentration practices that UK ports experience bring numerous possibilities, of which many of them have the opportunity to take advantage in port expansion. Small and minor ports are seen as the most positively impacted from this trend as they are able to quickly adjust and reposition their business to fit the current emerging market and subsequently reduce their peripherality.

In investigating the development of SMPs and their contributions in supporting the other regional gateway ports, Feng and Notteboom (2013) analyse the roles played by Jinzhou, Dandong, Weihei, Yantai, Yingkou, Rizaho, Tangsham and Qinhuangdou ports in supporting the gateway ports such as Tianjin, Qingdao and Dalian around Bohai Sea Economic Rim (BER) in China. To realise this analysis, they looked at five main variables: (1) cargo volume and market share, (2) international connectivity, (3) relative cluster position, (4) port city and hinterland connection, and (5) logistics and distribution function. Specifically, they examined how each of the ports in the BER region fitted into those five variables in order to differentiate the port category into small, medium and big. They found that small-medium ports handle less than 150-300 million tons and most of the cargoes are derived from domestic trade. In terms of port connectivity, small-medium ports are less connected to a hub-and-spoke system and their hinterland and cities are also less correlated. Most small-medium ports are relying heavily on inland port connections and this category of ports tends to have cooperative networking with other larger port stakeholders. It is also found that these ports are growing fast compared to big ports in the BER, whose market share is decreasing due to several reasons such as lack of space for future expansion and increasing congestion. Although the role of small-medium

ports are supporting the gateway ports in BER, it is anticipated that the importance of these ports will surpass the current gateway ports and these ports are seen to be instrumental to the peripheral port challenge and also have the potential to be and even replace the current gateway ports.

The above studies clearly show that limited studies have been devoted to improving the performance of ports on the periphery. As mentioned earlier, proximity to hinterland markets is seen as one of the factors that provide an opportunity for this category of the port to rely on. However, in today's business environment, ports can no longer attract cargo simply because they are a natural gateway to a rich hinterland. The evolution of port development has shown that ports are no longer seen as a monopoly sector instead as interlinked and part of a sub-system of supply chain networks. The availability of efficient infrastructures and superstructures to connect port and inland transport system has allowed ports to compete with one another at distant and extended hinterlands (Wilmsmeier & Monios, 2013). Thus, the opportunity for ports on the periphery to enjoy the rich hinterland markets is diminishing (Haralambides, 2002). In addition, ports have been considered as one of the logistics systems that are linked with the supply chain; therefore, they have to actively interact with other supply chain actors in order to provide an effective and efficient performance.

As recommended by Robinson (2002), ports are embedded in value-driven chain systems, in value chain constellations in which created values will be delivered to shippers and other third-party service providers. Under this new role, a port is considered as part of a cluster of organisations in which different logistics and transport operators are involved in bringing value to the final consumers (Tongzon, Chang, & Lee, 2009). Working closely with other supply chain actors, in particular, suppliers and customers through cooperation and collaboration are believed able to help ports in obtaining the competitive advantage by creating values along the supply chain networks. In addition, ports are no longer seen as simply places that handle ships and cargoes within efficient administrative and policy frameworks; instead, they need to be seen as one of the elements embedded in a supply chain that creates values not only for their customers but also for themselves. Hence, the competition between ports in maritime transportation is no longer considered as individual; instead, it is a part of the supply chain and shippers will only choose chains that could give added value to their business.

Brooks et al. (2010) indicate that there are two strategies that ports on the periphery can rely on in order to counterbalance the location disadvantage which are integration and coordination with hinterland transport networks and cooperation with neighbouring ports. Although the strategies were discussed for the other type of ports on the periphery, it is viewed that integration and coordination with other hinterland transport network are able to generate more cargoes and subsequently lure the incoming of more ports of call from shipping lines. In addition, given that ports on the periphery are only a small part of a larger supply chain network, therefore, it is necessary for such ports to collaborate and cooperate with other supply chain members and other ports and coordinate their nodal link with other transport networks in order to develop their business activities and subsequently their business performance. In fact, in the development framework of SMPs proposed by Olesen et al. (2014) which has been validated by using Aalborg Port in Denmark as a case study, it is indicated that regionalisation, terminalisation, core competencies and value added activities are ongoing approach that can help such ports in improving competitiveness.

Through these development approaches, the port performance of such ports can be enhanced through the concentration of the products, how the products are being handled, how they manage their products and how the process of the above activities can create added value for their customers. This subsequently demonstrates that the above activities should be synchronised with the supply chain integration where the collaboration and cooperation with other suppliers and customers are emphasised. Thus, the aforementioned indicates that the closeness of ports on the periphery to hinterland markets requires managers to have closer collaboration, cooperation, and coordination with other key business players including manufacturing companies, logistics companies, and other ports in order to ensure that the business performance can be remained at least.

Supply chain management (SCM) and integration strategy are not only critical for companies to be more competitive in intense competition but also crucial for companies to pursue environmental responsibility (Caniato, Caridi, Crippa, & Moretto, 2012). This can be performed through inter-firm collaboration either with (1) competitors from the same industry, (2) with suppliers and customers from the related industry, or (3) with other industrial symbioses that involve different firms from different industry (Zhang & Wang, 2014). In particular, it can be a platform for port stakeholders to minimise the impact of GHG on the environment and simultaneously it could assist peripheral ports in enhancing performance

through environmental sustainability. In recent years, environmental sustainability has become a key managerial issue, and practitioners are devoting increased attention to the topic as they face the challenge of achieving a balance between environmental and business needs (Caniato et al., 2012). With the global challenge of climate change and the increasing customer interest in environmental sustainability, greater opportunities may be seen for ports, including smaller ports that have been peripheral that can add environmental benefits to the supply chains of the customers. It is believed that some of the drivers that lead companies to initiate the environmental sustainability are environmental regulation, customer's preferences and competitive pressure.

In the supply chain, operational activities like sourcing, manufacturing and logistics are believed to be responsible for most of the environmental problems, in particular, the GHG emissions. To be more specific, Sundarakani, Souza, Goh, Wagner, & Manikandan (2010) have identified two broad categories of carbon emissions: stationary source and non-stationary source. The former category is usually associated with the emissions produced during material processing, manufacturing and warehousing while the latter category is usually incorporated with emissions from the inbound and outbound logistics. Similarly, Lee (2011) identified three scopes of carbon emissions under the protocol of greenhouse gas (GHG). Such scopes are scope 1 (direct GHG emissions), scope 2 (indirect GHG emissions of electricity) and scope 3 (other indirect GHG emissions). Rather than focusing on the traditional end-of-the-pipe approach, firms (suppliers, manufacturers and logistics providers) are envisaged to proactively manage the environmental issues along the supply chain networks. In today's business environment, it is important for firms to identify and manage the on-site as well as off-site emissions in their business operations along the supply chain networks as the current competition is between supply chains,and the performance of the firm is gradually relying on the competitiveness of the supply chain. Hence, it is viewed that companies that do not measure and manage carbon emissions along their supply chains in collaboration practices with their supply chain partners will place themselves at a disadvantage position (Sundarakani et al., 2010).

There are substantial studies that have discussed and offered ways to mitigate the environmental issues. One of the solutions to reduce or decarbonise carbon emissions is optimising the operational decision making in transportation and this approach may reduce more carbon emissions with less cost or no cost than adopting low-energy-consumption technology (Hua, Cheng, & Wang, 2011). In particular, for the decarbonising of carbon

emissions in transportation sectors, logistics companies could shift the freight transport operations to less carbon-intensive transport modes (McKinnon, 2010). For example, the high freight transport operations such as road could be shifted to rail or waterborne services which produce much lower carbon emissions. The author added that freight modal shift, vehicle utilisation, energy efficiency, and carbon intensity of energy source are also some of the decarbonising framework approach that not only reduce the carbon emissions in supply chain logistics activities but also cut costs, generating streams of economic and environmental performance.

Although the topic of green SCM has been growingly discussed among scholar, it is viewed that the attention given is more on the on-site, scope 1 and scope 2 emissions which these two categories are more on the manufacturing enterprises where production stages are taking place (Choi & Zhang, 2011). On the other hand, many scholars have overlooked the off-site and scope 3 emissions impact in their business activities that are known as the costliest and most environmentally damaging components in their supply chain activities, in particular, the freight transport decisions (Golicic, Boerstler, & Ellram, 2010). In addition, Rodrigues, Beresford, Pettit, Bhattacharya, & Harris (2014) mentioned that the studies of the port performance in the context of port selection criterion did not consider the carbon emissions reduction or how the carbon reduction intensity in future could be a significant influence on the port choice behaviour. Earlier Rodrigues et al. (2014) argued that in port selection criteria decision making, the only element that has not been considered by port users when making ports of call is the overall environmental impact.

Although smaller in size and residing away from major maritime shipping network, peripheral ports are seen as able to assist logistics firms in optimising the transportation operations, in particular, the efficient distribution network that could reduce the environmental degradation with less or no cost. This can be done through the transferring of freight hinterland road transportation to less carbon intensive freight transport modes such as water-borne transport (i.e. inland waterway/ short sea shipping) and rail. Rodrigues et al. (2014) mentioned that the modal shift from road to water-borne should be considering ports that are close to market, thereby providing with the shortest land route and subsequently following the 'sea-maximising-land minimising' principle. To be more specific, the spatial characteristics of peripheral ports, in particular the closeness of such ports to hinterland markets (situation element-centrality) and the availability of landside space and the port management (site

element) not only help logistics companies in particular logistics service providers and shippers to reduce distance travel to/ from ports but also help those companies to reduce cost and simultaneously decarbonise the carbon emissions. Peripheral ports could use their environmental advantage to promote the ports as green distribution network as they are able to help logisticians in reducing the CO2 emissions. This sustainability advantage subsequently contributes to the economic and social aspects of ports on the periphery. This is once again parallel with Rodrigues et al. (2014) who argued that ports could play a significant role in reducing transport-related CO2 emissions through their distribution to the redesign of the supply chain.

Realising this deficiency and opportunity, which is also identified as the gap in the literature, this thesis attempts to address this shortfall by considering spatial characteristics of ports (situation and site elements) on the periphery, PSCI strategy and sustainability, which could give a significant impact on the business performance. The inclusion of spatial characteristics in this study is due to the fact that in maritime transportation geography literature it is generally an important element which determines the success of ports. In addition, it is because previous studies did not look at the characteristics of the port itself, such as situation and site elements through centrality or hinterland markets, management and land-side availability, which could contribute to the performance of this category of ports. Nevertheless, it is perceived that the success of ports in today's business environment does not only rely on their geographical element but also because of the close collaboration and cooperation through integration strategy with other supply chain stakeholders.

Additionally, the sustainability is seen as the trade-off of this category of ports in which the contribution could be coming from the environmental, economic and social elements. Given that previous studies did not consider the spatial characteristics' effect on the environmental sustainability as a trade-off of the location disadvantage, therefore, this study will include and investigate its impact on the business performance of peripheral ports. The sustainability benefit of the peripheral port is not only being retrieved from the spatial characteristics of such port but also through the supply chain integration strategy between port stakeholders. Previously, the impact of these four factors over the performance of ports was studied separately and, after further readings were made pertaining to these factors, it was found that there are direct and indirect relationships between those factors. To investigate further, the underpinning theory of these relationships will be discussed in detail in the next chapter

(Chapter Three). In addition, the possible theoretical relationships that exist between spatial characteristics (situation element and site element), PSCI strategy, sustainability and the performance of ports on the periphery will also be explained in detail (Chapter Four).

2.4 SUMMARY

This chapter has discussed the trends that are taking place in the maritime transportation sector. Several trends have been identified in the literature as the factors that lead to the intense competition between ports. These trends are listed as below:

1. The increasing of vessel size
2. The fluctuation of bunker fuel price
3. The reduction of vessel speed
4. The changing of the maritime supply chain structure
5. The business culture of ports

These trends have significantly affected the competitiveness and performance of particular ports. Literature has confirmed that previous researchers focused more on the competitiveness and performance of large ports, in particular the transshipment hubs that reside in strategic locations. In addition, it was also found that little attention has been given to the ports that have a location disadvantage, known as ports on the periphery, particularly those ports that lack intermediacy but proximate to hinterland markets. Moreover, studies on ports on the periphery have concentrated on the development rather than the performance of the ports, especially with the current intense competition between ports. Realising this deficiency, this thesis attempts to address this shortfall by considering several factors such as spatial characteristics (situation element and site element) of ports on the periphery, PSCI strategy and sustainability which could significantly contribute to the performance of ports on the periphery.

Hence, to analyse the performance of ports on the periphery, the following chapter reviews the relevant theories and existence knowledge that associated with the research objectives of the study. In particular, the definitions and roles of the spatial characteristics, PSCI strategy, and sustainability advantage are explained and discussed thoroughly.

CHAPTER 3

PORT SUPPLY CHAIN INTEGRATION STRATEGY, SUSTAINABILITY ADVANTAGE, SPATIAL CHARACTERISTICS OF PORTS ON THE PERIPHERY AND PORT PERFORMANCE

This chapter begins with an introductory section where elements that contribute to the success of ports, as recorded in the literature, are briefly discussed. In the second section, explanation pertaining to the underpinning theory that supports the relationship between identified potential strategies and the performance of peripheral ports is presented. On the other hand, the third section of the chapter, brief explanations are provided on the notion of supply chain, SCM and supply chain integration that have been widely discussed in the literature as strategies to improve the firm performance and subsequently the overall supply chain performance. Given that the strategy of PSCI emanates from the supply chain concept, therefore, the forth section of this study is devoted to explaining the insertion of the port into the supply chain activities. The next section elaborates the concept of sustainability and the sustainability advantage of ports on the periphery, which is perceived able to contribute to their performance. In particular, three elements of sustainability, namely environmental, economic and social factors, are described in the study. In the sixth section, the spatial characteristics of ports on the periphery, in particular, the situation element and site element that form the conditions, are elaborated in detail. Lastly, the concept of port performance will also be presented in this chapter.

Prior to achieving the above aims, a comprehensive and precise theoretical foundation needs to be reviewed and synthesised through a review analysis of current and past literature associated with the PSCI strategy, sustainability advantage, spatial characteristics and port performance. Thus, this chapter discusses the relevant literature that is related to the above-mentioned strategies.

3.0 INTRODUCTION

The rapid growth of the globalisation phenomenal and the growth in international trade have had a huge impact on the port industry all over the world. In addition, the boom of containerisation usage and advance of the information technology (IT) phenomenon in

transporting goods between countries via oceans have accelerated the port industry's activities. On the other hand, meeting the seaborne trade commodity demand is considered to be a great challenge to port operators as they have to satisfy shippers and carriers that have become sophisticated and demanding with respect to the quality of the transportation services (Panayides et al., 2012). The principle challenge that seaports are facing is from the structural change of their main customers, especially shipping lines, which are becoming more powerful with stronger bargaining power, and the competition between ports is more intense at both inter and intra port levels (Woo et al., 2012). Those phenomena that are currently taking place in the industry have made the competition between seaports fiercer. Every port around the globe is struggling to maintain and sustain its competitiveness as well as its performance, in particular ports on the periphery. The impact from the current challenges that are taking place in the maritime industry is more severe for peripheral ports compared to gateway or big ports.

To counter these challenges and to ensure that they are still needed by users, ports have to come up with a great strategy that could not only benefit and success to themselves but also to their customers. It is viewed that the strategic factors for the success of ports have been well established in the literature. Commonly, the success and performance of ports in times of intense competition is frequently associated with port choice or port selection behaviour from port users in relation to: (1) port physical and technical infrastructure, (2) geographical location, (3) interconnectivity of the port, (4) port efficiency, reliability, capacity, frequency, and inland transportation cost, (5) quality and auxiliary services, (6) port management and efficiency, (7) logistics and value-added activities, (8) communication systems, (9) port security and safety, and (10) port reputation (Burns, 2014). In addition, it is also found that different port users such as shippers, shipping lines, and freight forwarders (Panayides & Song, 2012) emphasise different criteria when deciding to make a port of call at a particular port. Chang et al. (2008), for instance, discussed six important factors that influence shipping lines to make a port of call: local cargo volume, berth availability, transshipment volume, feeder networks, port location and terminal handling charges. Similarly, Tongzon and Sawant (2007) provide the most important factors (in ranking) to shipping lines when choosing a port at which to berth, namely efficiency, connectivity, port charges, location, infrastructure, wide range of port services and the lowest-ranked of factor considered by such users is cargo size.

Meanwhile, Tang, Low, and Lam (2011) highlight that shipping lines in the Asia region are more attracted to ports that are able to provide operational efficiency and economies of scale. On the other hand, as compared to shipping lines, Nir, Lin, & Liang (2003) found out that shippers are more attracted to distance, travel time and cost in selecting the port of departure. Likewise, Yuen et al. (2012) identified that port choice behaviour towards the selection of ports in the Asia region differs between port users when it comes to factors such as port location, costs at port, port facility, shipping services, terminal operator, port information system, hinterland connection and customs and government regulation. In addition, Lee (2007) includes the terminal operators' perspective in investigating the heterogeneity of port selection criteria comprising port depth, port infrastructure, berth availability, variety of routes, market size, cargo volume and cargo balance between shippers and shipping lines. Moreover, Yeo, Roe, & Dinwoodie (2008) discuss seven factors: port services, hinterland condition, availability, convenience, logistics cost, regional centre and connectivity that contribute to the competitiveness and subsequently to port performance of port in the Southeast Asia region.

Nevertheless, given that the current structure of the market environment has dramatically changed due to the globalisation of markets and the increasing competitive pressure, the logistics activities between suppliers and customers has also changed, in particular in relation to seaports. Notteboom and Winkelmans (2001) argue that the new market environment in the way a seaport operates its business is based on post-Fordism rather than Fordism. This explains that seaports are no longer focused on the economies of scale; instead, they are directed to economies of scope and flexible organisation through co-operation in economic networks. Similarly, Robinson (2002) advocates that ports or seaports must be seen as elements in value-driven chain systems that create added value through close cooperation and coordination with other supply chain actors with an integrated objective, instead of simply as places with a particular function that work separately. This translates as an integrated supply chain with others logistics companies is an important aspect that could help ports to reduce unnecessary logistics activities and subsequently fulfil customers' expectations in reducing costs. Given that customers are more demanding in terms of cost reduction in doing business activities, therefore, the supply chain is seen as a springboard for ports to remain competitive. Inserting themselves into the supply chain networks and working closely with other actors will be able to not only help them to respond quickly to customers' needs (Coppola & Torre, 2014) but also quickly response to the environmental, economic and social sustainability efficiency.

3.1 THEORETICAL BACKGROUND

In order to understand the relationships between the spatial characteristics, inter-organisational cooperation (supply chain integration strategy), and sustainability benefits towards the performance of ports on the periphery, this section provides an underpinning theory that supports the relationships between the variables. In investigating the performance of ports, there are a number of theories available and have been adopted by many scholars to underpin their studies. Such performance theories are Structure Conduct and Performance (SCP) paradigm, PESTLE theory, Stakeholder theory, Resource dependent theory (RDT) and Resource Based-View (RBV). SCP paradigm is related to the causal relationships of market structure, market conduct and market performance (Fu, 2003). In particular, it explains in detail how the market structure (such as seller concentration, degree of product differentiation, barriers of entry) would influence the market conduct – firm's behaviour (such as pricing strategies, collusion, advertising, research and development (R&D) and capacity investment) and give impact to the market performance - outcome (Such as profitability and price-cost margin) (Lee, 2007).

Meanwhile, PESTLE analysis is associated with the various important external elements that could have an impact on the business performance. These external elements are Political, Economic, Social, Technology, Legal and Environment. The purpose of PESTLE analysis is to identify issues that are out of control of the organisation which could have impacts on business activities and subsequently on performance. This PESTLE analysis is appropriate to be used when a firm (1) launches a new product or service, (2) enters a new region or country, (3) considers a new route to the market and (4) works as a part of strategic project team (FME, 2013). On the other hand, the shareholder theory emphasises the relationship of the firm with other stakeholders such as suppliers, customers, government bodies, financiers and political groups to name but a few in order to generate outstanding performance. To achieve the outstanding performance the theory focuses on two important questions viz. the purpose of the firm and management responsibilities to stakeholders (Freeman, Wicks, & Parmar, 2004). The former associates with the value firms created and how the value can bring the stakeholders together, while the latter relates to how firms can conduct business with the stakeholders.

RDT as depicted by Johnson (1995) is an organisational theory that seeks to explain the organisational and inter-organisational behaviour pertaining to the critical resources that a company must have in order to survive and function. In particular, the RDT focuses on the

resources, the resource exchange with other organisations, those dependencies and power differential created as a result of unequal resource exchange, the constraining effects and efforts to manage the dependent by organisational managers (Johnson, 1995). This indicates that a firm is seen as being unable to stand alone in order to generate all the resources needed in maintaining their business performance. Hence, it is necessary for firms to seek external resources such as production processes, external links of organisations and organisation behaviour for its strategic decision making in order to ensure that the business performance can be properly maintained (Nemati, Bhatti, Maqsal, Mansoor & Naveed, 2010). The explanations of the above theories have demonstrated its capability in supporting the business performance of a particular firm or an organisation. However, for the current study, it is viewed that the above theories are not relevant to the current study due to several reasons. Firstly, the above theories do not precisely underpin the whole elements (spatial characteristics, PSCI strategy and the sustainability advantage) that are being carried out in the current study. In particular, the theories only support the relationships of the firms or organisations with other partners that are involved in the same business. In addition, the inclusion of the above theories to support or underpin the current study would be seen as being inappropriate and misleading. Thus, it is wise not to incorporate these theories in order to underpin this study.

Even though the above theories are found to be irrelevant for the current study, nonetheless, it is perceived that there is one applicable theory that relates to the whole elements that are being studied viz. RBV. Prior to the theory development, the origin of RBV is stemming from various related sources in early 50s such as (1) the traditional study of distinctive competencies, (2) Ricardian economics, (3) Penrosian economics, and (4) the study of anti-trust implications of economics, that have been conducted in association with the firm performance (Barney & Arikan, 2001). Thus, Wernerfelt (1984) defined a firm's resources under the RBV theory as tangible and intangible assets that are tied semi-permanently to the firm. The author added that the tangible assets refer to things that are visible and fixed such as lands, buildings, machinery, plants, and factories, and, on the other hand, intangible assets refer to things that are invisible such as intellectual properties, skilled and knowledgeable employees, and reputation, to name but a few. To develop the competitive advantage, firms not only need to acquire the physical capital resources, human capital resources, and organisational resources (Barney J., 1991) but they also need to develop, combine, and effectively deploy those three resources in a way that would add more unique value (not available to everyone/ heterogenous), rare (not shared by a number of groups or competitors), difficult to be imitated (non-transferable) and non-

substitutable (cannot be replaced by any equivalent resources that can be used for the same purpose) (Dao, Langella, & Carbo, 2011). Also, if a firm has a resource/s that could last for a long time and is/are difficult for competitors to imitate, it is said to sustain the company's competitive advantage (Lockett, Thompson, & Morgenstern, 2009). It is viewed that these valuable resources not only facilitate firm to create the sustainable competitive advantage, but also could affect the overall business performance and subsequently outperform competitors.

This can be done by implementing strategies that exploit firm internal strengths, through responding to environmental opportunities, while neutralising external threats and avoiding internal weaknesses (Barney J., 1991). As notified earlier, the performance of peripheral ports can be attained through the integration of the spatial characteristics of peripheral ports, PSCI strategy (inter-organisational cooperation), and sustainability as a strategic capability within supply chain distribution networks. Though lack of intermediacy, peripheral ports are adjacent to the main hinterland markets where most of import and export activities take place. Being proximate to main hinterland markets is an advantage to this category of ports as it can be considered as a physical resource that could provide opportunities in a way to become more competitive. In addition, as compared to large ports, peripheral ports possess the availability of land site space where value-added activities can be conducted. One of the opportunities that could be coming from the physical resource of the ports on the periphery is environmental sustainability where the emissions of GHG, in particular, the CO2, can be reduced. A focus on sustainability not only facilitates firms to improve operation, innovation, and strategic growth, but also helps gain a sustained competitive advantage and delivering sustainable values to the broader society (Dao et al., 2011). In addition, emphasising on sustainability such as low carbon emissions not only differentiates firm from competitors but also acts as a strategic means to sustain the competitive advantage and subsequently the firm performance (Flint & Golicic, 2009).

As has been argued in the literature that the sustainability cannot simply be achieved by a single entity, instead, it needs a strong synergy from other sources that could assist peripheral ports to sustain their business in the competitive market. It is viewed that an organisational resource - internal and external relationship with the other supply chain entity is able to facilitate the peripheral ports to work with other entities in a sustainable manner. In inter-organisational cooperation, ICS, for instance, is one of the mechanisms that help to improve reliability, dependability, and speed between firms (Panayides & Song, 2009) when information is shared

between one another. In addition, it enables the firm to standardise, monitor, capture, and utilise data and metadata (Melville, 2010) that help evaluate environmental, economic, and social impacts of the business activities (Dao et al., 2011). Information sharing through technology is a valuable resource that could facilitate firm not only in operational activities but also at the strategic level pertaining to the sustainability. In general, the information sharing through IT from the resource portfolio perspective may not meet the resource-based view criteria as there is a low barrier of imitation and can be shared by many competitors when acting alone. However, the valuable resource is not depending on the technique of sharing (Wu, Yeniyurt, Kim, & Cavusgil, 2006), rather, it depends on how the information is being analysed and used in decision making. This translates that information sharing through technology between inter-organisational (peripheral port and other supply chain partners) within supply chain distribution network pertaining to the sustainability is not only valuable and difficult to imitate but also imperfectly immobile as there is a causal ambiguity or link between how the information is being used and the sustained competitive advantage are poorly understood.

The aforementioned has clearly provided the opportunities for peripheral ports to sustain their business in the competitive market and subsequently contribute to the business performance through the theoretical lens of resource-based view.

3.2 SUPPLY CHAIN MANAGEMENT (SCM)

Gibson, Mentzer and Cook (2005) state that the term SCM appeared in the early 1980s, where it was originally introduced by consultants and industry experts. The term SCM principally evolved from a broader and wider concept known the supply chain. The supply chain, as defined by Mentzer et al. (2001), is a set of three or more entities – either organisations or individuals – directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer. In particular, it encompasses a number of important flows (Mangan, Lalwani, Butcher, & Javadpour, 2012) comprising:

- The physical flow of materials
- The flow of information
- The flow of tangible and intangible resources (financial, human resources and equipment)

Generally, supply chain activities involve the transformation of natural resources and raw materials from suppliers into finished products and delivery to end customers. It is understood that supply chains differ in their complexity. Mentzer et al., (2001) identified three degrees of supply chain complexity, namely (1) direct supply chain (2) extended supply chain and (3) ultimate supply chain. A direct supply chain consists of only a supplier, a company and a customer. An extended supply chain consists of suppliers of the immediate supplier, a company and customers of the immediate customer. The third degree of supply chain complexity is all the organisations involved in all the upstream and downstream flow of materials from the ultimate supplier to the ultimate customer.

In addition, supply chain activities between organisations at the upstream and downstream should be properly managed. If none of the organisations manage the supply chain, they are considered to be distribution channels. However, if organisations are working closely through cooperation, collaboration and coordination with other suppliers and customers from upstream to downstream, they are managing their supply chain activities (Mentzer et al., 2001). Organisations that are keen to manage their supply chain activities are aiming to provide low inventory investment, low unit cost, improved overall business functions, improved operations management, improved customer value and satisfaction, and competitive advantage (Stevens, 1989). Stevens (1989) added that, given that supply chain activities between organisations are interrelated, the failure of one activity will disrupt the chain, resulting in poor performance, contributing to workload in other areas and jeopardising the effectiveness of the entire supply chain.

Given that, it is not an easy task to control the complexity of the supply chain; it requires orientation between companies in managing the various flows of resources; therefore, they have to closely cooperate, collaborate and coordinate their supply chain activities. This means that the relationship between partners is emphasised. The improvement of SCM activities between partners depends on the trust and commitment, the mutual dependency, organisational compatibility, SCM vision and key processes, the role of the leader, and top management support (Mentzer et al., 2001). The absence of the above supply chain orientation criteria in each of the organisations may impede the SCM activities and subsequently reduce the opportunity to achieve a competitive advantage. This indicates that integration of the supply chain between partners is imperative.

Integration from the SCM perspective can be defined as the outcome of the collaborative actions of individuals within a firm and between firms in the supply chain (Lee, 2005). Flynn, Huo, & Zhao (2010) added that integration of companies into the supply chain is important in order to achieve the effective and efficient flow of products and services, information, money and decisions, to provide maximum value to the customer. Mentzer et al. (2001) argued that the implementation of SCM needs the integration processes from sourcing, to manufacturing, and to distribution across the supply chain through cross-functional teams, in-plant supplier personnel, and third-party service providers. Given that a supply chain integration strategy has been identified as one of the approaches that is able to facilitate a firm's ability to respond to customers' needs (such as faster consistent product delivery, on time delivery, and no damage on the product) and demands, global market conditions (Droge, Vickery, & Jacobs, 2012), and enhance the company's competitive advantage, hence, it is vital for firms to improve and strengthen both their internal relationships and their external relationships with other partners (Coppola & Torre, 2014).

The motivations that lead to the adoption of an integration strategy between partners in the supply chain have been widely discussed in literature. One of the reasons is the intensity of competition (Chiang & Hwang, 2013) that a focal company encounters from local and global threats which could threaten the business performance (Katunzi, 2011). An integration strategy through vertical collaboration enables firms to increase their market share and simultaneously defend such market from other competitors, which is a way of increasing the market entry barrier (Bresnahan & Levin, 2012). In addition, given that the growth of international trade has sparked the globalisation phenomenon and revolutionised communication technology, thus, these situations have created more demanding customers and a demand-driven market (Handfield & Nichols, 1999). The authors added that the emergence of new types of inter-organisation relationships such as horizontal integration through cooperation and complementary cooperation have also contributed to the adoption of such strategy. Moreover, the desire that leads to the adoption of a supply chain integration strategy is not only due to economies of scope but also economies of scale, which are usually associated as a horizontal collaboration driver. However, research by Maggi and Mariotti (2010) revealed that achieving economies of scale in vertical integration is as important as economies of scope, in which both of these drivers could lead to elimination of transaction costs and simultaneously increase the input productivity (Grega, 2003).

The cost reduction through supply chain integration contributes to the profit generation as well as to the distribution performance. On the other hand, Economides (1998) identified several traditional (non-strategic) motives that encourage firms to integrate business with supply chain partners: (1) better coordination among components, (2) benefits of joint use of integrated product, (3) cost savings in joint production, (4) possibility of a better integrated design, (5) quicker information flow in a vertically integrated company, (6) assurance of markets for components, and (7) easier vertical expansion to new components – easier incorporation of vertical features. Meanwhile, Röder (2007) acknowledged contemporary factors that influence firms to embark on an integration strategy with supply chain partners. Such factors are: (1) innovation – opportunities for integrated product innovation, (2) knowledge transfer – direct and reliable information between suppliers and customers at all supply chain stages, (3) value migration – to capture higher margins of the service segments of the value chain, and (4) increasing product complexity – the ability to manage the increasing complexity of new product development. Another reason that influences firms to vertically integrate with other firms is to affect their bargaining power with suppliers (Ursino, 2015).

Of the mentioned motives, Yunus (2012) in her PhD dissertation concludes that those supply chain integration motives can be divided into two main categories that influence focal companies to integrate business with other partners in the supply chain or chains. These categories are external and internal drivers. The former driver is associated with demand uncertainty, supply uncertainty and technology uncertainty, whilst the latter driver is associated with anticipation of benefits and customer orientation. Similarly, Guan and Rehme (2012) identify several factors that stimulate supply chain integration practices (SCIPs) between partners, which can be categorised into two categories: external pressures and potential benefits. Specifically, the external pressure factors are associated with strategic partnership with customers, customer demand for an integrated solution, and technical complexity. On the other hand, the potential benefits are associated with learning, higher margins, differentiation and synergy.

Since SCM activities are associated with the flow of the input and output from suppliers to customers, thus, logistics is involved in this process. Generally, logistics is known as one of the segments involved in the SCM activities where movement of the raw material resources from the suppliers to the customers takes place (Panayides & Song, 2008). Specifically, logistics is the process of planning, implementing, and controlling procedures for the efficient

and effective transportation and storage of goods including services and related information from the point of origin to the point of consumption for the purpose of conforming to customer requirements (Mangan, Lalwani, Butcher, & Javadpour, 2012). This definition indicates that logistics is part of a wider concept of SCM activities where its functions and activities are concentrating on the movement of inbound, outbound, internal and external goods via selection of transport methods such as road, rail, air and water. In addition, it is in line with one of the perspectives of logistics versus SCM, namely 'unionist', as discussed by Larson and Halldorsson (2004), although there are four different perspectives for the relationship between logistics and supply chain (see **Figure 3.1**).

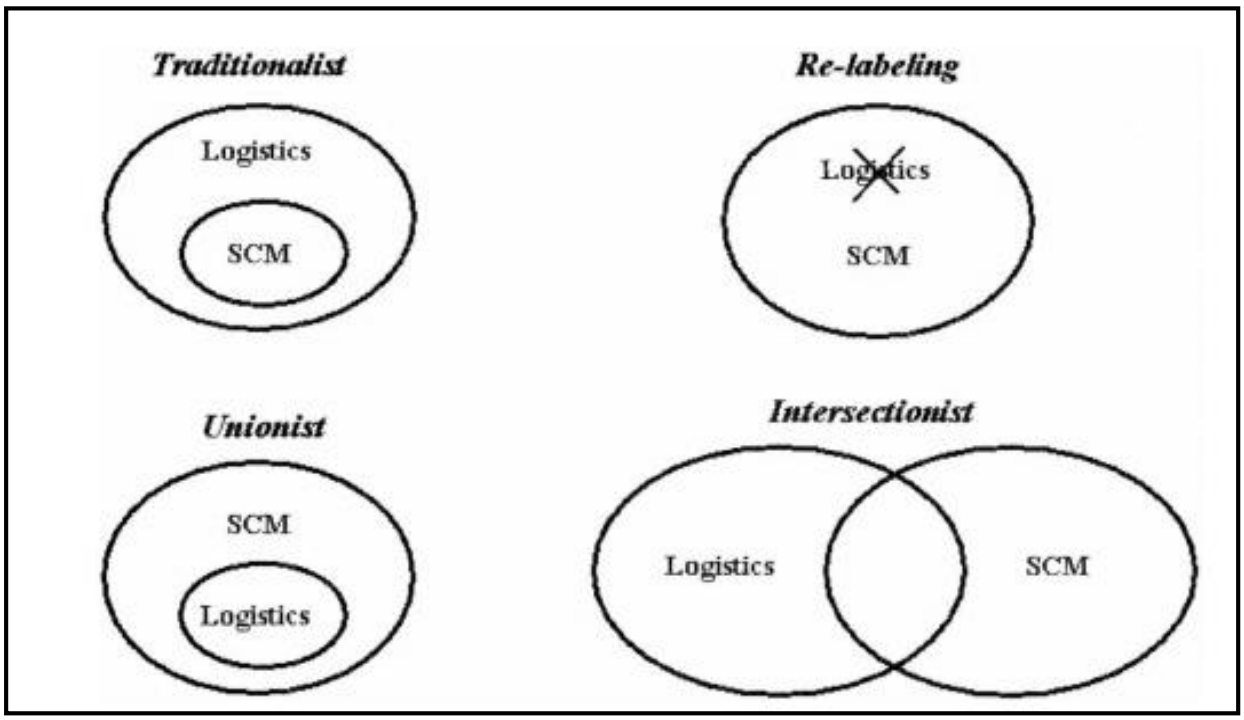


Figure 3.1: Perceptions on logistics versus SCM

Source: Larson & Halldorsson (2004)

With regard to the mode of transportation, water transport, in particular, seaport/port, is one of the transportation mediums involved in the movement of both raw material and finished

products from supplier to customers. The integration of seaport/port operations into the supply chain activities only started recently, as the view developed that the traditional operations of seaports/ports were no longer able to provide competitive advantages to port stakeholders. In the twenty-first century, seaports/ports are advised to work closely with other port stakeholders in order to gain more competitive advantages through lower costs and improved customer value and satisfaction.

3.3 SEAPORT/ PORT SUPPLY CHAIN INTEGRATION STRATEGY (PSCI)

PSCI as defined by Woo et al. (2012) is a strategy undertaken by a seaport/port terminal to integrate various functions and organisations in a supply chain to become an integral part of the supply chain. Studies on supply chain integration from the seaport perspective have focused on the integrated logistics services and organisational integration. Given that the current business environment is driven by customer's demand and it is critical for firms to meet customer's needs, thus, integration is the most appropriate strategy that should be employed. Emphasising the integration and coordination of the activities, either internally or externally, with suppliers and customers downstream or upstream or in both directions has a great influence on several business areas such as waste reduction, increasing of delivery speed, unit cost reduction, and flexible response to the needs of the market, and makes it possible for managers to perform actions dramatically better than their competitors (Hosseini, Azizi, & Sheikhi, 2012). This is because the integration per se is able to facilitate a firm's ability to respond to customers and to global market conditions. Therefore, a firm's business success depends on the management's ability and capability to integrate the company's intricate network of business relationships or SCM. In addition, the firm must shift its central focus to the consumer and use the value network as a means of securing whatever loyalty is possible from those consumers who offer the most profitable future.

In maritime transportation industry, an early integration of ports into the SCM activities has been discussed by Robinson (2002). In his study, Robinson argues that the role of port is no longer as a place to handle ship and cargo, instead it should be defined within a paradigm of ports as elements in a value-driven chain system. Similarly, Carbone & Martino (2003) have analysed the key supply chain business process of Renault (procurement, inventory management, manufacturing management, physical distribution and commercial practices) with port operators at Le Harve in terms of relationship, supplied services, ICS and key

performance. Through the study, they have successfully proven that inter-organisational relationships with other port stakeholders or port communities play an important role in determining the competitiveness and subsequently to the performance of ports. Meanwhile, Notteboom and Rodrigue (2005) have introduced port regionalisation as the new phase of development of the port system, in which inland distribution at the hinterland is the most integral part of port competition, favouring the emergence of transport corridors and logistics poles. In addition, with a more efficient hinterland connection, mainly through modal shift, it is presumed that port competitiveness can be increased.

On the other hand, Almotairi and Lumsden (2009) indicate that four stages of port integration can be found in the literature as adapted from Stevens' work on integration supply chain: simple point of freight transshipment (stage 1), functional development between ports' logistics system (stage 2), corporate logistics development with port logistics systems (stage 3), and integrated port logistics chain and supply chain partnership (stage 4). Similarly, Lam and Voorde (2011) identified four supply chain integration scenarios that have been recently taking place in the container shipping industry: low integration, partner-focused integration, activity-focused integration and high integration. Low integration between shipping lines basically refers to the traditional business activities of the focal firms and there are no integration activities between firms either at upstream or downstream along the supply chain. Smaller shipping lines and usually non-container-based businesses are classified under this category. In contrast to the low integration scenario, members of the container shipping supply chain are inter-linked in a partner-focused integration scenario; however, few activities take place between members and the collaboration is quite low as well.

Meanwhile, the third integration scenario is activity-focused integration. This type of scenario depicts the integration that occurs between members along the supply chain concentrating more on the activity, and the number of members involved in collaboration is small. This is quite a contrast to the partner-focused integration. Shipping lines that do not see themselves as traditional transportation service providers in transporting cargo are classified as having high integration with other members along the supply chain. The biggest names, such as Maersk and Hapaq-Lloyd, are among the shipping lines that actively practise the concept of supply chain integration. Firms under this category of scenario are conscious that the current bigger/global shippers (e.g. Wal-Mart) demand integrated supply chain solutions.

In the seaport/port sector, the concept of 'we just load and unload the ship' is no longer relevant in the 21st century as the business environment has changed. Port development nowadays should be seen as, and extended into, the perspective of supply chain as many players in maritime transport and logistics have been actively involved in the integration concept as a means to reduce the transportation cost, be more efficient and finally increase the port's performance. In addition, in order to be successful in the current business environment, it is critical for ports to concentrate on the 'customer-led' approach and be able to understand the customers' needs and to offer 'best-in-class' performance (Notteboom & Winkelmans, 2001). Given that the customers' power is increasing, therefore, it is critical for firms to be able to offer their products and services at the lowest price and be able to distribute them promptly as customers are no longer isolated, unaware and passive; instead, they are more aggressive and proactive in determining what exactly they want from firms.

In addition, Gimenez, Vaart and Donk (2012) suggest that firms should concentrate their efforts to integrate in a high supply chain complexity, in particular with those customers that demand high variety of products and services and at the same time have high expectations with regard to flexibility and quality. Thus, the flexibility to quickly adapt to the changing business environment and opportunities and an integral approach to logistics issues in the transport chain are two key elements that help ports obtain a competitive advantage. This is where the networking of ports begins, and it will be a critical role for them in the millennium era, as deriving competitive advantage will be more of a matter of going beyond the business boundaries, in terms of physical investment and managerial capability. Given that the port is the main location enabling different channels to interact, therefore, it is recognised as a good place for creating value-added services. This is due to the fact that a seaport/port is one of the very few networking sites that could bring together and closely integrate various members of the supply chain (Bichou & Gray, 2004). Therefore, it can be claimed that the success of a port will mainly be determined by its capability to fit into the network that shapes the supply chain.

One of the obvious benefits that will be derived from integrated supply chain logistics is in terms of inventory reduction. In traditional port practices, all the operational activities such as depot operations, freight forwarding, storage warehousing, and handling operations, to name but a few, at the terminal area were managed and controlled separately, without the presence of close cooperation and coordination among supply chain members, which may carry additional costs, as each firm will have to cover the cost involved, and this is an inefficient

operation. Thus, better inventory management allows the inventory cycle to be increased, which reduces holding costs while increasing cash flow. This can be seen where the problem of late delivery has been reduced with the implementation of a Just-In-Time (JIT) delivery approach. The JIT approach has the ability to eliminate inefficient operations and the value gained will be delivered to the other members, particularly the customers. The value delivery involves choosing, providing and communicating an explicit value proposition, which a statement of the target customers, the key benefits offered and the price asked will be specified to the customer or the customer segment (Robinson, 2002).

Integration basically requires communication on the part of the port operators, the adoption or the use of advance information and communication technologies, relational capabilities, facilitation of intermodal integration, provision of value-added services, and planning for the efficient and effective operation of the supply chain as a whole and not solely the port or terminal; that is, the extent to which the port or terminal plans or organises and seeks to identify the most efficient routes for cargoes passing through it. Therefore, integration can contribute to agility, which involves being proactive along the supply chain, and facilitation of intermodal integration, adding value along the supply chain, as well as organisational integration and partnership. It is viewed that the competitiveness of a port nowadays not only determined by its internal strength, such as the rapid operation activities at a terminal, but also the external strength of its integration and relationship with other members in supply chain coordination. Hence, supply chain integration is identified as an important requirement for the well-being and survival of a firm, particularly for a port's performance (Coppola & Torre, 2014).

The insertion of ports into SCM activity is characterised by several important components viz. Information and Communication System (ICS), Multimodal Operations (MMO), Value-Added Services (VAS), Relationship with other Supply Chain Actors (RWSCA) and Supply Chain Integration Practice (SCIP) which will operationalise the integration activities with other supply chain partners. These components are selected as important measurements which have been established and verified by previous studies (see Panayides and Song, 2008; Song and Panayides, 2008; Tongzon at al., 2009; Woo et al., 2012). In order to attract more port users to this category of ports, it is critical for a port to generate more cargoes from hinterland markets through integration activities with supply chain members in order to offset the costs that have to be borne by port users in order to make a port of call. Therefore, for this research, the

dimensions of the PSCI will be considered in determining its capability as a factor that is able to contribute to the performance of ports on the periphery.

3.3.1 Multi-modalism Operations (MMO)

Intermodal transport can be defined as the combination of at least two or more modes of transport in a single transport chain, without a change of container for the goods, with most of the routes travelled by train, inland waterway, or ocean-going vessel and with the shortest possible initial and final journey by road (Macharis & Bontekoning, 2004). In the transportation industry, the terms multimodal, intermodal and combined transport have always been used without any clarification of the differences when the transferring of goods involved more than a single type of transportation mode. In fact, these terms have been seen as widely interchangeable in the literature. However, Islam, Dinwoodie and Roe (2005) clarified them, in which the term multimodal is often associated with developing countries; meanwhile, intermodal is frequently used in reference to the US, and the usage of the term to date is increasing in Europe and Australia particularly; and combined transport refers to the intermodal transport where the major part of the European journey is by rail, inland waterways or sea, and the final leg of the transportation process will be carried out by road transportation, with this forming the shortest part of the journey.

Multimodal transport is appropriate for long distances and for large volume of cargo that need to be carried from one location to another. It is one of the most cost-effective means, as the cost of transportation could be reduced due to the optimisation of economies of scale, compared with the unimodal transportation and at the same time the terminal handling and fixed costs remain unchanged for the whole transportation processes. Multimodal is better than unimodal transport as it is capable of reaching remote areas at the hinterland and is able to avoid the congestion usually encountered by unimodal transport, particularly in big cities. Ports are known as the places where the bi-directional logistics system takes place, where they receive cargoes from the hinterland (road/rail/inland waterway) to be distributed to ports of destination by ship and at the same time receive cargo from the foreland (port of origin) that needs to be transported to land area by using rail, road or inland waterway (Song & Panayides, 2008). Since the port is the bi-directional system for the sea and land legs, therefore, efficient and effective coordination, inter-connectivity and inter-operability are within the port system. The high requirement for coordination, inter-connectivity and inter-operability requires ports to provide

adequate, efficient and effective inter-connectivity systems and operations for their multimodal interface operations.

Transportation cost is one of the main elements considered by users when transporting their cargoes. It is identified that the hinterland cost encompasses approximately 40% of the total cost of a single product (Franc & Horst, 2010). Furthermore, it is said that the cost savings at sea are getting smaller due to several activities undertaken by shipping lines, such as M&A, strategic alliance, joint venture and the expansion of ship size. Therefore, the only area left for shipping lines to explore the cost advantage is at the hinterland. Therefore, if a port is able to provide an inter-connecting multimodal infrastructure and systems through collaboration and cooperation to facilitate inter-modality as a nodal point in the supply chain, this constitutes an important variable in the context of a terminal's integration into the supply chain, and therefore is part of the PSCI construct.

In addition, port users frequently seek the most efficient routes able to offer the lowest cost, and ports offering efficient hinterland accessibility due to productivity, effectiveness and reliability in inter-modal transport connectivity and inter-operability are beneficial to shippers, consignees and carriers as well in the supply chain. As mentioned earlier, the competition is no longer between units of organisations; instead, it is between the supply chain, and the ability of a port to integrate its businesses with other partners along the supply chain would give numerous advantages. Theoretically, it is not doubted that port users are more attracted to and tend to make ports of call at ports that are located in the main maritime shipping networks; however, if ports that are off the main maritime route are able to provide the most effective and efficient services from and to the hinterland and at the same time are able to meet more demand, at lower cost, and provide prompt services, these would be attractive factors to port users. This is supported by Song and Panayides (2008), Panayides and Song (2008) and Tongzon et al., (2009): that cargo flows will seek the route that offers the lowest cost and the ports that offer efficient hinterland accessibility due to productivity, efficiency and reliability in inter-modal transport connectivity and inter-operability. In addition, other researchers such as Almotairi and Lumsden (2009) add the importance of a multimodal system to a port's competitiveness, and the requirement for ports to have sufficient transport modes for the creation of a specific platform.

3.3.2 Value Added Services (VAS)

The term VAS refers to the additional services offered by a firm to its users or customers in attempting to increase the number of customers and at the same time enhance its competitiveness compared with more basic services (Collins, 1986). In other words, customers will be providing or receiving additional services from suppliers/seller without having to pay for them, or at least only paying a small amount of money. Okorie (2011) enlisted value-added services features; firstly, offering services that firm does. Secondly, value-added services encompass the additional services provided by a firm purposely to complement its core business. Last but not least, value-added services are a customer-tailored concept; they cannot be provided overnight, as providers have to understand the customers' needs. In addition, because the value-added services are customer tailored, therefore, providers have to work closely with customers in assisting them to identify the most appropriate services needed and develop them as value-added services. Hence, Edvardsson and Olsson (1996) put forward four main suggestions on the implementation and development of new value-added services, as mentioned below:

- Fulfilling the prerequisite needs of customers
- Supporting customers to make their desires explicit
- Understanding the customers' needs
- Incorporating customers in the process of services development

From the perspective of the port sector, value-added services therefore refers to those services that a port can develop and offer for the benefit of port users, which are not essentially part of the main or traditional services offered by the port (Okorie, 2011). Value-added services can be divided into two categories, value-added logistics and value-added facility. There are two categories under value-added logistics, general logistics services and logistics chain integration services. General logistics services include, among other activities, loading/unloading, stuffing and stripping, storage, warehousing and distribution. These are the more traditional logistics activities, and do not directly affect the nature of the product as it moves through the port. Providing value-added services is a powerful way for ports to build a sustainable competitive advantage. In addition, shippers and port customers are becoming increasingly demanding and now they tend to look at value-added logistics services as an integral part of their supply chain (Popa, Beizadea, Nistor, & Nicolae, 2010).

Various studies show that the most successful ports are those that not only have a productivity advantage in their cargo-handling services, but also offer value-added services (Popa et al., 2010). Since the customers accentuate the elements of costs, efficient, effective and fast delivery of goods (Lee, Nam, & Song, 2012), it is a must for a port nowadays to provide services that contained these values. Therefore, valuable services that could give those mentioned elements should be a golden priority for a port to offer to its customers. In fact, a port should create a specialise value-added zone or logistical parks where the containers are unloaded and add the value to the products where necessary and reload them onto ships and transport them to their final destinations, as suggested by the then Puerto Rico Chamber of Commerce President Joaquin Villamil. However, a large area of the port is required to create these specialist value-added zones or logistics parks requires, and not all ports are able to provide these activities.

Nevertheless, ports on the periphery, as discussed earlier, an possess advantage in that they have large amounts of land or space that are yet to be explored in which future development or expansion can be carried out. The specialist zones or logistics parks such as Free Trade Zones or Commercial Zone Areas can be developed in order to create and offer value-added activities to port users, and as a consequence numerous benefits can be obtained through this development. Since the land or space cost is lower at the periphery ports than at the major or gateway ports, this again will help both port service providers and port users to enjoy the cost saving. In addition, longer hinterland transportation can be reduced and congestion can also be avoided since the value-added activities can be carried out at the port area and ultimately the cost, time, energy and carbon emission can be reduced as well.

Value-added services also help firms to increase their turnover, make them better than their competitors and at the same time help to build customer loyalty towards the services provided. In short, the value-added services are selling the advantages of the port and terminal itself. It is necessary to provide value-added services nowadays, as customers have an abundant choice of ports of call. There are many ports around the world; in fact, a country could have than 10 ports providing similar services to a single shipper. In addition, shippers are known to be less loyal to one specific service provider. If they not satisfied with the services provided to them, they simply switch to another service provider who is able to provide and fulfil their current needs, particularly the needs of efficient and reliable operations and low delivery costs.

Furthermore, since the competition among service providers is becoming intense, ports are trying to attract as many shippers as they can (existing, new and potential) by providing the most competitive services they have in order to ensure that their services will be bought by these customers. Therefore, in an open market and the rapidly changing business environment, only specific and dedicated services will help maintain high margins, keep existing clients, and attract new ones. By differentiating themselves from the other competitors by providing value-added services as one of the competitive advantages in the port business, ports are able to retain customer loyalty. In addition, long-term contracts, more visibility for the business, less influence from competitors, secure investments, and showing the willingness to provide what customers want are some of the benefits that could be gained from implementing or providing value-added services to customers. Thus, logistics service activities add value by making products available in the right place and at the right time, in the right way, and in the right quantity and right quality for the right customers at the right cost (Mangan, Lalwani, Butcher, & Javadpour, 2012).

3.3.3 Information and Communication System (ICS)

Mangan, Lalwani, Butcher, & Javadpour (2012) explains that ICS is the main key enabler of integration activities between partners in supply chain activities. There are two important elements that facilitate the efficiency and effectiveness of the integration activities, namely information sharing and how the information is being shared between supply chain partners. Prajogo and Olhager (2012) indicate that information exchange and IT used between partners is related to the social aspect and technical aspect of supply chain integration respectively. In particular, the social aspect is associated with the willingness and trust to share related information with others, and the technical aspect is associated with IT connection. In supply chain integration activities these two aspects are interrelated and mutually complement each other. The use of IT connection in order to share information for the partners' mutual benefits is extremely important in accelerating the integration activities between trading partners. However, IT connection is not the ultimate necessity for a firm in order to smooth and quicken the process of information sharing between partners; instead, it is the willingness of a firm to share its internal and important information with outsiders or partners. In short, having an expensive, large, sophisticated and up-to-date IT connection is not enough if the other partners are unwilling to share the information for mutual benefits.

There are two criteria that should be addressed when it comes to ICS in supply chain integration: the level of information sharing and the level of information quality (Lia, Ragu-Nathanb, Ragu-Nathanb, & Raob, 2006). The level of information sharing refers to the extent to which the critical and proprietary information (usually measured in terms of quantity of the data sharing) of a company is shared with other partners. There are four levels of information sharing: in which order the information is shared, operational information sharing, strategic information sharing and competition information sharing. For the information sharing to have a significant impact on the integration activities basically depends on a few factors that should be considered by the involved partners. It is very important to identify and decide what and which information should be shared between partners. In addition, partners should know the most appropriate time to share the information.

Moreover, how the information should be shared also needs to be considered by both partners. The most effective and efficient method of transferring the information between partners should be adopted in order to ensure that the information reaches the partners in a fast and secure manner. The adoption of EDI (Electronic Data Interchange), the Internet and World Wide Web, for instances, as mediums for transferring the information needed between partners in a supply chain is able to reduce the uncertainty and enhance the shipment performance of the suppliers and greatly improve the performance of the supply chain system as a whole. Furthermore, since the integration activities can be internal or external to the supply chain, and sometimes the external integration can be with multiple partners, therefore, a firm should decide to whom the information should be shared, because different partners need different information.

Meanwhile, the level of information quality basically refers to the extent to which the data sharing is accurate, complete, frequent, recent, valid and timeless. In addition, the quality of the information sharing should meet the needs of each of the partners. Great value will be received by both partners if the information shared is encompasses the characteristics of high-quality information. These two information criteria play a significant role in conveying and exchanging information between partners. It is found that the more information is shared with partners in the supply chain, the lower the total cost and the deeper the information sharing level, the higher in-time order fulfilment rate and the shorter the order cycle time, as information sharing may reduce the demand uncertainty that firms normally encounter (Lin, Huang, & Lin, 2002).

In addition, the environmental uncertainty can be reduced and at the same time the efficiency of the supply chain can be improved significantly when only real-time and accurate information regarding product availability, inventory levels, shipment status, and market needs is provided between partners (Li, Yang, Sun, & Sohal, 2009). Moreover, with the implementation of IT, information can be assessed quickly and easily, which indirectly improves the communication between supply chain partners. This means that IT facilitates supply chain partners to become better informed and allows them to make earlier decisions. Earlier decision-making which is based on accurate and automatic information sharing between supply chain partners enables them to lower costs through reduction of inventories (Tseng & Liao, 2015). Furthermore, an accurate and automatic information flow between supply chain partners enables partners to reduce both levels of complexity, namely dynamic and detail (Power, 2005).

The sharing of important, relevant and available information with other partners along the supply chain would help an organisation to speed up the information flow in the supply chain, improve the efficiency and effectiveness of the supply chain, and respond to customers' changing needs quicker and, as a consequence, this will bring competitive advantage to the involved organisations in the long run (Li & Lin, 2006). To ensure the smooth movement of the consignment process from point A to point B, partners in the supply chain need to share and exchange important and related information, thus, making the movement of the consignment effective and efficient. With the integrating of supply chain information, partners can work closely as a single entity, which will enable them to respond to the market's demands and to create best value for customers (Prajogo & Olhager, 2012). Information sharing between partners, regardless of the scope of the integration (either limited dyadic downstream, limited dyadic upstream, limited dyadic, limited triadic or extended), enhances a company's performance (Jayaram & Tan, 2010), specifically, contributing to profitability and operating efficiency, benefiting all members in cross-national collaboration (Myers & Cheung, 2008).

3.3.4 Relationship with Supply Chain Actors (RWSCA)

It is known that the supply chain relationship between actors is already established through the traditional concept of business as suppliers and customers. However, since this relationship is limited to the traditional concept of doing business, therefore, neither party gains many benefits. To maximise the supply chain benefits it is essential for both parties to work closely together as a robust team. Cooperation in the supply chain between partners is more than just

a supplier and customer relationship; it is a strategy to strengthen the business for each party. Rather than conducting a win-lose business practice in which only one party will get advantages from the business, it would be noteworthy to practise a win-win business practice where both parties are enjoying the advantages from the business. Cooperation brings numerous benefits not only to the parties involved as a team it also benefits the whole supply chain, which is able to increase its overall efficiency.

Despite its capability in creating advantages for a business, the literature also highlights that the supply chain relationship is also a significant factor that could determine the success and failure of the cooperation. As mentioned by many current scholars, the relationship with partners to date is the most challenging issue that needs to be dealt with. Although the relationship with supply chain actors is created through cooperation between partners, it does require trust and commitment for long-term cooperation, along with a willingness to share risks. Given that, when two different companies cooperate towards the same objectives, trust is one of the critical factors that determine the success or failure of the collaboration. Because cooperating companies are vulnerable to unforeseen circumstances, such as unresolved disputes over certain work or tasks, a contract is seen as a necessary vehicle to govern the cooperation for a period of time. However, there are mixed arguments in literature over trust and contracts when two or more companies are planning to cooperate or have cooperated. Some scholars argue that trust needs to be developed in the first place with the potential partners through communications and discussions before cooperation can be carried out. This initiative will help potential partners to achieve mutual understanding and only then will trust evolve through working closely together (Blomqvist, Hurmelinna, & Seppänen, 2005). Meanwhile, others argue that a contract is much more important in cooperation as it is a written guideline for both partners to compel them to certain acts that are subject to agreement in the signed contract. This is where trust between partners evolves over the agreements made in the contract. However, both trust and contract are imperative factors in cooperation and they are also complement each other. It is suggested that the contract between partners should be carefully designed, short and flexible in order to prevent any disputes.

Nevertheless, it is viewed that trust can also be a powerful mechanism that outweighs a contract when the partners have already bonded in a long-term relationship. Sahay (2003) has identified the effect of trust on the supply chain relationship between partners in cooperation. One of the effects is the length of the relationship in cooperation between partners. When partners are

comfortable with each other and satisfied with each other's capabilities in managing any tasks and issues during cooperation, this may contribute to the length of the relationship. This is significantly due to the trust factor that has grown between them. In addition, the willingness to make idiosyncratic investments or the willingness to make sacrifices for the benefits of the cooperation are also important. The willingness of the partners to put themselves at any risks indicates that they are willing to cooperate and win the benefits together rather than alone. Moreover, because of trust, partners are willing to share confidential information and it indicates that their intentions and motives are benevolent. This shows that cooperating partners can be trusted and are very determined in carrying out the cooperation in order to get and share the benefits.

As a matter of fact, trust cannot be developed in a short period of time, although some say that it should be developed quickly, particularly when it is at international level. However, in reality, to develop trust, particularly in new partners, definitely takes time. As trust is the most powerful 'make-and-break' part of collaboration, therefore, a certain time is needed in order to obtain a strong trust. Blomqvist et al. (2005) indicate that trust and contract are complementary mechanisms when it comes to collaboration. Although they are intertwined with one another, trust will be the most powerful vehicle of governance than the contracting mechanism when it is well established between two or more companies, particularly when the collaboration has lasted for years. Reina, Reina, & Rushton (2007) discuss three main components of the Transactional Trust Model, namely contractual trust, communication trust and competence trust. These components are interrelated with each other and move in a sequence in which contractual trust is the beginning of collaboration, followed by the communication between partners in collaboration, and finally the trust in each other's abilities and skills such as seeking their input and help. When trust is present, therefore, partners feel respected and are able to utilise their abilities, accomplishing the jobs for which they have been prepared.

3.3.5 Supply Chain Integration Practices (SCIP)

As mentioned by Bichou and Gray (2004), the SCIPs in the seaport/port terminal sector may involve the extent to which the port plans and organises activities, processes and procedures beyond its boundaries and monitors performance in such activities. Notteboom and Rodrigue (2005) suggest that such supply chain logistics integration practices may include involvement in the introduction of a new shuttle train service to the hinterland, together with the respective

national railway companies, rail operators, shipping companies and/or large shippers. It also includes the extent to which port management collaborates with other members of the supply chain in order to identify cost-effective and supply chain performance-enhancing solutions for the goods passing through the system.

Moreover, the authors indicate that, in order to accomplish the logistics integration practices, ports should be more proactive rather than reactive in a modern globalised world economy. This indirectly translates that ports should move from a fragmented system where functions or distribution activities ranging from shipping lines, freight forwarders, custom agents, rail and trucking companies are performed separately and individually into fully integrated system where all port stakeholders in logistics closely collaborate and cooperate towards mutual objectives (Notteboom & Rodrigue, 2005). The closest example of the supply chain integrated system where ports should be proactive in collaborating with other port stakeholder actors is precisely presented by Berg & Langen (2011) through a case study of port of Barcelona. The case study shows that the Barcelona Port Authority (APB) has successfully integrated its business activities with other hinterland transport companies such as rail operators, rail developer infrastructure, container depot operators and terminal operating companies in the hinterland area through the logistics activities, in particular the improvement of the inland infrastructures (i.e. rail shuttles) as well as logistics hubs and house through the development of multiple distribution centres (i.e. container depots) in order to tailor its users' needs. Through its master plan strategy, Barcelona Port Authority (APB) has extended its business scope activity from port-centric into the hinterland in which supporting the development of supply chain development.

3.4 SUSTAINABILITY ADVANTAGE OF PORTS ON THE PERIPHERY

As the world population of humans reached more than seven billion in 2014 (UN, 2014), so human activities that are believed to erode environmental sustainability are also increasing (Hanafi, 2012). It is viewed that the upstream and downstream flows of products/raw materials, services, finance, and information from source to end users are some of the human activities that contribute to the environmental issue in the supply chain process. In the supply chain process, transportation is one of the large contributors to pollution, resource depletion, congestion and GHG emissions and its impacts on the environment and society are increasing due to an increase in international trade between countries (Bloemhof et al., 2011). Thus,

sustainable supply chain activities and management receiving increased awareness from many entities such as governments, society and businesses in order to find innovative ways to make a profit without – or at least with minimal – environmental deterioration.

Sustainability awareness in reality could be used by firms as a stepping stone to distinguish themselves from competitors in the same industry, reduce cost, improve services to environmentally concerned customers and ultimately improve the business performance in the long run. Sustainability as defined by the Development (1987), means: ***"being able to satisfy current needs of the enterprise and its stakeholders today, while protecting, sustaining and enhancing the human and natural resources that will be needed in the future"***. This definition embraces issues such as the environment, economics and social aspects. These three elements are interrelated and cannot be measured with only one- or two-dimensional indicators (Bloemhof et al., 2011). Instead, these three elements must be combined to gain a thorough sustainability aspect (Bloemhof et al., 2011). Thus, it is important to view the sustainability dimension as an holistic integrated concept (Winter & Knemeyer, 2013). In addition, Kim (2014) indicates that sustainability should be considered as a strategic/operative practice, which means the simultaneous pursuit of economic prosperity, environmental quality, and social responsibility. Conducting its business differently and being difficult for other competitors to challenge would be a huge advantage to a firm, particularly in the long run.

It is understood that many firms lack sustainability awareness and sometimes some of them simply take for granted the importance of and consequences that could be generated from it. No matter how small or big a company is and in which industry they are operating, a sustainability initiative should be taken as early as it can be. Dey, LaGuardia and Srinivasan (2011) suggest two recommendations relating to short- and long-term sustainability which could benefit firms. For the short-term recommendation, there are five strategies that could be used and adopted by firms as guidelines for them to maintain awareness of the sustainability issue, such as (1) start today, (2) start simple, (3) the commitment from top management, (4) create a visual representation of your global supply chain, and (5) benchmark each area of the global supply chain against other firms. Meanwhile, the strategies for the long-term recommendation are: (1) stay ahead of government regulation, and (2) set measurable carbon goals.

Literature indicates that there are various drivers that influence companies, in particular in the port sector, to invest in environmental performance. **Table 3.1** shows the motives and drivers that influence ports to invest in environmental performance in order to be sustainable (Adams et al., 2009). Of the drivers, the three main reasons that force firms to take sustainability issues into consideration in daily business operations are social licence to operate, corporate conscience and competitive advantage. Firstly, whenever a port wants to expand its business area to a nearby new location or to environmentally sensitive areas which involves the construction of buildings from scratch, it will need approval from the government to make sure the project will not harm the environmental areas or society as well. The permission given by the government is seen as the social licence to operate when all the safety aspects have been comprehensively taken into account by the port. Secondly, the corporate conscience is an outcome from the corporate philosophy at the executive level. Previously, sustainability issues were not the main objectives of firms when conducting business; instead, they were more profit oriented. However, this is not the case anymore, as many firms nowadays are more sustainability conscious, particularly with regard to the environmental and social aspects of the business. In fact, some of the big firms put the sustainability aspect as one of the prime corporate objectives of the business.

This is where the third reason being created when firms undertaken the sustainability awareness into their consideration which is the competitive advantage. A lot of costs could be saved whenever the sustainability issues are being stressed by the firms. However, to persuade firms to emphasise the sustainability awareness and perceive it as one of the main corporate objectives of the firms is not an easy task. Hence, sustainability can be considered as one of the new mechanisms of competitive advantage which could be adopted by firm in distinguishing themselves from other competitors. Apart from the general discussions and claims that the sustainable development involved a fortune of money, study conducted by Lieb & Lieb (2010) on third party logistics (3PL) industry revealed that the environmental issues able to bring the positive impacts to the business. Fostering the green culture among employees within organisation, reducing operating expenses particularly the fuel cost up to 40%, produced satisfaction and fun for the staff and the improvement of company's image has been addressed as well.

In addition, the most interesting finding is the sustainability efforts by the firms led to the increasing business not only between existing customers but also with new customers. Being

as sustainability awareness offers tremendous opportunities for companies to save costs, increase efficiency and gain new customers and suppliers. Above all, it is one of the potential ways that can be exploited in gaining the competitive advantage in the long run particularly for the emissions and waste heavy supply chain. It is also viewed that the inability to follow what have been appointed by the government or in other words incapable to adhere the rules and regulations concerning the green environmental will ended up with the costly effects. Lopez-Gamero, Molina-Azorin, & Claver-Cortes (2010), in their study discussed the different impacts of environmental regulations styles between command-and-control and voluntary norm. The results from the study confirmed that between the two styles, voluntary norm initiated by the firms significantly contribute more to the competitive opportunities.

However, there are two contrary viewpoints in literature that have been written, discussed and presented over the sustainability issues in which one party sees it as the opportunity to economic success meanwhile the other is not. Upon the dispute over the sustainability issues, it is viewed that sustainability can be treated as business opportunities if companies think out of the box and be more innovative on how to tackle the issue and make it a profitable activity. Meanwhile, the negative views on sustainability issue are due to the inability to see it as an opportunity to make it as a profitable activity instead blaming the increasing costs that they have to bear. It is understood that changing a business structure activities to a more sustainable approach or method cannot be done overnight, particularly when it is associated with environmental aspect. Nevertheless, to be more environmental sustainable does not need to change every aspect in business activities, instead, a small or a slight changing in any business activities could bring a great impact not only to business performance but also to society.

Given that sustainability could be implemented in any areas (Dey et al., 2011) such as supply chain, value supply chain, distribution chain and reversed logistics, therefore, in this research, the concentration is on the distribution chain which involving the transportation network system. Transportation is well known as one of the sectors that contribute to the environmental issues particularly with the release of the CO2 from the GHG and as the consequence from the combustions, indeed the negative impacts will be hitting on our environment and individual health. Therefore, it is a necessary for managers to decide the best mode of transportation to be used in transporting the goods (raw, semi-finished and finished) from the supplier to the manufacturer as well as the distribution networks that are more efficient and greener.

Table 3.1: Potential investment motives and drivers for environmental performance

MOTIVES	DRIVERS	
(1) Regulatory compliance	International marine and/or environmental legislation	Regional environmental Regulatory legislation
	Local (e.g. provincial) environmental legislation	Self-regulation
(2) Respond to societal pressure (and enjoy resulting direct economic benefits)	Corporate and Social Responsibility	Local communities' concerns and public relations
	Environmental protection and/or quality improvement	Assess environmental impact of port's activities
	Economic Incentives (Tax exemption, subsidies, capitalisation, revenues)	Insurance premium & reduction in liabilities
	Environmental management (e.g. pollution prevention)	Profit: emissions trading market
(3) Development & Planning	Coastal zone planning	Port policy and planning
	Component of port's sustainable development programme	
(4) Operational Issues	Operational performance	Cost reduction and control
	Health and safety issues	Labour relations
	Processes standardisation	Environmental problem-solving and remediation plan
(5) Gain competitive advantage	Competition between regional ports	Corporate strategy
	Short sea shipping promotion	New markets
	Create/Enhance/Promote "green logistics"	Collaborative logistics
	External business pressure (e.g. shipping lines, terminal operators)	Strategic alliances
	Commercial and marketing interest	

Source: Adapted from Adams et al., (2009)

International Maritime Organisation (IMO) has identified that maritime transportation is the least environmentally damaging mode of transportation and it is the most minor contributor to marine environmental pollution from humankind activities. **Table 3.2** displays the carbon emissions produced by the main four modes of transportation. Other than ship, the combustion released by rail transportation is not bad as the other types of transportation as coal was using as the main source to move the rail. Moreover, inter-modalism-operations activity in

transporting goods from one location to another is listed as the second least contributors to the environmental damaging pollution from human activities. The amount of carbon emissions produced per transportation mode provides additional support that intermodal maritime transportation is the most efficient way to ship goods. Studies conducted by Liao, Tseng, & Lu (2009) and Liao, Lu, & Tseng (2011) in Taiwan found out that truck produced more CO2 emission than intermodal transportation in transferring container and when the two mode of tranportation being compared, intermodal transportation could reduce the CO2 emission by over 60%.

Table 3.2: Carbon dioxide (CO2) emissions produced by modes of transportation

Mode of transportation	CO2 emission per tonne.km
Air transport	550 g
Road transport	50g
Rail transport	20g
Maritime transport	3g

Source: Ligteringen & Velsink (2012), pp. 4.

Therefore, those firms that use water freight, rail freight and intermodalism freight to ship their goods long distances, while reducing the amount of road time, will not only make an impact financially, but also environmentally. In addition, increased attention has been focused on clean vehicles in their day-to-day operations and switching to sources of alternative or hybrid fuel technology. Therefore, to deal with the environmental problem, particularly the carbon emissions, released by road transportation, firms need to consider shifting their transportation choice to the most environmentally friendly modes of transportation when transporting freight, rail and water. Moreover, the intermodal mode of transportation should become more common in transporting the goods to the end users. An investigation carried out by Eng-Larsson and Kohn (2012) revealed that most shippers in Sweden were willing to change the mode of

transportation from road to rail, although a few adjustments had to be made, such as to operational activities. It was identified that the main reasons why those shippers were willing to change their distribution structure were due to the cost and environmental efficiency that the modal shift could achieve.

Ignoring the carbon emissions released into the air would have a negative impact not only on the environment and humans; it could also have a tremendous impact on the total cost of the products transported to the final customers and at the same time damage a firm's reputation. In developed countries, the concept of being green in any aspect of human activities is a new and widespread paradigm among communities in order to maintain the sustainability of the nation and region. Every single activity that a firm will undertake in the near future relating to sustainability issues, particularly the environmental and social aspects, should be emphasised and prioritised; otherwise, it will suffer negative consequences and its business activities will be affected.

Sweden for instance, has imposed a kilometre tax on heavy goods vehicles (HGVs) in road transportation since 1991. The tax is levied on fuel consumption, regardless of whether the company is a manufacturing or logistics one. The main objective of this policy is to reduce the amount of road transportation. In addition, it is also aiming to reduce the road network damage, because HGVs are one of the major contributors to road network damage, and subsequently reduce the maintenance required to the road network, as this consumes a lot of financial expenditure. If the carbon emissions released by the HGVs are in excess of the allowance given, then the tax will be applied and firms will be charged at 1-10 SEK per kilometre that they drive on the road. This is where the additional costs will be added to every product unit, as a consequence of the tax policy, which will be borne by the end customers.

In literature, there are three main ways to reduce the GHG emissions: (1) technical measures, (2) market-based instruments, and (3) operational options (Psaraftis & Kontovas, 2010). The technical measures relate to technical aspects of the instruments used, such as the energy fuel and the changes to vehicle specifications, to name but two. Meanwhile, the market-based instruments concern the taxes and subsidies available to prevent GHG. The often-mentioned market-based instruments are emissions trading and carbon levy schemes. On the other hand, the GHG emissions can be reduced by an organisation's business operations. Similarly, González-Benito & González-Benito (2006) have also suggested several initiatives to reduce

environmental degradation, such as through the selection of cleaner transportation methods (see **Figure 3.2**). In maritime transportation, the ship speed, the routing selections, the selection of energy and greener modes of transportation are some of the operational initiatives that could be adopted and applied.

As previously discussed, even though ports on the periphery lack intermediacy, one of the obvious advantages that could be obtained from this geographical weakness is environmental sustainability. Ports on the periphery could enjoy environmental sustainability as a trade-off for their lack of intermediacy or position away from the main maritime shipping routes or networks. The environmental sustainability enjoyed by ports on the periphery basically is an enormous opportunity that can be used as a mainstream mechanism to attract more port users to come to this category of ports. This indicates that business opportunities can be created with the dynamic capability of port managers to promote more efficient and greener distribution networks to foreland and hinterland port users. This opportunity becomes clearer when stringent environmental regulations are implemented by governments. These stringent environmental regulations will put pressure on companies such as logistics transport providers to become greener.

It is believed that environmental policies will encourage the logistics service providers to improve their current supply chain distribution networks to become greener and more environmentally friendly networks in order to optimise the efficiency of transport and logistics. In addition, they are also able to positively influence logistics service providers to pursue the best practice, innovation and strategy in their distribution networks. Changing to more modes of transportation that are more energy efficient and have a lower carbon footprint and to green distribution networks are two of the best practices that could be adopted in order to reduce carbon emissions and reduce environmental degradation. Hub and spoke services, for instance, can be used to replace the longer inland transport networks. This modal shift approach not only brings cost effectiveness derived from the greener distribution through the use of short sea, coastal and inland waterways to logistics companies, it is also more resilient, offers more price stability and is more environmentally friendly. This is where the new market opportunities for port users and port service providers of ports on the periphery are created if sustainability is treated as part of their business goals (see Markley & Davis, 2007; Nidumolu, Prahalad, & Rangaswami, 2009; Reinhardt, Casadesus-Masanell, & Nellemann, 2012).

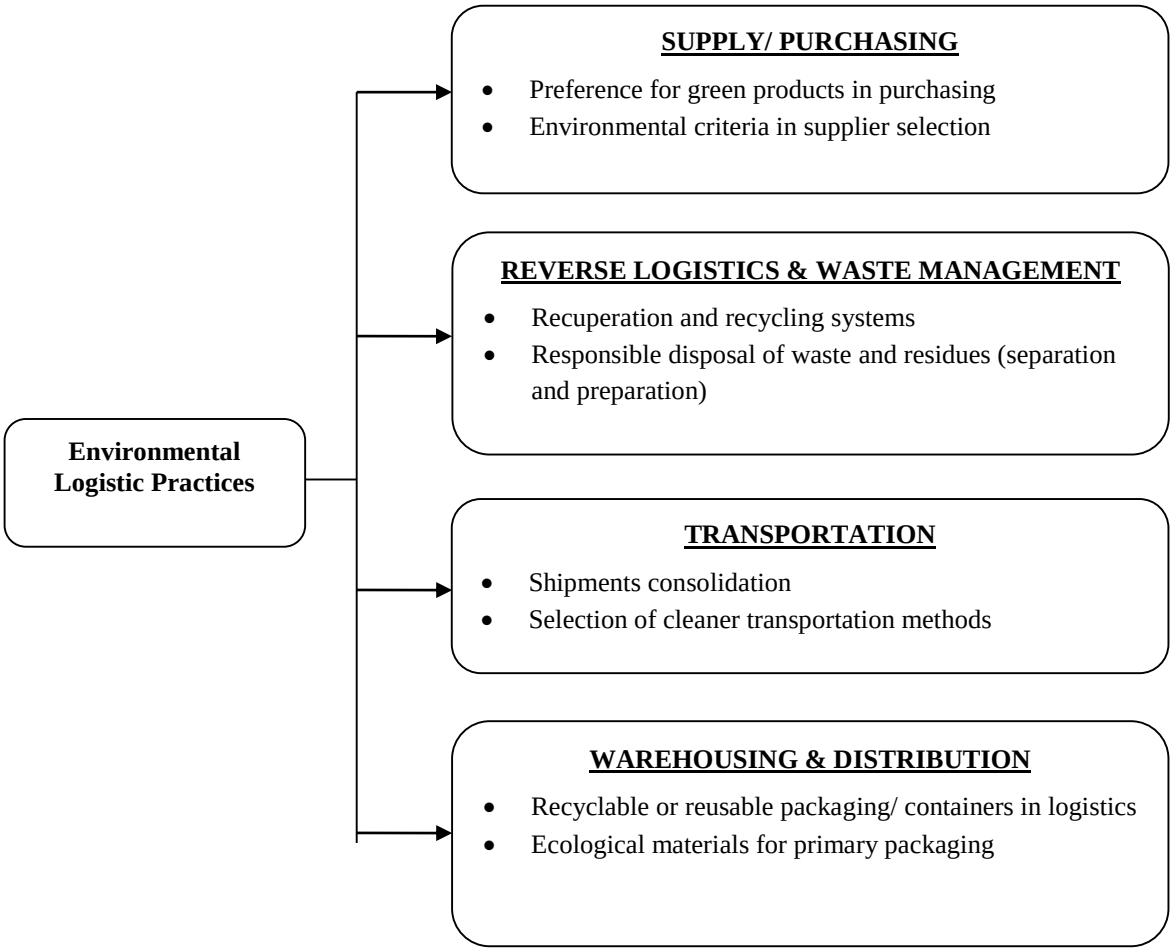


Figure 3.2: The representative of environmental logistics practices

Source: González-Benito & González-Benito (2006)

Apart from carbon emissions, other problems such as congestion are frequently associated with road freight transportation networks in which delays, either during the loading and unloading process (Bloemhof et al., 2011) or when vehicles are stuck in traffic due to various problems. Specifically, hinterland traffic congestion is characterised by the slow speeds of vehicles on the road and an obvious impact is longer and unreliable travel times and, ultimately, negative economic effects as a result of the inefficient distribution and delivery of goods, services and resources (Santos et al., 2010). Congestion does not only happen in inland transport networks but also at major ports as a result of traffic concentration. The agglomeration of traffic to specific ports has been questioned because it leads to congestion and also will dis-benefit many peripheral ports (Monios & Wilmsmeier, 2012) that are currently struggling to maintain their

traffic volumes and business from the foreland and hinterland. As the amount of traffic handled at major ports is increasing, it is foreseen that congestion will be the main issue as these ports become the centre for most port users. In addition, they will eventually encounter the dis-economies of operations due to the limitations for further expansion, such as land shortage, increased cost and environmental constraints. As a consequence, cargo concentration will reach its limit and enable smaller ports or new ports to acquire a place in the market. Gradually, the economic and social sustainability in the vicinity of the periphery ports will be developed and flourish.

With their proximity to large hinterland markets and the environmental sustainability advantage (greener supply chain distribution networks and the reduction of GHG - carbon emissions), ports on the periphery would be the catalyst to attract more conscious environmental users from foreland and hinterland markets. This environmental advantage represents a market opportunity for firms (Lopez-Gamero et al., 2010), in particular ports on the periphery. In addition, the continuous pressures from governments and non-government sectors have significant direct and indirect impacts for all port stakeholders. Moreover, it also will slowly but surely change the logistics service providers' business mind, behaviours, practices, and strategies to be more innovative and proactive towards greener supply chain distribution networks (Lau, 2011). The modal shifts from long inland transportation networks to shorter inland networks and water transportation is seen as a promising strategy in reducing carbon emissions, and attracting existing and new customers to ports on the periphery. This shift will promote and support the industrial development in the vicinity of the ports on the periphery and to regional areas by attracting more Foreign Direct Investments (FDIs) (Lu, Shang, & Lin, 2012). In addition, with the rational uses of ports on the periphery, it will eventually improve the local and regional traffic conditions through the modal shift as well as industrial developments (Jeon, Amekudzi, & Guensler, 2013). Given that the ports on the periphery are closer to the main hinterland markets, therefore, longer inland transportation networks can be reduced, and this would be a tremendous advantage to port stakeholders to minimise the environmental deterioration, and reduce costs and time.

Economic development is not the only impact generated from the environmental sustainability of ports on the periphery; the social welfare of the community in the vicinity of the ports also improves. One of the benefits of this sustainability advantage of ports on the periphery to the community is job opportunity and more jobs will be available as the economy flourishes and

prospers (Jeon, Amekudzi, & Guensler, 2008). With greener and more efficient of supply chain distribution network, it will be an attractive driver for port users to make more port of calls at such ports. The incoming of more port users encourages the development of the economic activities at port areas. In addition, with the availability of land spaces, it allows ports to create many logistics activities such as port-centric logistics, FTZ and Logistics Park at the port area in order to attract more business. Thus, it is viewed that the incoming of more port users and the development of logistical activities at the ports on the periphery will create more job opportunities as the economies in the vicinity of these ports are prospering and this consequently has positive impacts on the regional growth domestic product (GDP) as the economic activities become stronger. Given that ports on the periphery are closer to a country's main hinterland markets, therefore, the environmental pollution, particularly carbon emissions, can be minimised through the use of waterway transport (either deep sea shipping or short sea shipping) and shorter inland transport networks (Bloemhof et al., 2011). Since the use of ports on the periphery as ports of call would minimise the carbon emissions and other related emissions at gateway ports and big ports, this has an impact on human health. Thus, the competitiveness of ports on the periphery can be enhanced and improved as more and more business comes to the ports and port areas, and subsequently the business performance of ports on the periphery can be significantly improved.

3.5 SPATIAL CHARACTERISTICS OF PORTS ON THE PERIPHERY

In the maritime transportation geography literature, it has been recognised that, if a port wants to be competitive, there are two geographical perspectives that could determine its success: situation element and site element (see section 2.3, paragraph 9). Of the two elements, situation has been identified as the most significant contribution to whether a port will flourish (McCalla, 2008), as it relates to the location of socio-economic activities, including manufacturing, retailing, and services at central and intermediate traffic-generating areas. In addition, Rodrigue, Comtois, & Slack (2013) indicates that accessibility between a port's location and the location of the socio-economic activities is another important element that could influence the port's success.

Nevertheless, it should be noted that whether a port is successful or struggles not only depends on the situation element; the site element could also be influential. However, inadequate site or situation elements do not mean that a port will be unsuccessful; instead, they can be

manufactured as well as doctored by human, corporate and government contrivance. Similarly, transport accessibility can be manufactured, in particular when international trade activities and demand are increasing rapidly. Fleming (1997) indicates that, to become more competitive, to generate more local jobs and to generate and increase incomes, ports are advised to groom and improve their sites in order to attract more customers and lure in new portside industries development, which could generate higher traffic. Meanwhile, the situation element can be improved through the hinterland connection and by the port selling its relative location as being close to the main hinterland markets of a particular location, country or region.

3.5.1 Site characteristics of ports on the periphery (The significant of site element - The port location)

Under the transport and location concepts that have been discussed by geography experts (see Fleming, 1997; McCalla, 2008; Rodrigue, Comtois, & Slack, 2009, 2013), the site element relates to the specific micro-geographical (local) characteristics of ports, including land space availability, basic utilities, visibility (related activities such as management), amenities, and the level of accessibility to the local transportation network. Meanwhile, McCalla (2008) discusses the site element from two perspectives, physical environment and human environment attributes. The physical environment is the port's natural characteristics, such as land space availability (for future expansion such as cargo handling, storage, distribution) and water aspect (such as the water depth, tides and shelter). Meanwhile, the human environment relates to human activities and infrastructures including economics, financial resources, terminal/port management, infrastructures and labour.

Given that the focus of the current study is on peripheral ports, therefore, the literature discussion of the site and situation elements in this chapter is based on the condition of this category of port. The fundamental site element, according to McCalla (2008), refers to the spatial properties at that place, the vertical dimension. Specifically, it refers to the local underlying areal conditions or characteristics and leads to defining the geography of the port area (McCalla, 2008). Although seven site factor attributes have been discussed earlier, this study concentrates on two important attributes that have major impacts on the performance of this category of ports, land space availability and terminal/port management. Both of these important attributes contain two important components that will be discussed under the site element, human and physical environment. Specifically, the former refers to terminal/port

management that relates to the involvement of global terminal operators (GTOs) in the port operations, and the latter is associated with the availability of land space.

GTOs, as defined by Bichou and Bell (2007), are companies involved in international port terminal operations with the view of establishing globe-spanning network services. The classification of GTOs in maritime transport literature varies among researchers, although it has a similar meaning. Slack and Fremont (2005), for instance, discuss transnational terminal operating companies as being a product of horizontal integration and serving multi-user berth operations, and international shipping lines as being a vertical integration and serving dedicated terminals. In contrast, Parola and Musso (2007) discuss the GTOs in three difference categories: pure stevedores, who purely manage and get profits from port and terminal operations; integrated carriers, which purely handle their own terminal by having a dedicated terminal in order to manage their transportation costs in the hinterland leg; and last but not least is the hybrid terminal operators, which reflect the shipping lines that have separate or independent organisations to manage the port operation business. The terms used in their study are quite similar to those in the one conducted by Slack and Fremont (2005); however, the former added and discussed the hybrid classification. Meanwhile, Cheon (2009) also differentiates GTOs into three main categories, but they are global stevedores, global carriers and global hybrid. On the other hand, TOCs is a term used by Langen and Chouly (2009) in their research in reflecting the concept of GTOs. Recently, Notteboom and Rodrigue (2012) wrapped up the classification of these GTOs into three main categories: stevedores, maritime shipping companies and financial holding.

The involvement of GTOs in port operations is very important. Including GTOs in port operations is believed able to give tremendous impacts not only to the competitiveness but also the performance of a port. This is due to the capability of the GTOs in managing and handling the cargoes and containers effectively and efficiently. The absence of GTOs from port operations, which then solely rely on local port operators, might have severe impacts on port competitiveness and performance. This is proven with the case of Le-Harve and Marseilles ports in France (Slack & Fremont, 2005), which are reluctant to open their doors for GTOs to be established there. In addition, no international lines have made these two ports their hubs. Apart from being managed by local terminal operators, it has been identified that the two ports have many other problems, such as lack of financial sources, the inefficiency of the cargo- and container-handling equipment, and the low number of crane operating hours, to name but a

few. As a consequence, these ports have suffered a severe market flop, which has had a significant impact on their business performance.

Literature indicates that the involvement of GTOs brings prosperity to port activities and business. This is confirmed by positive results that have been obtained based on the data envelopment analysis (DEA) on the impact of GTOs carried out by Cheon (2009). He adds that, among the three categories of GTOs, global stevedores show the highest impact on port efficiency compared to global carriers and global hybrid. In addition, Tongzon and Heng (2005) found that the involvement of the private sector in port operations to some extent can improve port efficiency, and in turn it will improve port competitiveness and subsequently performance. Moreover, in 2008, a study performed by McCalla found a significant relationship between the port management (GTOs) and the higher productivity (in throughput) in three main Caribbean seaport hubs: Colon (Panama), Kingston (Jamaica) and Freeport (Bahamas). These three main hub ports are found to be handled by the top 10 GTOs, including Evergreen, SSA Marine, Hutchison, and APM Terminals. An interesting finding from the above relationship reveals that these top 10 terminal operators have a close relationship with shipping lines, which explains the higher throughput handled at these three hub ports.

Meanwhile, the physical environment element under the site domain factor refers to the availability of land or space that a port has and the depth of water at the port, which will allow bigger vessels to be berthed. It is said that the availability of land or space is not only very important for a port's future expansion and developments, it is also one of the factors that could attract certain trade and cargo volumes, particularly when there is direct competition between ports (Ligteringen & Velsink, 2012). The development of cargo or container yards and the development of the subsequent distribution business of a port, to name but a few, are some of the expansions that can be carried out in order to accommodate the increasing port traffic when a port has a large amount of land. The increasing traffic at a port basically increases the demand for space by both port users and operators, and a port with land or space available will be seen as able to accommodate the higher volume of traffic. This additional space helps a port to prevent any unwanted issues such as congestion. Thus, the turnaround time of vehicles at sea (ships) and land (trucks/ trail) can be maximised efficiently without any further disruptions or extra costs incurred. In addition, the availability of space allows ports to create the logistics park activities at the port area in order to attract more businesses. Ports on the periphery are seen as being able to offer these advantages with respect to congestion, costs of land and labour.

Port-centric logistics, for instance, is one of the logistics park activities that could be developed on the availability of land space proximate to the port area and consequently offer value-added logistics to customers (Mangan, Lalwani, & Fynes, 2008). Moreover, suppliers and other specialised inputs associated with the peripheral ports may also get benefits from these activities.

On the other hand, ports that lack of available land would find themselves struggling to handle increasing traffic, either at sea or land. Notteboom and Rodrigue (2005) indicate that ports, especially the large gateway ones, are facing a wide array of local constraints that impair their growth and efficiency. The lack of land for expansion, among others, is one of the most acute problems encountered by large gateways. This is perhaps due to the extensive expansions that have been carried out previously in order to tackle increasing traffic volumes. The continuous increasing traffic at the major ports coupled with the lack of space for further expansion may lead to severe problems not only at sea but also on land. Congestion, for instance, is seen as one of the main issues that will emerge from the said problems. In addition, the authors state that the increasing traffic volumes at major or gateway ports may lead to diseconomies as local road and rail systems are heavily burdened.

As mentioned earlier, one of the reasons that has led to the challenge of peripheral ports over transshipment hubs is severe congestion. Severe congestion at the transshipment hub will impact on the operational efficiency, whereby the process becomes slower, and contribute to the carrier's lower transship times. In addition, the carriers have to wait longer to be served at the anchorage area and the waiting costs are increasing. These problems would lead to carriers charging its shippers or customers congestion or demurrage charges due to the longer waiting time and higher costs that they have to bear. As a consequence, the congestion or demurrage charges will be shared with end users through the higher cost per unit of product that has to be paid.

In addition, due to the massive expansion that has been carried out previously by major or gateway ports, they also might encounter environmental problems if they insist on pursuing port expansion. As the environmental issue is becoming intense nowadays, ports need to be more dynamic in their business strategies in order to balance their profits and their environmental impacts. Southampton port, for instance, has been battling with Britain's environment sector over the expansion of Dibden Bay. The expansion, worth £600 million,

was turned down in 2004 by the Labour Government following a heated year-long public inquiry. It is said that the development of Dibden Bay, which will be ready between 2021 and 2027, at the proposed New Forest National Park will bring negative impacts to the area; among these are the total loss of the foreshore mudflats, the total loss of the grazing marsh, and the irreparable damage to nationally and internationally designated wildlife sites (McCarthy, 2001). When interviewed in 2014, the former ABP chief executive in Southampton, Mr. Doug Morrison, was optimistic over the Dibden Bay development and believed that one day the project would continue (Robinson, 2014), although it had been a decade since the 20-year master plan was rejected.

3.5.1 Situation element (Proximity to hinterland markets - The concentration of port)

Intermediacy and centrality are two important attributes that encompass the situation element. A port in the maritime transportation industry is said to be successful when these two important attributes are met. In fact, to claim a port as a transshipment hub port (one of these types: hub-and-spoke, relay transshipment, interlining transshipment and feeder-feeder transshipment), it is a must to have these two important elements. If one of these attributes is not met, the port is claimed to be a port on the periphery. The intermediacy attribute refers to the proximity of a port to major shipping lane networks. It is said that, if the port is close to main maritime transportation networks such as Singapore and Hong Kong, which are located amidst the main corridor to Europe and the East Coast of United States of America (USA), it has the opportunity to grab throughput in the middle of the shipping lines' journeys from port of origin to port of destination.

In contrast, the centrality attribute refers to the hinterland area or a catchment area that the port serves for its population. In another term it is also known as the place where a port actively interacts with its customers (Ayfandopoulou, Gagatsi, & Myrovali, 2012). This is the market area in which the port sells its services and interacts with its clients, particularly with shipping lines, freight forwarders, shippers, consignors and consignees, and haulage operators, to name but a few. There are two main types of hinterland markets, as mentioned by Rodrigue, Comtois, & Slack (2013): main or fundamental hinterland and competitive hinterland. The former refers to the closest market area that the port serves and the latter indicates the market area that the port has to compete with other ports in attracting and to serve its clients. Nevertheless, it is difficult to identify a port with a captive hinterland market currently and it is said that they have

been diminishing gradually, with different strategies embarked by different ports. As a consequence, many ports are competing with each other in obtaining and sustaining the cargoes from existing and potential customers. In the contemporary maritime transportation industry, ports are advised to be more competitive in every single aspect in enlarging the scope of their hinterland markets, where the traffic could be generated continuously.

Ports on the periphery, as briefly explained previously, are ports that are off the main maritime transportation networks or ports that do not have large hinterland markets. Of the two, ports that do not have a large hinterland market are perceived to be able to be successful or become a transshipment hub, as they are located closely to the major maritime shipping networks. In addition, if it is warranted, development at such a site can be carried out by the port authorities in order to attract more shipping lines and hinterland users to come and use the services offered. In contrast, if a port is far from the main maritime shipping networks, it will be difficult to re-position its location to the vicinity of the main maritime shipping networks. The only advantage that can be relied on by this category of ports is their centrality or their hinterland markets. The centrality or the hinterland markets does not only reflect the market that the port serves, it also reflects how the market is being controlled by the peripheral ports, particularly when the hinterland markets that the port serves is contestable rather than being a captive hinterland market.

The concept of traditional hinterland markets is no longer exclusive to specific ports since the introduction of intermodal transportation networks. This situation means that the hinterland markets are prone to be competitive markets because any ports in different places could grab the opportunity to attract port users to use their ports. Ports have to ensure that the quality of hinterland transport services is closely controlled and monitored from time to time. Therefore, ports need to be more competitive in the contestable market by developing strategies that best serve the hinterland markets. As mentioned by Langen (2008), the quality of hinterland access depends largely on the behaviour of supply chain actors such as container operators, terminal operators, rail operators, port authorities and freight forwarders. In addition, there are a number of related maritime companies that provide hinterland services to port users and it is necessary to have effective collaboration and efficient coordination in hinterland networks between these related maritime companies and ports (Langen, 2007).

With the absence of the effective cooperation and efficient coordination of these supply chain actors, ports are unable to provide quality hinterland access or connection. Langen (2007) adds that there are five conditions for effective and efficient hinterland access to a seaport, as reported in the literature: (1) the transport infrastructure to the hinterland needs to be sufficiently well developed, (2) the transport infrastructure needs to be efficient, (3) the transport infrastructure needs to be well coordinated, (4) there is an increasing need for a sustainable transport system, and (5) the services provided by private firms (e.g. terminal services, barge services , etc.) need to be attractive. Since the competition between ports nowadays is no longer actually between ports but is instead between supply chain networks, therefore, it is crucial for ports to provide the current needs if they want to enhance their competitiveness and performance.

The important of centrality to a port is crucial to its ability to generate traffic, as it is one of the determinants that contribute to port competitiveness. Both established and new manufacturing firms are prone to choose ports that have the shortest distance from their firms rather than other ports, although rapid developments are taking place in the logistics chain in relation to transferring the goods (Garcia-Alonso & Sanchez-Soriano, 2009). It is seems obvious that, since hinterland markets are shared with many ports in the same country, continent or region, a port needs to be proactive when controlling its market and provide efficient coordination of hinterland access or networks with other supply chain actors through collaboration or cooperation, and thus it will be able to secure and widen its business compared to other ports.

3.6 PORT PERFORMANCE

Song (2012) in an 'ad hoc meeting assessing port performance' in Geneva, Switzerland, mentioned that port performance is used to monitor business activities, to compare the present and past performance, to compare the present with the target performance, to compare with competitor performance, to adjust business targets, to promote the business and to check efficiency, productivity and effectiveness. Although port performance is used to measure the success of a port, the concept is still unclear, albeit widely discussed and applied to measure the success of ports in the literature because it includes the overall concept of port productivity, economics, and finance (Lee & Kim, 2006). In addition, it has been identified from the literature that no specific definition or indicator of port performance has been extensively discussed and thoroughly developed. Moreover, the port performance indicators that have been

adopted in the literature are diverse in range as are the techniques for assessment and analysis (Bichou & Gray, 2004). This is due to the fact that no industry standard has been developed to measure performance effectively, and there is no single measure that can be used to sum up the important aspects of port or terminal performance indicators used to measure performance (Esmer, 2008). It is also viewed that the indicators used to measure port performance vary in perspective and change depending on the current business environment. International organisations, business practice and individual researchers have difference perspectives and thoughts on the measurements of port performance.

Despite the lack of specific indicators to measure the port performance, previous studies have relied on both macro and micro points of view in order to measure port performance. The macro and micro measurements of port performance that encompass three broad general indicators have been discussed and adopted in the literature – the physical factor, productivity factor, and economic and financial factor – are favoured by international organisations (UNCTAD,1976; Monie, 1987). In addition, the transportation, water and urban development department of the World Bank identified three port performance indicators: operational performance (including ship turn-around time and tonnage handled per ship day), asset performance (berth throughput and berth utilisation) and financial performance (rate of return on turnover, income generating operating surplus and expenditure to total GRT/NRT of shipping and the total tonnage of cargo handled at the port) (Chung, 1993). Similarly, Song and Han (2004) measure the performance of Asian container terminals using several indicators including berth utilisation, demand from economic activity, number of ship calls and geographical location. On the other hand, Fourgeaud (2000) argued that customised indicators used to monitor the performance of ports should be based on certain aspects, given that the benchmarks and requirements of one port to another are dissimilar in functions and category. He mentioned that the benchmarking of port performance should be differentiated base on types of commodities handled, operational handling (berth occupancy rate – types of charted ship) and staffing level (based on port ownership type).

Other than IMO, academic researchers have also shown an interest in the issue of port performance. From an academic perspective, port performance was traditionally measured at an intra-port level and an inter-port level (Marlow & Casaca, 2003). In particular, the former port performance was measured by comparing ports' actual throughputs with their optimum throughput, whilst the latter was measured through port productivity to reflect port operations.

For instance, (Tongzon, 1995) adopted port productivity, in particular the number of container boxes moved through a port (port throughput), to measure the performance of 23 ports around the globe by considering the port's location, the frequency of ship calls, port charges, economic activity and terminal efficiency. Similarly, in his PhD thesis, Yeo (2007) used throughput as a proxy for competitiveness measurement, which eventually contributes to the performance of ports in the Northeast Asia region. The use of port throughput as the main measurement of port performance is because of the theory assumption that ports are keen to maximise the throughput handled at their terminal/port.

Meanwhile, Feng, Mangan and Lalwani (2012) evaluate port performance (through the availability of shipping services, shipping services price, port/terminal handling, warehousing and other charges, feeder connection, cheapest overall route, cargo-handling speed, congestion and risks, port/terminal security and safety, proximity to customer, skilled employees, quality of hinterland transport networks, availability and quality of logistics services, government support and depth of navigational channel) and compare Western ports and Asian ports. On the other hand, given that most of the previous study focuses on a single approach, thus, Talley (2007) advocates that port performance should be evaluated through a multi-port approach (economics), which should be based on technical-efficient optimum throughput, cost-efficient optimum throughput and effectiveness optimum throughput. Meanwhile, Su, Liang, Liu and Chou (2003) measure port performance through financial, economic, internal business process, customer, and learning growth perspectives by using a balanced scorecard system and compare it with national ports in Taiwan, namely Taichung port, Keelung port and Kaohsiung port.

Apart from technical, operational and economic perspectives of port performance measurement, literature also suggests that some studies use non-financial indicators such as customer satisfaction, company image, and market share, to name but a few, to measure the performance of ports (see Brooks & Pallisz, 2008; Friman & Fellesson, 2009; Kim, 2014). Given that customer satisfaction emanates from the quality of services offered to customers, thus, it leads to the increasing of market share and profits and consequently to business success (Ugboma, Ogwude, Ugboma, & NNadi, 2007) as firms can attract new customers, increase their business with existing customers, suffer fewer lost customers, gain more insulation on price competitiveness, and fewer mistakes requiring the performance of services (Parasuraman, Zeithaml & Berry, 1985). Given that logistics such as ocean freight services are considered to be part of the service sector, therefore, customer satisfaction is the key ingredient to business

success in building customer loyalty and simultaneously retaining customers (Durvasula, Lysonski, & Mehta, 2000). The flexibility of services (such as quick response to customer demand) offered to customers is able to give significant satisfaction to customers (Zhang, Vonderembse, & Lim, 2005).

Given that the business environment in maritime transportation has changed, so too has the role of ports, which has moved from being simply a sea and land interface between ship and cargo for loading and unloading activities to being an element of a value-driven chain system (Robinson, 2002). The port industry has moved from providing a basic service to having a broader function that has close logistics chain activities throughout the entire process, from manufacturing to end customers. This highlights that the port is a pit for creating and offering value-added logistics activities where benefits can be increased through close collaboration between sea and inland logistics service providers. It also indicates that the measurement of port performance should also be parallel with the current business scope and role of the port. Thus, Bichou and Gray (2004) suggest that port performance should be measured from the logistics and SCM perspective rather than being based on the sea access. In addition, given that the port performance framework is associated with the logistics and SCM, the land-side efficiency should also be taken into account when measuring the current and future performance of a port. In the same study, Bichou and Gray (2004) revealed that almost 36% of respondents were dissatisfied with the current measurements that only considered throughput, productivity, financial and economic impact as their main indicators to measure port performance.

This port performance framework is in line with the suggestion made by Marlow and Casaca (2003) where the performance of ports should be measured not only from an agile perspective but also from a lean heart perspective. Seeing that the performance of a port could be enhanced through the creation of value-added services, Lee and Kim (2006), evaluate the performance of ports relating to the distriparks by considering the port back-up (distriparks) factor in terms of spatial view besides the container terminal factor. The measurements of port performance should include not only the inner factors of a port; instead, they should be associated with the outer factor, where the function of a port is no longer isolated but is integrated with other hinterland factors. In addition, Merk and Li (2013) clearly suggest that the performance of a port should be measured from three points of view: maritime foreland, where the intermediacy and centrality attributes are the main focus of the activities; port operational efficiency, where

the land productivity and labour relations are the centre of attention that should be concentrated on; and hinterland connectivity, where the accessibility between the port and the hinterland markets through efficient transport networks is the focus.

Seeing that the traditional measurement of port competitiveness performance has concentrated on the foreland perspective rather than on a combination of foreland and hinterland, Langen, Nijdam and Horst (2007) proposed new indicators in order to measure port performance (firm-level perspective) in the new business environment, where it should be based on three aspects, namely cargo transfer product, port logistics products and port manufacturing product. Given that the port industry nowadays is not like it used to be, when it reacted only as a transit point for ships to load and unload cargoes, thus, throughput is no longer suitable to measure a port's competitiveness. Instead, in the current supply chain environment, ports are advised to include its hinterland or external aspects, such as stakeholders' satisfaction and perception, for port performance assessment. In addition, rather than focusing only on one aspect of port performance, either the internal aspect or the external aspect, it is a must for ports to include both aspects in order to measure their overall performance in the millennium era; thus, port assessment will become balanced and not biased to only one aspect of the port system (Brooks, Schellinck, & Pallis, 2011).

Moreover, because port operations and management is a combination of three interrelated channel approaches, which are trade channel, logistics channel and supply channel, thus the performance of a port should be measured in terms of its contribution to the performance of the entire channel (Bichou & Gray, 2004). In particular, the internal aspect of a port's performance will be based on the efficiency of its operations, and the external aspect of its performance will be based on the effectiveness of its services in order to enhance its business profitability by concentrating on 'doing things right' and 'doing the right things' (Schellinck & Brooks, 2014). This means that it is important to measure whether or not the port system is successfully providing and delivering the services not only to foreland users but also to hinterland users.

Knowing that the performance of a port should not be measured by only looking at its internal or external aspects, therefore, in this study, both efficiency and effectiveness of the port system will be included in order to measure the performance of ports, in particular the performance of peripheral ports. This is in line with the claim made by Brooks et al. (2011) where these two

port performance indicators are like ‘yin’ and ‘yang’, in which they are interconnected and complementary to each other in bringing the ultimate success to the port system. In addition, Bichou (2007) indicates that focusing merely on a single aspect of efficiency or effectiveness is not the only way to enhance the performance of a port because there are many examples of ports around the world that operate effectively but are still inefficient and vice versa. To measure the performance of the fourth generation of ports, a comprehensive performance measure should involve all appropriate activities in the process and the interests of all relevant port users and stakeholders. Therefore, in this study, the effectiveness of port performance will be measured by service quality, customer orientation and service price. Meanwhile, the efficiency of port performance will be measured by sea and land operation, cargo operation and sustainability performance. These measurements of effectiveness and efficiency are adopted from various studies including Lopez-Gamero et al. (2010), Molina-Azorin, Claver-Cortes, & Jorse Pereira-Moliner (2009), Panayides and Song (2008), Panayides and Song, (2009), Rao and Holt (2005), Song and Panayides (2008), and Woo et al. (2012).

3.7 SUMMARY

This chapter has discussed the potential strategies that could facilitate the enhancement of the performance of ports on the periphery. In particular, the strategy of PSCI, sustainability advantage and the spatial characteristics of ports on the periphery such as situation and site elements have been discussed in details. In addition, this chapter also explains the importance of the strategies for the success of ports on the periphery in retaining the existing customers and attracting more potential and new customers from foreland and hinterland markets. All of the information that has been gathered in this chapter will be used for further discussion in this study. To be more specific, in the following chapter - the development of research hypotheses and the research framework model to examine the possible relationship between spatial characteristics, PSCI strategy, sustainability advantage and peripheral ports’ performance will be presented in details.

CHAPTER 4

HYPOTHESES DEVELOPMENT AND RESEARCH FRAMEWORK MODEL

This chapter presents the conceptual research framework which has been developed through the literature review. In addition, this chapter addresses the presence of the causal relationships between constructs and subsequently the development of the hypotheses. The chapter starts with an introduction, in which a brief explanation of the flow of the research conceptual framework and hypotheses development will be highlighted. The relationship between each construct will be highlighted and presented separately in section two. Thirteen hypotheses have been developed through the literature review. The last section of this chapter provides a summary, which will recap the process in generating the study hypotheses.

4.0 INTRODUCTION

In chapters two and three, the author reviewed the past and current literature. Based on the reviewed literature, a gap has been identified and further work should be conducted, which is the hypotheses development. In formulating the hypotheses, this section discusses the potential theoretical relationships between situation and site elements of peripheral ports, PSCI strategy, sustainability advantage and the performance of peripheral ports. To test the hypotheses, measurements for each construct have been identified and adopted from the existing and established literature. Given that, the current study has multiple variables that have causal relationships between one another, therefore, to develop the hypotheses, the relationships between the constructs will be explained separately in details. It is important to explain and discuss the relationships separately as each relationship between construct may have direct or indirect effects. The first hypothesis will be explained through the relationship between the situation element of peripheral ports and the port performance. For the second hypothesis, the relationship between the site element of peripheral ports and the port performance will be elaborated in detail.

Thirdly, the relationship between the situation element of peripheral ports and the strategy of PSCI will be uncovered in order to show the presence of a positive relationship between the

two constructs. Similarly, the development of the fourth hypothesis between the site element of peripheral ports and the strategy of PSCI will be carried out accordingly. It is followed by the fifth hypothesis, where the potential relationship between PSCI strategy and port performance will be revealed based on the literature. The sixth hypothesis of the current study is between the situation element of peripheral ports and sustainability. The relationship of the site element of ports on the periphery and sustainability will be explained in order to propose the seventh hypothesis. For the hypothesis eight, the relationship between sustainability and port performance will be revealed. On the other hand, given that there are indirect relationships found in the literature, therefore, the ninth and tenth hypotheses focus on the strategy of PSCI and the three other constructs, the situation and site elements of ports on the periphery and port performance.

It is presumed that there is a positive link between PSCI strategy and sustainability. The relationship between the two constructs will be presented in the development of the eleventh hypothesis. Meanwhile, the development of the twelfth and thirteen hypotheses concerns the indirect relationships of PSCI strategy between spatial characteristics (situation and site elements) and sustainability.

4.1 RESEARCH MODEL AND HYPOTHESES DEVELOPMENT

This section elaborates in detail on the hypotheses development of the study. In particular, the direct and indirect relationships between variables are explained separately.

4.1.1 SPATIAL CHARACTERISTICS OF PORTS ON THE PERIPHERY AND PORT PERFORMANCE

4.1.1.1 Situation element (proximity to hinterland markets - concentration of ports)

Intermediacy and centrality are two important factors that are incorporated in the situation element. A port in the maritime transportation industry is said to be successful when these two important elements are present. In fact, to claim a port as a transshipment hub (any one of these types: hub-and-spoke, relay transshipment, interlining transshipment and feeder-feeder transshipment), it is necessary to have these two important elements. If one of these elements is not met, the port is claimed to be on the periphery. Given that the current study focuses on ports on the periphery that lack intermediacy but are proximate to hinterland markets, therefore,

centrality will be highlighted in this section where its capability in attracting customers from hinterland and foreland markets will be discussed. In addition, its impact on the ports' performance will be discussed and addressed.

The importance of the hinterland markets to a port is crucial as it is one of the factors that contribute to the volume of traffic generated and subsequently to business performance. This is highlighted by Feng (2013) in his study in the Bohai Sea Region, China, where the importance of the hinterland in terms of GDP positively influences the increment of total cargo volume at the peripheral port. In addition, in port selection criteria study from the hinterland perspective, Garcia-Alonso and Sanchez-Soriano (2009) argued that most established and new manufacturing firms prefer to choose a port that has the shortest distance from their firms, although rapid developments in the logistics chain are taking place in transporting the goods (even for container traffic) – in particular, the hinterland's accessibility through an intermodalism approach. This indicates that the distance between port users and port of departure is an important key factor to many firms. In addition, Nir et al. (2003) revealed that travel time and cost are two significant factors that influence the port users' behaviour when selecting the port of choice. This shows that they (port users) prefer to choose the closest port to save on travel time. This might be because transportation cost is one of the main elements that port users consider when it comes to transporting their goods (Tongzon, 2009). Shorter travel times from/to port of departure help firms to reduce costs significantly (such as fuel consumption, vehicle maintenance, toll and congestion tax).

Moreover, Wiegmans, Hoest, & Notteboom (2008) show that the hinterland markets is among the top three criteria considered by deep sea container operators when deciding where to make ports of calls. Meanwhile, Chang et al. (2008) revealed that, if ports want to become ports of call for shipping lines, they have to ensure that the local cargo volume is highly significant as shipping lines are more attracted to higher volume of local cargo. To increase the volume of local cargo and attract more shipping lines, ports are recommended to build up their local cargo base. Given that ports on the periphery are proximate to the main market of a particular country/region compared to other distant ports that need to rely on the effectiveness and efficiency of the hinterland network, therefore, it is viewed that such ports are able to generate huge amounts of cargo where most of the key business players such as manufacturers and logistics companies reside. Lugt and Langen (2005) added that ports not only need to be reactive to any changes in supply chain strategies, they also have to develop strategies to

improve their attractiveness for logistics activities and subsequently improve their competitiveness (Mangan, Lalwani, & Fynes, 2008). Furthermore, Wu (2011) suggests that the choice of which ocean carriers will use is increasingly reliant on the economies and conditions of the entire chain rather than the locational advantages (intermediacy) of individual ports. Tongzan (2009) claims that the distance of a port and its users' premises is critical for freight forwarders in Thailand, where it was ranked second out of seven factors.

Hypothesis 1: The closeness of ports on the periphery to main hinterland markets despite their lack of intermediacy has the ability to attract more port stakeholders to come to such ports and subsequently contribute to their business performance.

4.1.1.2 Site element (the significance of the site element – the port location)

The site element fundamentally refers to local underlying areal conditions and leads to defining geography as the study of the relations between humans and the environment. Specifically, it refers to the properties of a port's space (McCalla, 2008). The site elements on which this study focuses are port management (terminal operators) and land-side spaces. Terminal operators, as defined by Bichou and Bell (2007), are companies involved in international port terminal operations with a view to establishing globe-spanning network services. The classification of GTOs in maritime transport literature varies among researchers, although it has a similar meaning. Slack and Fremont (2005), for instance, discussed transnational terminal operating companies as being a product of horizontal integration and serving multi-user berth operations, and international shipping lines as being a vertical integration and serving dedicated terminals.

The involvement of GTOs in port operations is very important, as it is believed to have a greater impact on a port's competitiveness and consequently on its performance (Slack & Fremont, 2005). This is due to the capability of the GTOs in port operations, as they are not only efficient in management and operations but also possess a solid technical capability. The important involvement of GTOs in ports has been highlighted in the literature. Cheon (2009), for example, indicates a positive effect between GTOs and port efficiency through a DEA analysis of port efficiency. In addition, Tongzon and Heng (2005) mention that the involvement of private sector entities in port operations to some extent can improve port efficiency, which in turn will improve the competitiveness and performance of ports. Moreover, McCalla (2008) shows a significant relationship between port management and higher productivity in Caribbean seaports where these ports are handled by the top 10 GTOs.

On the other hand, if GTOs are absent from a port's operations and the port only relies on local operators, this could have a severe impact on the port itself. This is proven with the case of Le-Harve and Marseilles ports in France (Slack & Fremont, 2005), due to their reluctance to open their doors for GTOs to be established there. In addition, no international lines have made these two ports their hub, although the ports are proximate to the main maritime shipping lane. Apart from being managed by local terminal operators, it has been identified that the two ports have many other problems, such as a lack of financial resources, inefficient cargo- and container-handling equipment, and a minimum number of crane operating hours, to name but a few. As a consequence, the ports have suffered a severe market fall, and this has had a significant impact on their performance.

Meanwhile, the physical environment element under the site domain refers to the availability of land-side space that a port has and the depth of water at the port, which allows bigger vessels to berth. In the literature review, it was clear that the availability of land-side space is very important to ports for future development. The development of cargo or container yards and the development of the subsequent distribution business of the port, to name but two, are some of the expansions that can be carried out in order to accommodate the increasing port traffic when a port has large land-side space. The increase in traffic at a port increases the space required by both port users and operators, and the availability of land-side space is seen as able to accommodate the higher amount of traffic. In addition, the availability of spaces allows ports to create many logistics activities such as port-centric logistics at the port area in order to attract more business. This approach makes supply chains more efficient and effective and at the same time allows ports to become more profitable. These logistics activities, as indicated by Mangan, Lalwani, & Fynes (2008), are a potential area through which to generate more revenue. The Port of Humber, for instance, has increased its profit margins and associated cost savings to supply chains by providing similar logistics activities in the vicinity of port (Menachof & Talas, 2013). Monios and Wilmsmeier (2012) added that the bigger the land area available for the logistics activities, the more attractive a port will be. Given that land-side space is crucial in contemporary supply chain logistics activities, therefore, it is viewed that the demand for land for future logistics-land activities will be higher (McKinnon, 2009). However, it is viewed that not all ports (particularly large ports) are able to fully accommodate these logistics activities due to local constraints, which will impair their growth (Notteboom & Rodrigue, 2005). Nevertheless, these logistics land activities will be of benefit to ports on the periphery as they are seen as able to offer these advantages with respect to congestion, land and labour.

As mentioned earlier, one of the reasons peripheral ports are able to challenge other ports to be transshipment hubs is the severe congestion at the latter. The lack of land-side space for expansion is one of the most acute problems encountered by large gateway ports. This is due to the extensive expansions that have been carried out previously in order to tackle the increasing traffic volumes (Notteboom & Rodrigue, 2005). The continuous increasing traffic at the major ports coupled with the lack of space for further expansion may lead to severe problems not only at sea but also on land. Congestion, for instance, is seen as one of the main issues that will emerge from such problems. Severe congestion at the transshipment hub will have an impact on operational efficiency, in which the process will become slower and this will contribute to the carrier's longer transshipment times. In addition, the Notteboom and Rodrigue (2005) added that increased traffic volumes at major or gateway ports may lead to diseconomies as local road and rail systems are heavily burdened. Moreover, the carriers have to wait longer to be served at the anchorage area and waiting costs are increasing. These problems would lead to the carriers imposing congestion or demurrage charges on their customers. As a consequence, the congestion or demurrage charges will be shared with end users through the higher cost per unit of product that has to be paid.

Hypothesis 2: The significant availability of land-side space and the involvement of global private terminal operators are able to help ports on the periphery to generate more revenue and subsequently contribute to their performance.

4.1.2 SPATIAL CHARACTERISTICS AND PORT SUPPLY CHAIN INTEGRATION STRATEGY

4.1.2.1 Situation element (proximity to hinterland markets – concentration of ports)

Boschma (2005) in his study indicates that the dimensions of proximity such as cognition, organisation, institutions, society, and geography are mechanisms that bring together actors within and between organisations through learning, knowledge and innovation. He adds that geographical proximity facilitates inter-organisational learning, in which it may enhance interactive learning and innovation more indirectly and most likely by stimulating other proximity dimensions. In addition, Hall and Jacobs (2010) claim that proximity between actors is important because it supports the processes of acquiring new competencies and coordinating collective activities that are crucial to competitiveness in an economic environment of

heightened global flow. This reflects the fact that proximity dimensions contribute to the integration activities between actors in a supply chain.

Proximity to main hinterland markets does not only reflect the market that the port serves but also reflects how the market is being controlled. This indicates that it is vital for such ports to focus on developing their coordination competencies in their own operations and their collaboration competencies in relation to other ports and logistics companies (Brooks et al., 2010). Meanwhile, Olesen et al. (2014) in their research business model on the development of small sized ports indicate that this category of ports should begin their business strategy with four phases: regionalisation, terminalisation, core competencies and value-added activities. Prior to implementation of the aforementioned phases, it is worth mentioning that managers of peripheral ports need to understand the importance and configuration of the local supply chain networks in order to achieve a higher level of port performance. With the development model, new business opportunities can be identified by focusing on supply chain integration.

Meanwhile, based on the regression study conducted by Feng (2013), it is demonstrated that this category of ports have a closer link with their local economy in terms of either port-city or port-hinterland connection. In addition, McCalla (2008) indicates that the proximity to hinterland access also plays a significant role in the port site, where it has become a key component for more efficiently linking elements of the supply chain, namely to ensure that the consignees' needs are closely met by the suppliers in terms of costs, availability and time in freight distribution. Given that the hinterland markets have become overlapped and contestable, therefore, hinterland accessibility has become a crucial factor that affects the competitiveness and performance of ports (Wei, 2012). Given that ports on the periphery are only a small part of a larger supply chain network, therefore, it is necessary for such ports to collaborate with other companies and other ports in order to develop their business activities and subsequently their business performance. Thus, the aforementioned indicates that ports on the periphery that are close to hinterland markets require managers to have closer collaboration and coordination with other key business players including manufacturing companies, logistics companies and other ports.

Hypothesis 3: Ports that are on the periphery but are close to hinterland markets require closer collaboration and coordination with other supply chain partners in a larger supply chain network and with other ports.

4.1.2.2 Site element (the significance of the site element – the port location)

As indicated earlier, there are four phases of port development that SMPs could rely on in order to achieve a higher performance. One of the phases is core competencies, where such ports should focus on a range of activities that could add value when goods pass through them (Olesen et al., 2014). These values can be generated from warehouse-derived terminalisation (Rodrigue & Notteboom, 2009), where such ports could provide a specific place for logistics activities to take place in their vicinity in order to increase their service level, and the delivery time and distance can be reduced significantly for the local supply chain (Olesen et al,. 2014). Therefore, it is crucial for small- and medium-sized ports to identify the core competencies that could facilitate their quick growth and subsequently contribute to their performance. In the port system, physical assets can be part of the core competencies that ports could rely on as sources to provide a sustainable competitive advantage in certain specialised supply chains.

One of the identified core competencies of ports on the periphery is the availability of land-side space, therefore, the availability of such space would be beneficial for the logistics activities that could create added value for customers. The ability for logistics companies to carry out logistics service activities in the vicinity of the port area is attractive with regard to activities such as re-packing, de-vanning, and on/off port warehousing, to name but a few, which can contribute to the value-added created. In addition, this co-location of logistics establishments on the logistics parks is seen as an enabler of integration activities between ports and logistics companies. Moreover, Panayides and Song (2008) indicate that the provision of port facilities for logistics activities that add value to cargoes is an important criterion for ports to integrate in the supply chain. Heuvel, Langen, Donselaar, & Fransoo (2014) mention that there are synergies through the co-location of logistics establishment in which logistics companies could combine transport capacity, have better accessibility and have better opportunities for expansion. Moreover, Ferrari, Parola, & Morchio (2006) added that the availability of land-side space for logistics park provision near the port area implies the (1) good integration between terminal operators and logistics service activities, and (2) the possibility to re-export from the port to other market(s) (low-cost solution).

Meanwhile, the involvement of private and big terminal operators in port management has been acknowledged in the literature. Soppé, Parola, & Frémont (2009) claim that the integration of terminal activities between supply chain actors can be a consequence of carriers' network extension. In addition, Franc and Horst (2010) indicate that terminal operating companies are

one of the actors contributing to the fact that the worldwide maritime transport chain is perceived as an integrated system. This can be seen when many terminal operating companies tend to integrate with hinterland services through multi-modal networks or extended gates in order to minimise costs and develop a competitive advantage. This indirectly promotes the presence of the terminal operators and subsequently attracts the inflow and outflow of goods through their terminals and the ports as a whole.

Hypothesis 4: The availability of land-side spaces at ports on the periphery as a source of core competency in providing added value through logistics service activities in the vicinity of the ports and the involvement of global terminal operators in port management system are seen as enablers to the integration activities with other logistics companies in a larger supply chain network.

4.1.3 PORT SUPPLY CHAIN INTEGRATION STRATEGY AND THE PERFORMANCE OF PORTS ON THE PERIPHERY

The inclusion of ports into the supply chain has changed the nature of competition between ports. The contemporary competition is no longer between ports; instead, it is within supply chains and in supply chains competing with other supply chains. Given that a number of chains will be focused on the port, port users will only choose the one that is able to provide them with competitive advantage and value. The literature has emphasises the importance of integration across the supply chain, particularly with respect to performance outcomes (see Armistead & Mapes, 1993; Bagchi, Ha, Skjoett-Larsen, & Soerensen, 2005; Panayides & Song, 2008; Song & Panayides, 2008; Panayides & Song, 2009; Flynn et al., 2010; Özdemir & Aslan, 2011; Droge et al., 2012; Danese & Romano, 2011; Woo et. al., 2012 and Huo, 2012).

Integration is perceived as able to facilitate a firm's ability to respond to customers as well as global market conditions. The growing power of consumer demand has led firms to improve their responsiveness (Droge, et al., 2012). Those firms that are highly integrated with other members within a supply chain in areas of very severe competition are basically able to achieve two main advantages compared with those firms that do not practise supply chain integration in their daily business operation. Such advantages are (1) since the business environment is volatile and rapidly changing due to the changing needs of customers, supply chain integration is able to assist firms to promptly respond to a sudden demand in the market due to their

increased information visibility with other supply chain members, and (2) being highly integrated with supply chain members enables firms to reduce their operation cost and the total cost passed on to their customers, as they only have to concentrate on their core competence activities that have to be performed in-house, and for the other, non-core, competencies they can simply collaborate and cooperate with other supply chain members, and this is where the costs previously borne by firms can be diminished.

This is supported by a study conducted in Turkish Small Medium Enterprises (SMEs) where the supply chain integration has a positive impact on business performance, particularly on the market performance (Özdemir & Aslan, 2011). Özdemir & Aslan (2011) added that the integration between partners in a supply chain can have a significant effect on the delivery performance. Similarly, Armistead and Mapes (1993) studied managers' perceptions of the impact of supply chain integration on operational performance, particularly the quality, delivery, flexibility and price criteria, and the weighting scores are quite impressive. It is also viewed that the supply chain integration strategy has improved several important business areas between suppliers and customers, including order fulfilment lead time, order fill rate, production flexibility, reduction of total logistics costs, and improvement in on time delivery, as well as inventory return rates (Bagchi et al., 2005).

Meanwhile, the increasing responsiveness to customers' needs is timeliness (i.e. responsiveness to customer's problems on time with an accurate solution). Moreover, the ability to identify ways to reduce or remove redundancy costs, improve quality and reliability, and increase speed and flexibility can also be improved through integration. Empirical studies have revealed that supply chain integration influences the delivery performance (Lee, Nam, & Song, 2012). Late delivery has been reduced with the implementation of Just-In-Time principles. This also has sped up the information and communication flow from customers, and an immediate response can be made according to the customer's specification. Even though there are contradicting point of views over the compatibility of the strategy of PSCI strategy on the size of ports, Trupac & Twrdy (2010) discussed the possible impact of such strategy on the competitiveness of Port of Koper which is relatively small in size. Given that ports on the periphery are usually small and medium in size, therefore, the supply chain integration strategy is perceived as a good platform to develop their growth opportunities through collaboration with other logistics partners in providing effective and efficient service levels to port users and to increase turnover, making the firms better than their competitors, and at the same time it

helps to build customer's loyalty towards the services provided. Thus, these collaboration and coordination activities subsequently contribute to the performance of such ports.

Hypothesis 5: The initiative to insert and integrate themselves into a larger supply chain network with other logistics companies is perceived as able to bring the positive impact to the performance of ports on the periphery that relatively small to medium in size.

4.1.4 SPATIAL CHARACTERISTICS AND SUSTAINABILITY

4.1.4.1 Situation element (the proximity to hinterland markets – concentration of ports)

Given that ports today are viewed as an important element in supply chain logistics, therefore, ports on the periphery are seen able to assist port users in selecting the best mode of transportation right from the manufacturer's site to the final destination. From the environmental perspective, maritime transportation is seen as a greener form of transport compared to road or rail, so it follows that it should be used to send products as close to market as possible rather than using more distant ports and subsequently land transport. Proximity to hinterland markets not only saves time and cost but also enables port users to reduce GHG emissions, in particular the CO2 emissions, by re-arranging the distribution networks and thus to be greener. In addition, not only can cargo volumes be increased at their ports but port users can also be assisted to improve environmental sustainability through more efficient and greener modes and distribution networks (González-Benito & González-Benito, 2006; Kumar, Teichman, & Timpernagel, 2012). It is also viewed that the proximity of peripheral ports to hinterland markets indirectly promotes green logistics initiatives which can help business to improve their competitiveness by reducing distribution costs and CO2 emissions (Park & Yeo, 2012). The modal shift from inland to water transport, for instance, is able to reduce carbon emissions, thus attracting existing and new customers to ports on the periphery. This consequently will encourage the port users to pursue the best practice and be innovative by changing their behaviour and strategy towards greener and more efficient distribution networks. Given that water transport is greener and emits the least CO2 emissions in comparison to the other transportation types, therefore, hub and spoke services, for instance, can be used to replace the longer inland transport networks. This approach is cost effective for logistics companies and also more resilient, stable in price and environmentally friendly (Association, 2012). This is where the new market opportunities for both port users and ports on the periphery are created if the green approach is treated as part of their business goals (see

Markley & Davis, 2007; Nidumolu et al., 2009; Lopez-Gamero et al., 2010; Reinhardt, Casadesus-Masanell, & Nellemann, 2011).

The changing behaviour, practices and strategy of port users to greener and more efficient distribution networks will gradually improve the local and regional traffic conditions from port to hinterland (Joen, Amekudzi, & Guensler, 2008). This means that such improvement will facilitate economic activities such as the development of local and regional industries to support the port and it will act as a catalyst to industries that naturally locate themselves near to ports, such as food suppliers, chemical plants, and power stations. In addition, the improvement of accessibility from/to ports on the periphery will encourage more FDIs from MNCs to be located closer to the port area (Lu et al., 2012). The above developments at such ports will bring prosperity to the economic region and subsequently enhance the particular country's regional GDP. This will also have the social benefit of creating good-quality jobs in the port region, and more jobs will be available as the economy flourishes and prospers (Jeon, Amekudzi, & Guensler, 2008).

On the other hand, the proximity of ports to hinterland markets most likely minimises the morbidity and mortality of inland transport accidents, in particular those caused by road transport, so enhancing safety and security. Of the three 'on the ground' transportation networks, water transportation, in particular inland waterways, is considered to be the safest transport modality as compared to rail and road (Bloemhof et al., 2011). It is also understood that the modal shift from longer inland transport networks, in particular rail and road networks, to the shorter water transportation network, feeders or inland waterways, will have less impact on human health, in particular through less GHG emissions and noise. Water transportation is not only known to contribute the smallest amount of GHG emissions to the environment but it also produces very little noise (Bloemhof et al., 2011).

Hypothesis 6: It is perceived that the proximity of ports on the periphery to hinterland markets is able to contribute to environmental, economic and social sustainability through greener and more efficient distribution network.

4.1.4.2 Site element (the significance of the site element – the port location)

Despite being overshadowed by other, bigger, ports, peripheral ports demonstrate a potential for economic growth (Feng, 2013; Feng & Notteboom, 2013). One of the reasons is that this

category of ports has enough land-side space for future expansion. Unlike ports on the periphery, in spite of the increasing amount of traffic handled at gateway ports, it is foreseen that congestion will be the main issue for the gateway ports (Monios & Wilmsmeier, 2012) and eventually lead to dis-economies of operation due to land shortage, increased cost and environmental constraints (Notteboom & Rodrigue, 2005). Gradually, the economic and social sustainability in the vicinity of the periphery ports will be developed and flourish. The availability of land-side space not only benefits the ports on the periphery but also other organisations such as logisticians where new business opportunities can be created. With enough land-side space, distribution centres (DC) and other types of logistics activities in the port area – for instance, those that could add values to the goods – can be developed in the port vicinity.

These activities stimulate the surrounding economies through the inward flow of more logisticians in pursuing the opportunities offered and this eventually increases the ports' business. Thus, the performance of ports on the periphery can be improved with the inward flow of more business to the port and port area. The availability of land-side space for logistics parks' provision near the port area indicates that traffic congestion experience by local inhabitants can be reduced, given that the logistics service activities are far from the city and its crowded population (Ferrari et al., 2006). In addition, the provision of adequate facilities could not only reduce congestion for local inhabitants but may also reduce the transportation costs and time from port to manufacturer and vice versa. Moreover, with such provision, the road miles in freight transport across the complete supply chain, for example the movement of empty containers from port to manufacturing site, can be eliminated through the value-added activities that can be conducted in the port area. In addition, with such elimination, CO2 emissions can also be reduced. Moreover, with the development of economic activities on the availability of land-side space can deliver new job opportunities to be filled by the port communities (Guerrero & Abad, 2013).

Meanwhile, the involvement of GTOs in the port management system brings benefits to ports on the periphery in many ways, as these private sector operators are more efficient in management and operation of the port system. This is because they have richer expertise in such activities and are able to maintain an efficient service commitment. GTOs are not only efficient in managing the operations of ports but also in maximising the profitability and minimising the environmental effects of their operations (Venus, 2011). This can be seen in

their initiative to combat environmental issues through green management practices. Venus (2011) added that closer collaboration and coordination, internally and externally, with supply chain partners can be one of the instruments to improve environmental sustainability. Through such an approach, GTOs are seen as able to influence their partners directly or indirectly to adopt similar practices in protecting the environment.

Apart from integration with supply chain partners, GTOs also have the capability to contribute to environmental sustainability, in particular through their operational activities such as the use of energy-efficient transport equipment and modes in reducing energy waste. Despite incurring higher costs for their greener operations, GTOs still possess a more solid technical capability and have a very solid capacity for equipment replacement. This subsequently will create benefits in terms of economic and social sustainability in the long run. With support from the top management in maximising profitability and minimising the effects of the operations on the environment, it is foreseen that the GTOs will always have the capability to formulate, implement, maintain and control their business management and operations towards sustainable business practices.

Hypothesis 7: The availability of land-side space at ports on the periphery as a source of core competencies in providing value-added services through logistics activities in the ports' vicinity and the involvement of global terminal operators improve the effectiveness and efficiency of the port management system which are seen as able to contribute to environmental sustainability, economic sustainability and social sustainability.

4.1.5 SUSTAINABILITY AND THE PERFORMANCE OF PORTS ON THE PERIPHERY

Sustainability is defined by the Development (1987), means: ***"being able to satisfy current needs of the enterprise and its stakeholders today, while protecting, sustaining and enhancing the human and natural resources that will be needed in the future"***. This definition embraces the environmental, economic and social elements, and these three elements are interrelated with each other and cannot be measured with only one- or two-dimensional indicators. Instead, these three elements must be combined to perform a thorough sustainability benefits (Bloemhof et al., 2011). In addition, Kim (2014) indicates that sustainability should be considered as a strategic/operative practice, which means the simultaneous pursuit of economic prosperity, environmental quality, and social responsibility. The sustainability

concept emphasises the importance of risks and opportunities for present and future needs that could be a good driver for a firm and have an effect on its success (Schaltegger, 2011). In addition, sustainability, in particular the environmental issue, could be used by firms as a stepping stone to distinguish themselves from competitors in the same industry, reducing cost, improving services to conscious customers, offering the chance for new markets and growth, and ultimately improve the business performance in the long run (Oberhofer & Furst, 2012). Conducting business differently and being difficult to challenge would be a huge advantage to a firm. In the resource-based view (RBV) theory, if a company has a resource/s which could last for a long time and which is very difficult for competitors to imitate, it is said to have sustained its competitive advantage (Lockett et al., 2009).

Literature indicates that there are various drivers that influence environmental investment, but the main three that force firms to take sustainability issues into consideration in daily business operations are social licence to operate, corporate conscience and competitive advantage (Adams et al., 2011). Firstly, licence to operate refers to government approval that allows a port to expand its business to a new location, which involves the construction of buildings, to make sure the projects will not harm the environment and society. Secondly, the corporate conscience is an outcome from the corporate philosophy at the executive level. Previously, sustainability issues were not the main objectives of a firm when conducting its business; instead, firms were prone to be profit oriented. However, this is no longer the case as many firms nowadays are more sustainability conscious, particularly with regard to the environmental and social aspects of the business. In fact, some of the big firms have made the sustainability aspect one their prime corporate objectives. Whenever firms take sustainability issues into consideration they are creating competitive advantage.

A sustainable supply chain framework that encompasses the elements of the ‘triple bottom line’ or 3BL has been proposed by Markley and Davis (2007), which could be a future competitive advantage. Prior to the proposed sustainability framework, Lieb and Lieb (2010) revealed that environmental issues can have a positive impact on a business. They added that this consequently improves the economic performance and has a positive impact on operational performance and ultimately enhances the organisational performance. In addition, the environmental issue is not only able to retain existing customers, it is also able to attract more new customers through the improvement of the company’s image and reputation. Meanwhile, Rao and Holt (2005) argued that greening the outbound, which encompasses the transportation

system such as types of transport, fuel sources, infrastructure, operational practices and organisation, can have an impact on a firm's competitiveness and improve its economic performance. Changing to a more energy-efficient and lower carbon footprint mode of transportation and green distribution networks, for instance, are some of the best practices that could be adopted in order to reduce carbon emissions and reduce environmental degradation (Gonzalez-Benito & Gonzalez-Benito, 2006). Moreover, Jr, Zelbst, Meacham, & Bhadauria (2012) disclosed that environmental sustainability has a significant relationship with environmental performance. Thus, firms that use water freight, rail freight and intermodalism freight to ship goods long distances while reducing the amount of road time, will not only make an impact financially, but also environmentally (Liao, Tseng, & Lu, 2009; Liao, Lu, & Tseng, 2011). Principally, it is one of the potential ways to create competitive advantage in the long run and generate profits through carbon emissions reduction.

This indicates that ports on the periphery can change their geographical weakness into a sustainability advantage where the environmental impacts can be lessened through the reduction of long inland distribution networks, in particular, the road transportation network. The proximity to hinterland markets and the environmental sustainability advantage (greener supply chain distribution networks and the reduction of GHG – CO2 emissions) possessed by the ports on the periphery would be the catalyst to attract more environmentally conscious users from foreland and hinterland markets. This environmental advantage represents a market opportunity for firms (Lopez-Gamero et al., 2010), in particular ports on the periphery. In addition, the continuous pressures from governments and non-government sectors has significant direct and indirect impacts on all port stakeholders. Moreover, it will also slowly but surely change the logistics service providers' business-minded behaviours, practices, and strategies to be more innovative and proactive towards greener supply chain distribution networks (Lau, 2011). The modal shifts from long inland transport networks to shorter inland networks and water transportation is seen as a promising strategy in reducing carbon emissions, and attracting existing and new customers to ports on the periphery. This subsequently indicates that the sustainability advantage (environmental, economic and social) of ports on the periphery significantly contributes to port performance.

Hypothesis 8: The sustainability advantage of ports on the periphery as a trade-off for lack of intermediacy can be a springboard in attracting more port users through greener distribution networks (lower CO2), have economic and social advantages and subsequently contribute to the port performance.

4.1.6 SPATIAL CHARACTERISTICS (SITUATION ELEMENT & SITE ELEMENT), PORT SUPPLY CHAIN INTEGRATION STRATEGY AND THE PERFORMANCE OF PORTS ON THE PERIPHERY

There is an abundance of literature that supports the importance of the spatial characteristics of ports in influencing their performance. Hayuth and Fleming (1994) and Fleming and Hayuth (1994) have comprehensively explained and discussed the spatial characteristics particularly concerning the strategic commercial location of a port and its importance. They mentioned that site and situation are two important key drivers that contribute to the success of ports as they can attract both hinterland and foreland port users. However, even though the situation and site elements are able to have positive impacts on ports on the periphery, this is not without the involvement of the ports themselves in the supply chain integration strategy through active cooperation and coordination with other supply chain partners.

Literature clearly indicates that both situation and site elements facilitate the success of a port (McCalla, 1998; McCalla, 2008) but a greater impact can be achieved through the dynamic capability of port managers to insert and integrate themselves in the supply chain in order to provide the most efficient distribution network to port users. In addition, Notteboom (2008) argues that the critical success of a port depends on its ability to effectively integrate not only with other supply chain players but also with other nodes in the network of business relationships that shapes the supply chains. Observation of import and export activities from a case study conducted by Langen (2007) in Austria shows that distance advantage alone (proximity to hinterland markets) does not stimulate the market shift of shippers and freight forwarders from the ports of Hamburg and Bremen (German), Antwerp (Belgium), and Rotterdam (The Netherlands) in the northern and western regions of Europe to the ports of Trieste (Italy) and Koper (Slovenia) in the southern part of Europe. This indicates that crucial cooperation and coordination with supply chain partners should be initiated in order to enhance the market share of the ports in that particular area. Such activities will strongly support the terminal activities and provide an efficient logistics solution for ports on the periphery (Trupac,

2012). Meanwhile, the performance of ports on the periphery can be enhanced with the provision of network sites or logistics facilities through their available land-side space where various and different supply chain members can meet and interact (Yan & Qiang, 2008) to create value-added logistics activities. As argued by Lugt and Langen (2005), there are several criteria in developing a distribution centre in a particular place, but the most important one that enables ports to be developed as distribution centres is the availability of space in the vicinity of ports that are located centrally in the market. This translates that value-added services in the vicinity of a port cannot simply be achieved without close collaboration and coordination with other partners.

Given that, in today's maritime transportation environment, businesses have been derived according to customers' requirements and needs, therefore, ports are required to be proactively observed and work closely through cooperation and coordination with their customers and suppliers at foreland and hinterland networks in order to ensure that they remain competitive. Such cooperation with customers and suppliers and coordination with supply chain nodes in a larger supply chain network are able to help them to monitor the customers' needs and quickly respond to the current market demand. Therefore, the ability of ports to work closely with partners within the supply chain is an advantage, as port users are more attracted to distribution networks that could offer them cost and delivery efficiency.

Hypothesis 9: The closeness of ports on the periphery to hinterland markets towards the performance of ports on the periphery is significantly influenced through a port supply chain integration strategy with other supply chain partners.

Hypothesis 10: The land-side space availability of ports on the periphery as a core competency and the credibility of port management towards the performance is significantly influenced through a port supply chain integration strategy with other supply chain partners.

4.1.7 PORT SUPPLY CHAIN INTEGRATION STRATEGY AND SUSTAINABILITY

In the context of a supply chain integration strategy between partners, it is not only important in enhancing the competitiveness and performance of a firm but it is also an important business strategy to allow companies to mitigate the sustainability issue, in particular their carbon footprint. Given that supply chain integration is a collaborative strategy, many companies in

different and related industries are beginning to recognise that reducing their carbon footprint is one of the critical issues in SCM (Lee, 2011). To accomplish this requires coordination, integration and management across members in the supply chain, including raw material suppliers, manufacturers, distributors, and users (Lee, 2011). Meanwhile, Wolf (2011) pinpointed that there are two main reasons as to why SCM plays an important role in achieving sustainability. First, SCM has a strong and deep impact on the natural environment because it deals with the resources needed for the production of goods or services. Second, buying practices can impact a supplier's ability to improve their sustainability. This addresses the importance of integrating sustainability not only internally but also integrating external SCM practices with other supply chain partners.

Similarly, Vachon and Klassen (2006) indicated that, in general, the supply chain integration characteristics in terms of logistical integration and technological integration have a positive link with green supply chain practices, in particular environmental monitoring and environmental collaboration. In addition, through a collaboration strategy, information sharing between partners is an imperative means to draw managerial attention towards reducing the GHG emissions and thus improve performance (Plambeck, 2012). Moreover, inter-company, horizontal and logistical collaboration in a supply chain network can not only reduce a significant amount of CO2 emitted from transport but also contribute to the overall transportation costs (see Ballota & Fontane, 2010; Lin & Ng, 2012; Pan, Ballot, & Fontane, 2013). Furthermore, Zhang and Wang (2014) mentioned that, in reducing the carbon emissions' impact on the environment and at the same time contributing to the environmental and economic performance, inter-firm collaboration, in particular with suppliers and customers and through industrial symbiosis in an industrial chain, is imperative in decision-making. Through inter-firm collaboration and the demand from stakeholders who are environmentally conscious, some logistics companies rely on fuel consumption reduction and minimise the number of delivery trips by adopting a Just-In-Time approach in order to reduce carbon emissions. Through employing a supply chain collaboration strategy with other port stakeholders, peripheral ports are viewed as able to assist the logistics service providers and port users in reducing fuel consumption, cost, and the long delivery trips through utilisation of a greener distribution network.

Hypothesis 11: Inter-firm collaboration through supply chain integration strategies with other supply chain stakeholders also contributes to the sustainability benefits where significant environmental and economic performance can be achieved

4.1.8 SPATIAL CHARACTERISTICS (SITUATION ELEMENT & SITE ELEMENT), PORT SUPPLY CHAIN INTEGRATION STRATEGY AND SUSTAINABILITY

As explained previously in section 4.1.4.2, the situation and site elements of ports on the periphery play a significant role in contributing to the sustainability benefits. Studies have shown that the proximity of ports, in particular the port's distance to the main hinterland markets for import and export activities, is able to reduce the environmental impact of GHG carbon emissions, in particular CO2 emissions (Gries, Naude, & Matthee, 2009; Liao, Lu, & Tseng, 2011). A shorter distance to a hinterland markets not only reduces carbon emissions but also reduces fuel consumption, and ultimately reduces the overall transportation costs. Moreover, initiatives to re-route the port of call away from the traditional large ports that are frequently associated with congestion issues could also curb the carbon emissions of marine-based goods (Rodrigues et al., 2014). Furthermore, moving cargo via coastal or maritime intermodal transportation with as little road transportation as possible contributes to reduction in carbon footprint (Liao, Tseng, & Lu, 2009). Given that the international maritime shipping industry is currently exempted from the regulations to reduce carbon emissions under the Kyoto Protocol (UNFCCC, 1997), utilising a greener mode of transportation is a promising means by which to mitigate its environmental effects. As a matter of fact, the CO2 emissions are free from any regulations currently (Kontovas & Psaraftis, 2011).

Meanwhile, under the site element of spatial characteristics, the literature has shown that the availability of land in the vicinity of or adjacent to the ports is able to add more sustainability benefits to ports on the periphery, in particular in relation to environmental, economic and social aspects (Mangan, Lalwani, & Fynes, 2008; Menachof & Talas, 2013) such as the reduction of carbon emissions by cutting off the inland road transportation and generating more revenue through the growth of the business. These sustainability benefits can be gained through logistics activities such as the development of port-centric logistics, distriparks and free trade zone areas (FTZs). Through these logistics activities, ports are seen as able to secure the growing volume of throughput as well as gaining cost-efficiency (Pettit & Beresford, 2009).

Similarly, the management of the port, in particular the involvement of GTOs in the port operations, has a significant contribution to the overall sustainability benefits of the peripheral ports through environmentally friendly operations and internal management support from the top management (Venus, 2011).

However, whilst sustainability benefits can be gained from the spatial characteristics of peripheral ports, this is not without collaboration with other supply chain partners. Given that in today's business environment the concept of competition is prone to be between supply chains rather than firms, hence, it is important for port management to work closely with other port stakeholders not only for economic performance purposes but also for environmental performance. In addition, Lai and Wong (2012) indicated that partnership with suppliers and customers is an important instrument to alleviate the environmental impact frequently associated with inter-organisational activities as well as product and service flows. Moreover, Dao et al. (2011) insisted that sustainability cannot be achieved by a single firm's action; instead, the entire supply chain must operate its business activities in a sustainable manner. Through collaboration and partnership, logistics processes, for instance, can become greener with the implementation of green environmental practices such as green practices for logistics and transportation, the adoption of resource-sharing and clean transport (multi-modalism operations) (Caniato et al., 2012).

Hypothesis 12: There is an indirect relationship between the situation element of peripheral ports and sustainability benefits through the mediating effect of a port supply chain integration strategy

Hypothesis 13: There is an indirect relationship between the site element of peripheral ports and sustainability benefits through the mediating effect of a port supply chain integration strategy

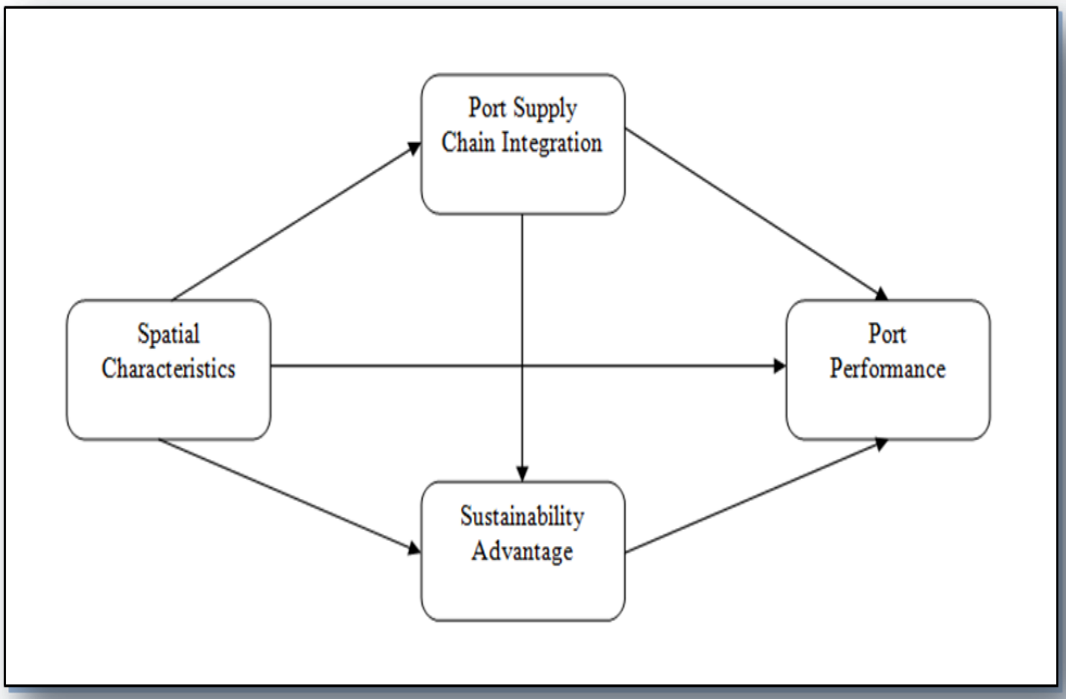


Figure 4.1: Simplified conceptual research framework

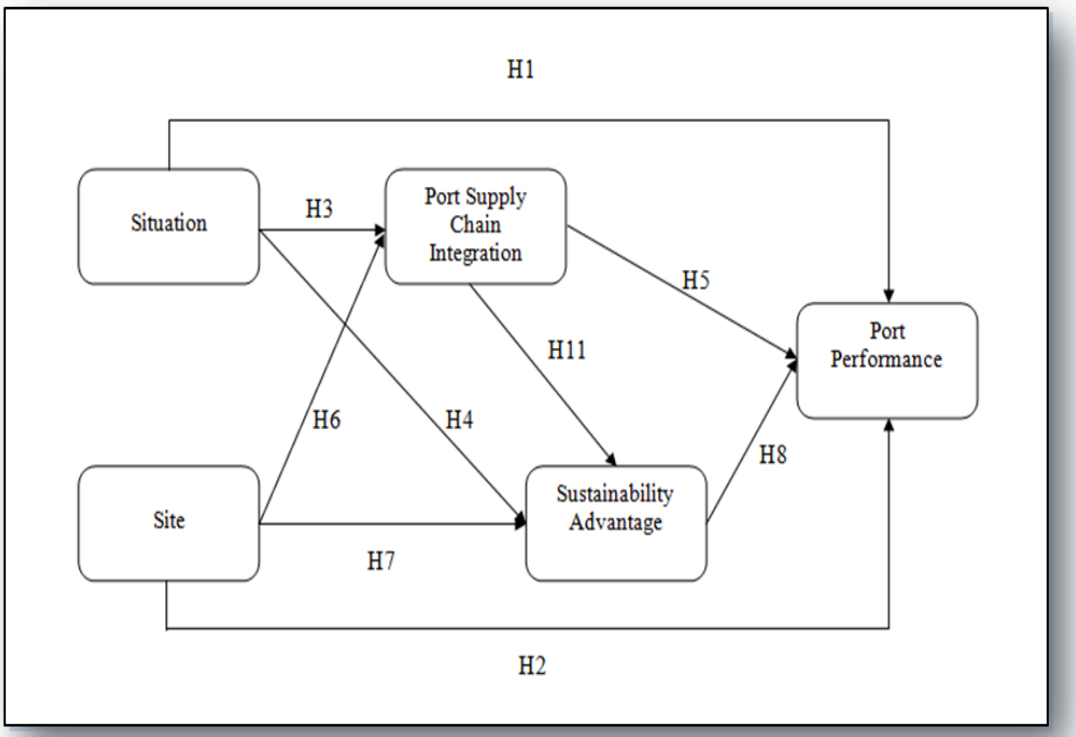


Figure 4.2: Research framework for ports on the periphery

4.2 SUMMARY

In conclusion, this chapter has presented the research model and the hypotheses development of the study. The first part of the chapter has explained and discussed the study's research model, based on the review of the past and current literature. This was followed by an elaboration of the hypotheses development where the relationships between variables were explained in detail. The relationships of the variables are shown in **Figure 4.1** and **Figure 4.2**. **Figure 4.1** shows the simplification of the relationship between those four variables, while **Figure 4.2** demonstrates the details of the research framework where the hypotheses development is presented. In particular, 13 hypotheses have been developed through an extensive literature review. Given that this chapter has successfully developed 13 research hypotheses, therefore, it is necessary to empirically test these hypotheses in order to find whether they are fully supported or rejected. To do this, a separate chapter called Data Analysis and Findings (Chapter Five) will be revealed the findings of the research hypotheses that associated with the 5th and 6th research objectives of the study. Prior in analysing the data, it is compulsory to go through a research methodology chapter where the discussions pertaining to the data collection and statistical analysis technique are taking place. This methodology chapter is specifically discussed in Chapter Five.

CHAPTER 5

RESEARCH METHODOLOGY

The previous chapter has systematically reviewed and discussed the development of the research framework and research hypotheses. It is now followed by the methodology chapter where the data collection and data analysis procedures will be discussed accordingly. Specifically, this chapter consists of several sections to depict the steps and processes involved in the data collection and data analysis. Every single process involved in this study is supported with the reasonable justifications. First, this chapter begins with the research design of the current study. Second, data collection strategy is explained. Under this strategy, questionnaire survey, questionnaire design, potential participants, and questionnaire distribution method are addressed and discussed. The next section covers the technique used to define and identify the population of the study and the sampling design approach adopted. Also, the selection of the research locations is addressed. The fourth section concentrates on the data analysis. Data file preparation, EDA and MRA are employed to conduct the preliminary and inferential analysis of the study. Lastly, a summary section is provided to briefly recapitulate the whole process of the methodology chapter.

5.0 INTRODUCTION

Research methodology basically implies the process of collecting data from potential participants and analysing the data collected in order to obtain the objectives of a particular study. It involves several underlying principles and actions that should be undertaken based on the research questions and objectives. Briefly, it includes three main principles, firstly, related to the information per se such as what kind of information should be gathered, how much information should be collected, from whom the data should be gathered, from where the information should be accumulated, how to collect the information and how long to allocate to data collection. The answers to these principle questions rely on the research objectives of the study. Therefore, researchers need to understand what they want from their study. Only then do they know what they need to do and the following steps and processes necessary to achieve this.

Secondly, researchers should know and identify the most suitable and appropriate tools to collect the information or data. The questions that should be considered are, amongst others, what types of method could be used in collecting information, and how the information collected can be used, to name just two. There are many approaches that can be adopted by researchers to collect the data or information. However, researchers cannot simply pick up any method they like to collect the data. The selection process of method to be employed should be scrutinised. Factors such as the practicality and intellectuality of the method selected should be considered before deciding which methods should be applied. Time, cost, locations, resources, accessibility and distance are some of the things that could influence the practicality and intellectuality of the method chosen. In addition, researchers should be aware of the different methods of data collection between qualitative and quantitative research approaches: a different research designs require different methods of data collection.

Lastly, once the researchers have recognised the information needed and what kind of method should be employed for the study, they need to think about the statistical analysis. Specific tools are required in order to respond to questions such as how the information should be analysed, how the information should be presented, how the information should be discussed, and how the information collected could answer the research questions and achieve the research objectives of the study. Similar to method of data collection, there are a variety of ways that could be used to analyse the data. The analysis tool that is suitable for a researcher to use again depends on the research questions and objectives. Each of the steps involved in the above process requires detailed justifications and reasoning in order to support the actions taken in order to complete the study. This is where research design of a study is very important to that particular study.

5.1 RESEARCH DESIGN

Research design is generally defined as 'the planning procedures for conducting an investigation based on the nature of the research problem in order to get the most valid findings' (Collis & Hussey, 2014). In particular, it refers to research activity that encompasses identifying the research problem, research questions and research objectives, research philosophy, research approach, data collection methods, data analysis and ends with reporting the findings of the study in a consistent way for public reading and reference (Punch, 2005).

To conduct these procedures, research onion as depicted in **Figure 5.1** has been used as a guideline to conduct the current study.

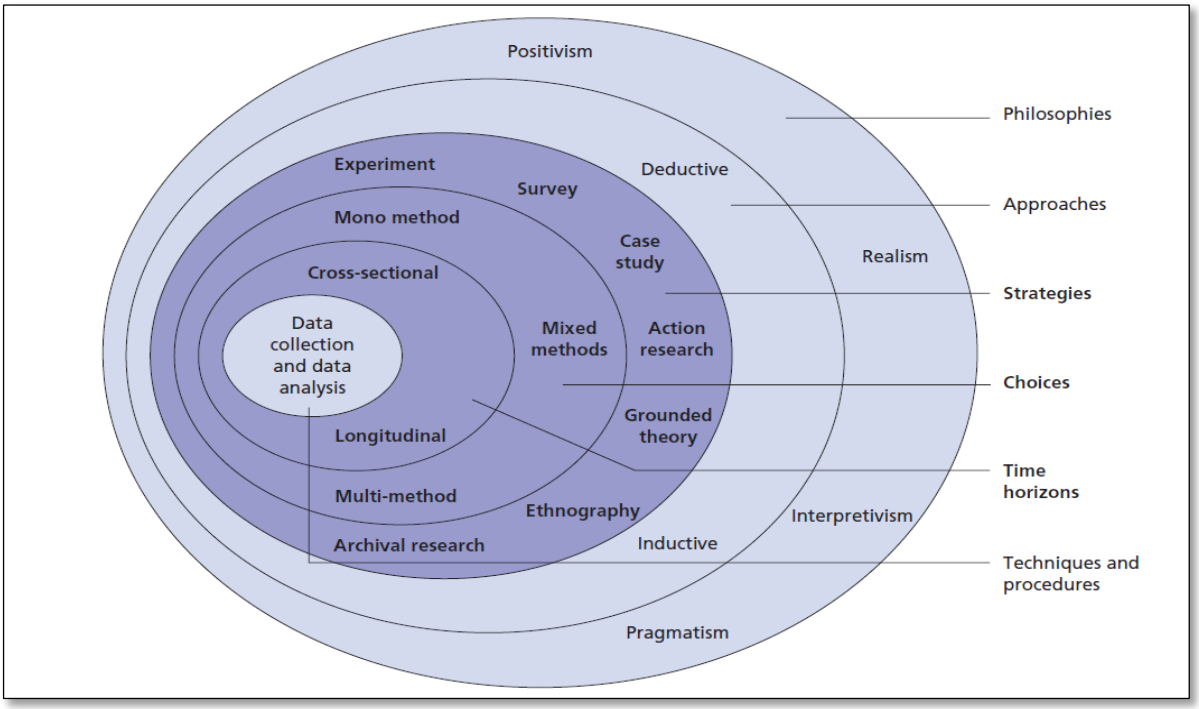


Figure 5.1: Research Onion

Source: Saunders, Lewis, & Thornhill (2009)

5.1.1 Research Philosophy

Different researchers might conduct a piece of research differently because of different point of views, opinions, thoughts and the way they interact with their surroundings. Nevertheless, there are certain guidelines that help researchers to conduct research. These guidelines are known as research paradigms. A research paradigm is a set of basic beliefs that deals with the ultimate or first principle (Jonker & Pennink, 2010) as to how the world is perceived, which then serves as a thinking framework that guides the behaviour of the researcher (Wahyuni, 2012), based on ontology, epistemology and methodology (Saunders et al., 2009). This demonstrates the importance of the paradigm as it will influence on how a particular piece of research is being conducted (Crossan, 2003). In business and management field of research,

there are a number of philosophical paradigms that could be a good guideline for researchers to conduct a study viz. positivism, interpretivism and pragmatism. Each of these philosophical paradigms differs from one another in terms of ontology, epistemology and methodology (see **Table 5.1**).

Theoretically, positivism's ontology assumes that the reality is 'out there' in the world and needs to be discovered using conventional scientific methodology (Tuli, 2010); however, a researcher remains separated and emotionally detached from what s/he is researching (Weber, 2004) by creating distance and being independent observers in the research all the time (Jonker & Pennink, 2010). This indicates that the positivist tries to be objective by which the statements are descriptive and factual. Additionally, in its methodology, a positivist is directed at explaining relationships which seeks to identify the causes of changes in social facts and explain the outcomes (Scotland, 2012). Moreover, a positivist also employs experimental or correlational designs to eliminate biases and empirically test and justify their stated hypotheses (Johnson & Onwuegbuzie, 2004). Given that, positivists seek predictions through cause and effect of the phenomenon and generalisation of the findings, thus it indicates that positivists are associated with qualitative data whereby the method of data collection is usually through survey (closed-ended questionnaire).

Meanwhile, the interpretivism's ontology as explained by Scotland (2012) is relativism in which the reality or phenomenon is viewed as subjective and different from person to person. Thus, it is necessary for researchers to understand the difference between humans in our role as social a actor (Saunders et al., 2009). In its epistemology, the view of the reality in a real world and researchers are inseparable in which they are involved and must participate to gain the experience and knowledge of the researched phenomenon. In its methodology, interpretivism is directed at understanding a phenomenon from an individual's perspective, investigating interactions among individuals as well as the historical and cultural contexts which people inhabit (Scotland, 2012). To further understand the researched phenomenon, researchers could use case-study, ethnography, hermeneutics and phenomenology. Given that, the reality and researchers are inseparable, thus the method of data collection is usually in the form of interviews, observations, focus groups, role playing and think aloud protocol. This indicates that interpretivism is associated with qualitative research approach.

Traditionally, positivism and interpretivism paradigms stand on their own and they are incompatible with each other as they are based on paradigms that make different assumptions about the world and what constitutes valid research (Firestone, 1987). Both of these paradigms have strengths and weaknesses (Johnson & Onwuegbuzie, 2004) and due to their imperfect nature, many researchers opt to combine them, which is known as pragmatism or mixed method research approach. Thus, the goal of a mixed methods research approach is to draw on the strengths and minimise the weaknesses of both in a single research study and across studies.

Grounded on the explanations of the above paradigms, the philosophical stance of the current research depends on the nature and objectives of the study in which will be the main guideline to shape the way it is conducted and influence how the data should be collected, analysed and interpreted. Briefly, the current study intends to investigate the performance of ports on the periphery and to achieve the aim and the objective the researcher has outlined for the current study viz. to identify, synthesise, develop the business model and examine the potential strategies or factors that contribute to the performance of peripheral ports. In addition, both of aim and objectives of the study demonstrate that researcher attempts to seek and identify the cause that influences the outcomes of the researched phenomenon. In particular, the researcher tries to explain the possible relationships between cause and effect of the performance of ports on the periphery through the development of hypotheses. Based on the information above and to provide credible data researcher needs to collect the data quantitatively which is through highly structured closed-ended questionnaire from participants. This translates that the current study is considered as positivism and researcher is a positivist where she conducted the research independently from the researched phenomenon.

Table 5.1: Research paradigm

Paradigm	Positivism	Realism	Interpretivism	Pragmatism
Ontology The researcher's view of the nature of reality or being	**External, objective and independent of social actors**	Is objective. Exists independently of human thoughts and beliefs or knowledge of their existence (realist), but is interpreted through social conditioning (critical realist)	Socially constructed, subjective, may change, multiple	External, multiple, view chosen to best enable answering of research question
Epistemology The researcher's view regarding what constitutes acceptable knowledge	**Only observable phenomena can provide credible data and facts. Focus on causality and laws like generalisations, reducing** **phenomena to simplest elements**	Observable phenomena provide credible data and facts. Insufficient data means inaccuracies in sensations (direct realism). Alternatively, phenomena create sensations which are open to misinterpretation (critical realism). Focus on explaining within a context or contexts	Subjective meanings and social phenomena. Focus upon the details of situation, a reality behind these details, subjective Meanings motivating actions	Either or both observable phenomena and subjective meanings can provide acceptable knowledge dependent upon the research question. Focus on practical applied research, integrating different perspectives to help interpret the data
Axiology Researcher's view of the role of values in research	**Research is undertaken in a value-free way, the researcher is independent of the data and maintains an objective stance**	Research is value laden; the researcher is biased by world views, cultural experiences and upbringing. These will impact on the research	Research is value bound, the researcher is part of what is being researched, cannot be separated and so will be subjective	Values play a large role in interpreting results, the researcher adopting both objective and subjective points of view
Data Collection Techniques most often used	**Highly structured, large samples, measurement,** **quantitative, but can use qualitative**	Methods chosen must fit the subject matter, quantitative or qualitative	Small samples, in-depth investigations, qualitative	Mixed or multiple methods designs, quantitative and qualitative

Source: Saunders et al. (2009)

5.1.2 Research approach

There are two prominent categories of research approach that can be found in the literature viz. inductive and deductive. Inductive approach is prone to building the theory and starts with method, data, findings and theory; meanwhile, the deductive approach is prone to testing the existing theory and starts with theory, method, data and finding (Pathirage, Amaratunga, & Haigh, 2008) (see **Table 5.2**). Saunders et al. (2009) indicate that a particular study is regarded as deductive when it possesses these five sequential stages: (1) deducing hypotheses from the theory, (2) expressing the hypotheses in operational terms, (3) testing the operational hypotheses, (4) examining the specific outcomes from the inquiry, and (5), if necessary, modifying the theory. On the other hand, a study is considered to have an inductive approach when researchers are trying to get a better understanding of the nature of the problem. This process helps researchers to gather more useful and reliable information and data through interviews, experiences or observation from the problem scene. Subsequently, theory will be developed based on the collected data that has been analysed. There are two main reasons that lead to the adoption of this research approach: (1) the explanation of social phenomenon grounded in observation and experience, and (2) critique of some of the philosophical assumptions embraced by positivism (Pathirage et al., 2008).

Nevertheless, the decision about which research approaches should be adopted depends on the purpose of the research, whether it is exploratory, descriptive or explanatory (Saunders et al., 2009). Exploratory research is conducted when the nature of a particular issue or phenomenon has not been clearly defined in the literature. It is usually carried out for an issue or phenomenon that lacks of theories. It is a valuable means for researcher to know what is happening, to seek new insights, to ask questions and to access the phenomenon in a new lights. This indicates that, exploratory research is an inductive research approach. Meanwhile, descriptive research is undertaken purposely to describe the characteristics of a population or phenomenon that is under investigation. In particular, it is prone to portraying an accurate profile of persons, events, or situations of a researched phenomenon. On the other hand, explanatory research is undertaken to explain the relationship between variables. Specifically, it is a means to establish the cause and effect of an issue or phenomenon between two or more variables that are being studied. Descriptive and explanatory researches are considered as deductive research approach.

Table 5.2: Comparison of research approaches

Deductive	Inductive
Moving from theory to data	Moving from data to theory
Common with natural sciences	Common with social sciences
A highly-structured approach	Flexible structure to permit changes
Explain causal relationships between variables	Understanding of meanings humans attach to events
Select samples of sufficient size to generalise conclusions	Less concern with the need to generalise

Source: Pathirage et al. (2008)

Given that, literature pertaining to the performance of port has been concentrated on the large and established ports as well as ports that are close to major main maritime shipping lane, thus, the purpose of the current study is to investigate the performance of small ports that usually reside away from the main maritime shipping lanes. To achieve the aim of the study, several research objectives have been outlined and listed in Chapter One (see section 1.1). Firstly, the objective of the current study is to identify and ascertain the potential strategies that could contribute to the performance of ports on the periphery. To identify the potential strategies that could assist the performance of peripheral ports, an extensive literature has been thoroughly reviewed. Hence, it is identified and ascertained that spatial characteristics (in particular the situation and site elements), PSCI strategy and sustainability advantage are the potential strategies or factors that are able to contribute to the performance of peripheral ports.

Secondly, given that, the potential strategies for the performance of ports on the periphery have been identified, it is important to synthesise the direct and indirect theoretical relationships between those identified potential strategies and the performance of peripheral ports. To synthesise the direct and indirect theoretical relationships between the identified variables underpinning theory of resource-based view has been adopted to support the relationships. Through the lens of resource-based view theory, the study is able to explain the opportunities and benefits that can be generated from the integration of those strategies in order to achieve the sustainable competitive advantage and subsequently port performance.

Thirdly, as both potential strategies and theoretical relationships have been identified and synthesised, the causal relationships or the direct and indirect relationships between variables are hypothesised. These hypotheses are then explained in details in operational terms. In particular, the explanations are based on the reliable and established measurements that have been adopted from the literature for each of the involved variables. Finally, hypothesis testing will be the final objective of the study. Prior to examining the hypotheses of the current study, a sufficient sample size has been selected through a specific procedure in order to represent the whole population and simultaneously generalise the results of the study.

In accordance with the explanation of the above purpose and objectives of the current study, it is demonstrated that this is an explanatory research and it clearly indicates that the current study is adopting the deductive research approach which is associated with the quantitative method of data collection. This study is parallel with the explanations of the sequential stages of research approach that have been explained by Saunders et al. (2009) in which it starts with theory, and is followed by hypothesis, data collection and findings. On the other hand, the current study is not adopting an inductive research approach as it is neither researcher's intention to explore nor to get a better understanding on the nature of performance of ports on the periphery.

5.1.3 Research Strategy

5.1.3.1 Survey

In the research onion framework (see **Figure 5.1**) research strategy is the third phase in the research methodology after research paradigm and research approach, which requires researchers to decide which technique is the most appropriate to be adopted in order to collect the reliable data to meet the research objectives of a particular study (Saunders et al., 2009). There are a variety of research strategies available to choose from such as experiment, survey, case study, action research, grounded theory, ethnography, and archival research which could facilitate researchers in gathering important and necessary information from selected resources (Saunders et al., 2009). Since there are many research strategies identified in social research, therefore, the selection of the most suitable method of data collection should be according to the research objectives of a particular study. In addition, the selection of the research strategy will also be guided by other criteria such as the extent of existing knowledge, the amount of

time and other available resources as well as the philosophical underpinning of the researchers (Saunders et al., 2009).

As explained earlier in section 5.1.2 and 5.1.3 pertaining to research paradigm and research approach, the current study has adopted the quantitative data for the data collection. In particular, a survey research strategy has been used in the current study to collect data from selected participants. A survey has been identified as the most appropriate research strategy for this study due to several reasons. One of the justifications that this study should collect the data through survey is because it tries to meet the research objectives of the current study by answering 'who', 'what', 'where', 'how much' and 'how many' questions. Given that, the objectives of the current study are related to identifying, synthesising, developing as well as examining the direct and indirect impacts of the potential strategies or factors toward the performance of ports on the periphery, thus, the data that need to be collected from participants or respondents is through research survey strategy, in particular, the questionnaire survey. This is because the survey method is able to help this study to obtain get data directly from selected participants pertaining to practices, views, and situations of the researched phenomenon.

In addition, as the current study tries to examine and understand the causal relationships between the identified potential strategies or factors and the performance of peripheral ports, therefore, survey has been recognised as the appropriate strategy to get valid verification of the theory of the researched phenomenon from participants. Moreover, as positivists tend to be objective and not involved with the phenomenon that is being examined, thus, the only available method to collect data from separate participants is the survey. Given that, the current study and the reality are emotionally separated, the researcher has the opportunity to ask any questions that are precisely related to the topic being researched and able to cover the full range of issue and variables that may be relevant to a particlar research question (Lynn, Erens, & Sturgis, 2012). This subsequently indicates that the required data are credible and reliable as the current researcher is independently separated from the participants and emotionally neutral (Jonker & Pennink, 2010). Moreover, the survey can be designed to represent the whole population that is under study by collecting data from a sufficient size of sampling and the research produces results based on a real-based observations (Lynn et al., 2012; Kelly, Clark, Brown, & Sitza, 2003). In accordance with the above explanations, it clearly shows that this study should be guided by the survey for her research strategy through a questionnaire to a sufficient selected sampling size of participants for the data collection.

On the other hand, although other methods of data collection, such as experiment are offered under the positivism and deductive approach, it focuses more on a natural scientific method, which tends to answer 'how' and 'why' questions instead of 'what', 'who', 'where', 'how much' and 'how many' questions. In addition, this type of research strategy is prone to be conducted inside the laboratories rather than in the field (Saunders et al., 2009). Meanwhile, the method of data collection through case study is inappropriate for this study as it involves an empirical investigation on the real-life context within a particular phenomenon. In addition, the adoption of case study is proper when a piece of research needs deeper and richer understanding of a phenomenon in which researchers are interested. As the current study has no intention to solve or improve any organisational issues that require immediate solution, therefore, case study has been omitted.

In addition, as a case study approach needs researchers to be part of the organisation through collaborative research, it requires a certain amount of time, effort, financial input and accessibility to accomplish the mission. On the other hand, the other research strategies under the inductive approach such as action research, grounded theory, ethnography and archival research were also excluded from the current study. This is because these research strategies focus more on theory building when the research objectives have been developed through the data collection rather than relying on existing theory. In addition, these four research strategies are purely qualitative and beyond the scope of the current research, which is only interested in investigating the relationships between factors or variables of ports under study. On the other hand, the current study is guided by the deductive research approach which starts with the existing theory, hypothesis development, data collection and findings.

5.1.3.2 Research method choice

Prior to selecting the research strategy, a combination of a single questionnaire survey (mono method) and MRA were the only data collection and data analysis technique adopted in this study. The selection of a mono method is mainly due to the purpose of the study, where the researcher is interested in investigating the performance of ports on the periphery through causal relationships that might occur between identified factors or variables. In addition, the sub-objectives of this study can also be achieved through this mono method, where related questions can be included in a single questionnaire survey and tested in a single statistical analysis procedure. This subsequently indicates that multiple methods – neither multi-methods

(through several quantitative or qualitative data collection techniques and several quantitative or qualitative data analysis procedures) nor mixed-methods (through a combination of quantitative and qualitative data collection techniques and data analysis procedures) – are required for this study.

Under the research design scope, a research time frame is required in order to accomplish a particular study within a given time. However, the time frame here does not refer to the number of years required to produce solid findings from the analysis; instead, it refers to the time horizons required to conduct the research. There are two important time horizons that could be found when conducting a particular piece of research viz. cross-sectional and longitudinal study (Saunders et al., 2009). A cross-sectional time horizon is a 'snapshot' of a current situation at a particular time. Meanwhile, a longitudinal study requires a specific period of time such as years where repetitive activities such as interviews with and observations of the same individuals, groups, or organisations will be carried out from the beginning of the study. To identify which time horizons a particular piece of research falls inside again depends on the research questions or objectives of the study.

Grounded on the time horizons as briefly discussed above and the objectives of the study, this research is considered to be a cross-sectional study because it only collects necessary data for a short period of time on a particular situation as a 'snapshot' (Saunders et al., 2009) in order to investigate the relationships between potential strategies and the performance of peripheral ports and subsequently to explain the possible causal relationships that might or might not occur between the variables. In addition, as mentioned earlier, survey is the main research strategy adopted to collect necessary information and data from participants; thus, this strengthens the time horizon approach of the study. On the other hand, longitudinal study was not considered in this study because of several reasons. Firstly, the current research is collecting and analysing data through a quantitative approach instead of a qualitative approach. Secondly, the period of collecting and analysing data only lasted for a few months. Thirdly, longitudinal study is a qualitative approach where in-depth understanding is required for a longer period of time. Finally, despite the fact that a longitudinal study could produce invaluable and lasting results, it does require times and money to set up and run the process. In accordance with the objectives, this study did not require the longitudinal study approach and it is beyond the scope of the current interests of the researcher.

5.1.3.3 Questionnaire survey

As explained in the previous section (5.1.3.1 & 5.1.3.2) survey is one of the research strategies and also a process of acquiring information or data from a specific group of people. Precisely, the information or data that researchers seek can be obtained through a questionnaire survey and interview either face-to-face or telephone which can be applied to one or more groups in a wide range of settings. Given that, the choice of the research strategy is survey, therefore, the method of the data collection for this study is in quantitative approach. To be more specific, a well-structured questionnaire is employed and distributed to port stakeholders that have direct business activities with port service providers. Questionnaire survey has been identified as the best method of data collection for the current study because it provides a path to investigate the attributes, behaviours, opinions, beliefs, preferences and attitudes of a particular subject (Aldridge & Levine, 2001). In addition, a questionnaire survey is more simple and well-structured and is usually performed as a self-administrated questionnaire in which participants can simply fill in the questionnaire after reading the instructions enclosed. This can be carried out through the distribution of the questionnaire survey to the selected participants via several existing means, either traditional or sophisticated and modernised.

Generally, a questionnaire survey is a printed (pencil-and-paper form) list of questions that have been categorised according to the researcher's requirements. However, with sophisticated and up-to-date ICS, more and more researchers tend to use and adopt on-line questionnaire surveys. In addition, as compared to other means of data collection, such as face-to-face and telephone interviews, respondents are believed to be more truthful and honest in giving their opinions or judgements in the questionnaire, especially when sensitive or controversial issues are being addressed. This is because participants have been granted assurance that their identity will not be revealed to other parties and all their responses will be private and confidential (Leedy & Ormrod, 2010). This is where the cover page of the questionnaire is vital in giving information about the research and the questionnaire itself. All information about the participant's privacy and confidentiality needs to be clearly stated and that the data received from participants will be used for research purposes only. This initiative thus makes participants feel more secure and safe when giving their opinions and judgments when completing the questionnaire. Moreover, Phellas, Bloch, & Seale (2011) identified several advantages of the self-administrated questionnaire survey such as cheaper to administer, greater geographical coverage, reduces biasing error, and greater anonymity.

As the current study is prone to get opinions and perspectives on the performance of ports on the periphery from port stakeholders in three different continents viz. UK, Malaysia and Nigeria that have direct business activities with ports, hence, this study has adopted and deployed both mail and email questionnaire survey rather than interview in order to collect reliable and credible data from those selected participants.

5.1.3.4 Questionnaire Design

There are a number of criteria that should be considered by researcher before designing a complete questionnaire survey in order to collect appropriate information and data from participants. Criteria such as the aim of the questionnaire, location of the study (locally or globally), respondents of the study (including who are the right participants, why they are selected and how many of them should be involved in the study), means of distribution (either mail, fax, telephone, interview, observation, e-mail, web-based survey, etc.), how to attract participants' attention to participate in the study, and, finally, how to analyse the data that have been received (including what type of data analysis, why the data analysis has been selected and how the data has been analysed) are some of the criteria that should be in the researcher's mind before collecting the data.

In order to attract the participants to participate in the study, a cover page is attached for each of the respondents. The cover page includes all information about the study such as its background of the study, aim, participants' consent, time taken to complete the questionnaire survey, the risks involved, and the researcher's institution and contact details. It is important to enclose the cover page as it is a medium of communication between researcher and participants in briefing the latter regarding the intention of the questionnaire survey and the procedures that they should follow before continuing to participate in the study. In addition, two star notes also appear on the cover page as explanation of the terms used in the questionnaire; therefore, ensuring that participants should not experience difficulties when completing the questionnaire survey as everything has been explained beforehand.

The questionnaire survey contains questions which are grouped into six subject sections: demographic/participants' background, concentration/situation of port, venue of port, PSCI strategy, sustainability and port performance. The first section of the survey asks about the participant's details relating to demographic/ background such as the business category, the origin of the company, work experience, number of employees, participant's position in the

organisation, types of commodity handled, market scales, annual total TEUs, annual total tonnages and company annual revenue. The second section asks for information about the hinterland of the port, also known as the catchment area of the port. In the third section, questions about the characteristics of the port such as physical and human environment are asked.

PSCI strategy indicators such as MMO, VAS, ICS, RWSCA, and SCIP are grouped in section four. In the next section, participants are asked about sustainability as a trade-off for the ports on the periphery as a result of lack of intermediacy or being far from maritime shipping routes. Environmental, economic and social elements are the ones that have been identified from the literature in order to measure the sustainability variable. The last section, section six, encompasses the performance indicators such as effectiveness and efficiency of the ports.

Meanwhile, the measurements for each of the indicators used in this study were adopted from the past literature. There are five important variables that form the research framework in the study. The detailed measurement of concentration of port indicators or hinterland of port has been extracted from extensive studies carried out by authors such as Hayuth & Fleming (1994), Fleming & Hayuth (1994), Slack and Fremont (2005), Yeo (2007), McCalla (2008), Wiegmans et al. (2008), Cheon (2009), Feng (2010) and Brooks et al. (2010); on the other hand, the measurements for site element are adopted from Brooks et al. (2010), Flemming & Hayuth (1994), McCalla (2008) and Feng (2010); whilst the measurements for the PSCI indicator in this study were adopted from recent studies such as Panayides & Song (2008), Song & Panayides (2008), Tongzon et al. (2008), Panayides & Song (2009) and Woo et al. (2012).

Studies accomplished by Jeon & Amekudzi (2005), Jeon, Amekudzi, & Guensler (2008), Lopez-Gamero et al. (2010), Lau (2011), Lu et al. (2012) and Jeon et al. (2013) support the measurements used for the sustainability variable. Last but not least is the outcome indicator, known as the dependent variable of the study, which is port performance. Prior to port performance measurements, most of the previous studies in maritime transportation used throughput as a proxy for port performance measurement (see Yeo, 2007). In addition, traditional measurement of performance has concentrated on the foreland perspective rather than the combination of foreland and hinterland. However, the port industry nowadays is not like it used to be when it reacted only as a transit point for vessels to load and unload cargoes. The port industry has moved from providing a basic service to a broader function which has

close logistics chain activities throughout the entire process from manufacturing to end customers.

Thus, throughput is no longer suitable to measure the performance of ports. Therefore, this study will use effectiveness and efficiency to measure the performance of ports on the periphery. In addition, because port operations and management is a combination of three interrelated channel approaches, which are trade channel, logistics channel and supply channel, thus the performance of a port should be measured in terms of its contribution to the performance of the entire channel (Bichou & Gray, 2004). Therefore, measurements were identified and pulled from previous studies that have been conducted by Song & Panayides (2008), Molina-Azorin et al. (2009), Woo et al. (2012), Lopez-Gamero et al. (2010) and Rao & Holt (2005). The summary of the variables and measurements used in this study can be found in **Table 5.4**.

In terms of questionnaire design, there are two types of 'how' question being asked to participants. The first type is multiple choice questions, which require participants to choose one or more answers for each question. This type of question only appears in section one, which is related to demographic of participants or background. Meanwhile, Five-Point Likert Scale questions are asked in sections two, three, four, five and six by using three different indicators such as (1) 1=Strongly Agree and 5=Strongly Disagree (2) 1= Very Important and 5=Very Unimportant and (3) 1= Excellent and 5= Poor (see **Table 5.3**). In this type of question, participants were asked to only tick one box per row and were not allowed to tick more than one box and they have to answer all questions. There are a few underlying reasons that led to the selection of a Five-Point Likert Scale measurement instead of others. Firstly, the use of a Five-Point Likert Scale in maritime transportation studies is prevalent and popular. Secondly, the choice of Five-Point Likert Scale measurements in the questionnaire survey was to enable a simple and easy approach.

Table 5.3: Five-point likert scale questions

1	2	3	4	5
Strongly Agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Very Important	**Important**	**Neutral**	**Unimportant**	**Very Unimportant**
Poor	**Fair**	**Neutral**	**Good**	**Excellent**

To balancing the strongly agree and strongly disagree, a neutral position is available in the Five-Point Likert Scale measurement, in order to provide a fair approach for participants if they neither agree nor disagree with the questions or statements given in the questionnaire survey (Feng, 2010). She added that, initially, it is better to give a greater choice of points to respondents (i.e., Scale of 7); however, it is argued that a greater choice of scale points may confuse the participants and there is a concern that this would not produce rich information and the quality of the data might be jeopardised. In addition, Nunnally & Bernstein (1994) mentioned in their psychometric theory book that having more scales in a questionnaire will eventually diminish the return rate of the data, not to mention increasing the number of questions included and being asked in the survey. With these issues in mind, therefore, a Five-Point Likert Scale measurement has been adopted in this study in order to get a balanced view from participants as it is found to be able to reduce the possibility of receiving a low response rate from participants.

Table 5.4: Measurements of the study

Author	Variable	Measurement
• Hayuth & Fleming (1994) • Fleming & Hayuth (1994) • Slack and Fremont (2005) • Yeo (2007) • McCalla (2008) • Wiegmans, Hoest, & Notteboom (2008) • Cheon (2009) • Brooks et al. (2010) • Feng M. (2010)	Situation	• Market size • Market distance • Transport generating
• Hayuth & Fleming (1994) • Fleming & Hayuth (1994) • McCalla (2008) • Brooks *et al.* (2010)	Site	• Human environment • Physical environment
• Panayides & Song (2008) • Song & Panayides (2008) • Tongzon et al. (2008) • Panayides & Song (2009) • Woo et al. (2012)	PSCI	• Multi-Modalism Operation • Value-Added Services • Supply Chain Integration Practices • Information & Communication Technology • Relationship with Supply Chain Actors
• Jeon & Amekudzi (2005) • Joen, Amekudzi, & Guensler (2008) • Lopez-Gamero, Molina-Azorin, & Claver-Cortes (2010) • Lau (2011) • Lu, Shang, & Lin (2012) • Jeon, Amekudzi, & Guensler (2013)	Sustainability Advantage	• Environmental Advantage • Economic Advantage • Social Advantage
• Rao & Holt (2005) • Song & Panayides (2008) • Molina-Azorin, Claver-Cortes, Pereira-Moliner, & Tari (2009) • Woo et al. (2012) • Lopez-Gamero, Molina-Azorin, & Claver-Cortes (2010)	Port Performance	• Effectiveness • Efficiency

5.1.4 Who are the participants?

Upon developing the desire to collect data for this study, specific and suitable participants were identified. Given that this study is about the strategy in the port industry, therefore, port stakeholders were identified as the most appropriate participants. While no clear definition of port stakeholders has been found in maritime transportation literature, Notteboom & Winkelmans (2002) have defined them as persons or groups that have legitimate interests in any aspect of port activities and development. In the narrow view, port stakeholders include shareholders, managers, employees, port users, service providers, and other economic players in and around the port. However, the use of this port stakeholder's category in a particular study depends on the purpose of the study (Notteboom & Winkelmans, 2002).

Prior to this definition, other maritime transport studies have used a similar approach in order to identify the right organisations or groups to be included in their study as the right port stakeholders. Lam, Ng, & Fu (2013) considered government, shipping companies, terminal operators, shippers, logistics providers, and parties in related and supporting industries as port stakeholders in their research. Meanwhile, Langen (2007) considered port stakeholders as transport firms, port labour, manufacturing industry, end users (importers and exporters), local environmentalist groups, and government (both regional and national). Denktas-Sakar & Karatas-Cetin (2012) classified port stakeholders into four broad categories: internal stakeholders (parties inside the organisation), external stakeholders (organisations that invest directly and indirectly), legislation and public policy stakeholders (governments) and community stakeholders (non-governments).

In her PhD research, Feng (2010) has classified port stakeholders into five main categories: shipping lines, consignors and consignees, port managers, port service providers and other port stakeholders. On the other hand, Kim (2014) classified port stakeholders into four main categories: port authorities, terminal operating companies, government bodies and, lastly, researchers and academic groups. Based on the previous studies, it is clear that there is similarity in terms of organisations involved under the port stakeholders category. Specifically, these organisations are said have direct and indirect business activities with ports. Organisations or groups that have direct activities with ports are port service providers, ports' users and ports' employees. Meanwhile, those organisations that have indirect business activities with ports are governments and non-government sectors.

Parallel with the above studies, therefore, it has been identified that organisations or groups that have direct business activities with ports need to be included in this study. To be more specific, these organisations are port service providers (such as port or terminal operators and port authorities) and port users (such as shipping lines and freight forwarders); these are the most prominent participants that have been selected to be involved in this study and thus answer the questionnaire. However, shippers or importers and exporters, also known as consignors/ consignees, are excluded from the current study. This is because most of them have indirect business activities with ports, particularly those shippers that are involved with small business activities, also known as SMEs. Also, most of them have a tendency to using agents or freight forwarders to transport their products or goods either in small or large volume.

As port service providers and port users are selected in this study, hence, top management decision-makers are the main targets participants of the disseminated survey. Specifically, the strategic decision-makers who have been selected in this study are the ones who are the most prominent person in the organisation, filled with knowledge, skills and experiences in the field. Thus, it is strongly believed that their views, opinions, judgments, and cooperation will be very valuable to this study. In addition, they were selected to be involved in this study because they are responsible for mapping the roadmap of their company's success. Therefore, the questionnaire survey has been specifically designed to be responded to by those individuals who are responsible for business strategy.

Given that port stakeholders in the three countries under investigation are the main participants to receive the questionnaire survey, thus, they are also identified as the main population to be involved in this study. Based on the detailed explanation above regarding the organisations that should be considered as port stakeholders, port service providers and main port users provide the sampling frame for this study. Nevertheless, this research discovered that there is no specific public representative database of port stakeholders; therefore, various but reliable sources were used to identify the population of this study. This approach is a guideline in determining the size of population and sample to be adopted in this study. Feng's (2010) PhD adopted a similar approach in her research where the population involved is port stakeholders at both Xiamin port in China and Humber port in the UK. A similar case can be found in Kim's (2014) PhD when he was relying on a variety of sources in Hong Kong, Shanghai and Busan in order to determine the number of population and sample for his research.

Three countries provide the location for the current study, residing on three different continents: Malaysia, the United Kingdom (UK) and Nigeria. In Malaysia, a wide-ranging search all over the country has been carried out in determining the participants for the study. Since port stakeholders encompass numerous parties, therefore, a thorough search was needed in order to identify the right participants to be contacted from each association. For instance, in relation to port/terminal operators and port authorities, it is understood that no single organisation or association has been developed to assist these two port stakeholders. Although the Federation of Malaysian Port Operating Companies (FMPOC) can be found in the Ministry of International Trade and Industry's website, nevertheless, the details (website) of the said association cannot be found.

Therefore, the Ministry of Transport of Malaysia (MOT-Maritime Division) was contacted to get a clear picture about the FMPOC. It was confirmed that the FMPOC has been developed to purposely discuss the needs and current issues among port operators in Malaysia. However, the MOT stressed that not all port/terminal operators in Malaysia are registered as a member of the association. As a consequence, organisations that are related to the maritime transportation sector were contacted in order to identify the port operating companies and port authorities. Most of the port/terminal operators and authorities were generated from the MOT, Jabatan Laut Malaysia (Malaysia Marine Department), and Maritime Institute of Malaysia (MIMA).

In addition, the Malaysia ASEAN Port Association (MAPA) – an organisation that is formed by Malaysia, Brunei Darul Salam, Singapore, Cambodia, Philippines, Myanmar, Vietnam, Thailand, and Indonesia in order to advance their agenda for economic growth, social progress and cultural development – has also been contacted to obtain a complete list of port operating companies and authorities in Malaysia. On the other hand, the Federation of Malaysia Freight Forwarders (FMFF), the Shipping Association Malaysia and Malaysia Shipowners' Association were contacted to acquire a list of freight forwarders and shipping companies respectively in Malaysia.

Meanwhile, in the West African region, the NPA was contacted in the desire to obtain a complete list of port/ terminal operating companies and port authorities. Several email conversations took place between the researcher and one of the University of Liverpool alumni members (senior operations manager at the NPA) in order to get the total number of port/

terminal operating companies and port authorities in Nigeria. Through close cooperation with an NPA staff member, the researcher managed to acquire a complete list of port operating companies and authorities in Nigeria. Meanwhile, through the Nigerian Shippers' Council website, researcher was able to obtain list of freight forwarding and shipping lines.

On the other hand, in the European region, list of participants in the UK have been generated from reliable sources, among others the United Kingdom Major Ports Group Limited (UKMPG), British Port Association, British International Freight Association (BIFA) and the UK Chamber of Shipping. Similar to Malaysia, port stakeholders in the UK came from several sources, especially port/ terminal operating companies and port authorities. Meanwhile, freight forwarders in the UK region were retrieved from the BIFA, where its members are often updated. On the other hand, the shipping line companies came from the UK Chamber of Shipping. However, it has been identified that the data from UK Chamber of Shipping are mixed with other related companies such as legal, insurances, oils and gas drilling, ship builders, fisheries, engineering and others. Therefore, data that were generated from the UK Chamber of Shipping have to be scanned beforehand in order to produce a clean list of shipping line companies.

Since there are many organisations being contacted by the researcher, particularly in Malaysia and the UK, in order to identify the organisations, cross checks need to be carried out carefully over the resources in order to ensure that there is no redundancy among port stakeholders that have been identified previously. To accomplish this, an appropriate database has been created in order to gather the number of population from those countries. Through carefully cross checked of the population, researcher managed to provide a finalised database that can be used to identify sample size and select the right sample. In addition, the created database is complete with the contact details of the potential participants which include full name, position, company name, company address, contact number, email address and fax number.

Once the number of population in this study has been finalised, it is necessary to identify the appropriate number of participants who will receive the questionnaire survey. Therefore, the sample size should be decided and drawn from the total number of population. Sekaran (2003) proposed several rules of thumb that could be used as a guideline to determine the sampling size for a particular study. First, generally it is acceptable to have a sample size of more than 30 and less than 500 to conduct a study. Second, any research that has sub-samples such as

gender (male/female) and organisation (private/public), to name but two, should have a minimum sample size of 30 for each of the sub-samples. Third, a larger sample size is required for a multivariate study and it depends on the number of variables included in that particular study. Lastly, a sample size of 10 or 20 could be used for a simple experimental research with tight experimental control.

For the current study, the number of participants or the sample size that will be used in order to disseminate the questionnaire survey is based on the provided table entitled sample size for a given population size (Sekaran, 2003). **Table 5.5** below indicates the population size of port stakeholders and sampling size in the three countries under study. Specifically, the population size for the UK, Malaysia and Nigeria is 1700, 1200 and 819 respectively. Based on Sekaran's sample size table, the sample size for the UK population is about 313, the sample size for Malaysian port stakeholders is estimated to be about 291 and the sample size for Nigeria is approximately 260. Nevertheless, the sample sizes of port stakeholders in three countries were rounded up to 400 in the UK, 300 in Malaysia and another 300 for Nigeria in order to increase the response rate. Thus, the total number of questionnaire distributed to selected participants in the three countries was approximately 1000.

Table 5.5: Population and sampling size

Country	Population	Sampling	Rounded Sampling
UK	1700	313	400
Malaysia	1200	291	300
Nigeria	819	260	300
Total	**3719**	**864**	**1000**

Given that the nature of this study is trying to investigate the relationships of the variables that could impact on the sustainability and subsequently on the performance of ports on the periphery, a probability sampling technique was adopted in order to determine how the

participants would be selected. There are various sampling techniques under the probability sampling technique that researchers could stand on such as simple random, systematic, stratified random, cluster and multi-stage. Each of these sampling techniques has its own strengths and weaknesses. Nevertheless, under foreseen circumstances, only one sampling technique will be used in this current study. The technique and decision to draw these sample sizes from the population, a complete procedure drawn by Saunders et al. (2009), was used as a guideline in order to select the right participants. Based on **Figure 5.2** below, the most appropriate sampling technique that should be adopted for the current study is stratified random sampling technique.

Several underlying reasons have influenced the researcher to adopt the sampling technique in this research. One of them is population size. Given that the size of the population of port stakeholders in the three countries is reaching 4000 in number, thus, it seems impossible for the current study to collect data from the entire population due to some uncertainties such as lack of budget, time constraints, distance constraints, and accessibility constraints. Therefore, it is wise to only pick a specific sample size from the identified population as the final findings could be generalised to the whole population size. Secondly, as the current study has adopted a mono-method approach where survey is the main medium of data collection (other methods of data collection such as face-to-face interviews, observations, etc., were not used) and there are many organisations or strata of port stakeholders, therefore, the said sampling technique should be employed. Lastly, because the sampling frame contains periodic patterns, therefore, the selection of the sampling size from the whole population of port stakeholders should be according to stratified random sampling technique

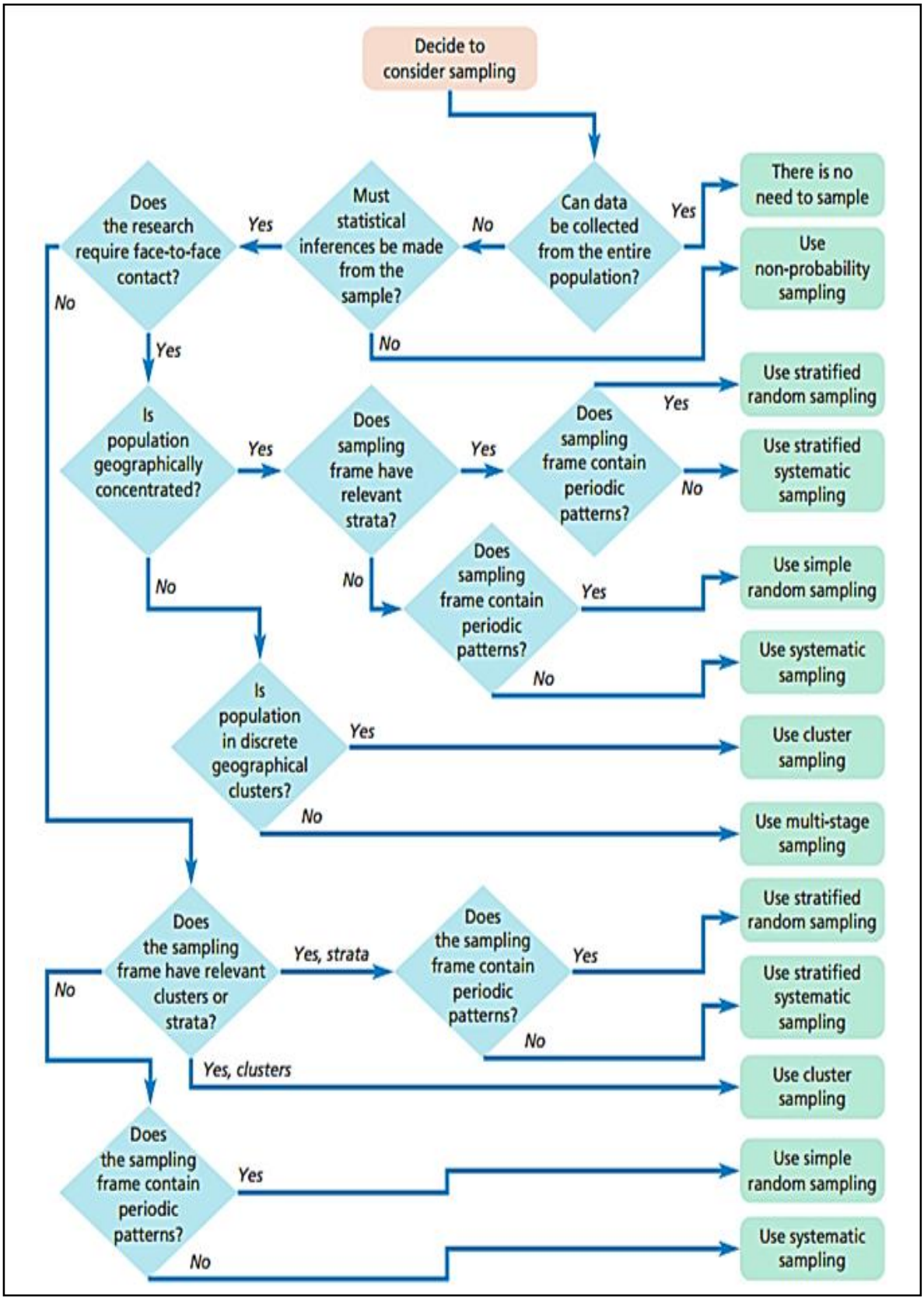


Figure 5.2: Probability sampling decision-making

Source: Adopted from Saunders et al. (2009)

5.1.5 How to distribute the questionnaire survey

This research employed both a pencil-and-paper and an online method as these are the most appropriate and prominent means for the data collection of the current study. Nevertheless, before questionnaire survey was disseminated to potential participants, pre-pilot and formal pilot tests were carried out a few times to ensure that the questions were understandable without any uncertainty or confusion. The pre-pilot test of the questionnaire survey was undertaken before the formal pilot test was distributed to participants. It is not a formal test but rather a process of information gathering from academicians and research fellows in the same department and also PhD students. Although it is not a formal process in data collection, it is essential for a researcher to identify any ambiguities in the questions and to identify the range of possible responses for each question.

This pre-pilot test was undertaken a few times by the researcher and all the feedback received from academicians, research fellows and PhD students was followed-up with amendments and corrections. Once the researcher was satisfied with the amendments and corrections to the questions, a formal pilot test was carried out. The pilot test aimed to increase the reliability, validity, and practicality of the survey, particularly for newly written items and questions, identify any further unexpected problems with the original survey, and refine the survey (Oppenheim, 1992; Saunders et al., 2009). In addition, the whole survey needs to be tested for length, time and how difficult it is to complete (Punch, 2003). The questionnaire survey was distributed to PhD students, academicians and practitioners who have knowledge and work experience in the port industry and are involved in decision-making strategy, especially port stakeholders. Once the pilot test had been conducted, necessary correction was undertaken based on the respondents' reviews, comments and suggestions.

The actual data collection was launched with approximately 1000 questionnaire survey distributed to port stakeholders on three different continents: Europe, Asia and Africa. Those surveys were disseminated on August 14, 2014. The questionnaire survey in these three regions was delivered via mail as the researcher has personal contacts who were able to assist in distributing the survey directly to the right respondents. Meanwhile, email was also used to send the questionnaire survey to respondents as a reminder in order to collect the data.

The data collection period lasted for around four months. Then, every two weeks follow-up calls and emails were carried out as a gentle reminder for participants to complete and return the survey. In the follow-up reminders, the researcher emphasised the crucial nature of the research to the port industry and to the respondents specifically. In addition, the value of the respondents' participation was highlighted in the reminder as an appreciation from the researcher of their willingness to be involved in the study.

5.2 DATA ANALYSIS TECHNIQUES AND INTERPRETATION

Data analysis is a further step involved after the researcher has managed to collect a required amount of cases from participants. Specifically, it is a process by which to obtain the findings that are able to answer the research questions of the study. There are many statistical tools available, from the technique of exploring the relationships among variables to the technique of comparing groups. In order to explore the relationships between variables, the researcher has several options available, such as correlation, partial correlation, regression, logistic regression and factor analysis. Meanwhile, the statistical techniques such as non-parametric statistic, t-tests, one-way Analysis of Variance (ANOVA), two-way between groups ANOVA, mixed between-within subject's ANOVA, Multivariate Analysis of Variance (MANOVA), and Analysis of Covariance (ANCOVA) could be used for comparing two or more groups in a study.

However, in order to determine the suitable and appropriate statistical techniques to be adopted in this study, the researcher is required to follow several necessary steps. Processes from data inspections to inferential statistical analysis will be determined under this procedure. To run the data analysis, SPSS version 22 was employed. Prior to the data analysis procedure, there are three important steps that need to be conducted in order to generate and produce solid findings from the selected statistical analysis. These three procedures are data file preparation, EDA or also known as preliminary analysis, and inferential analysis. The first step that should be conducted is data file preparation, followed by EDA and, lastly, the inferential analysis.

5.2.1 Preparing the data file

There are three key steps required to prepare the data file into SPSS: (1) check and modify, where necessary, the options that SPSS uses to display the data and the output that is produced, (2) set up the structure to define the variable names and codes and, lastly, (3) enter the data that have been received from participants (Pallant, 2010). However, before data were entered into SPSS file, it was first recorded in Microsoft Excel 2007 in order to avoid any carelessness that could produce mistakes while entering the data. Data that have been recorded in Microsoft Excel were checked regularly in order to ensure that they are free from any mistakes. This procedure was conducted several times until the data collection process was completed.

Prior to entering the data into SPSS, the software options were checked and modified, where necessary, in advance before entering the data. The changing and modification of the SPSS options helped with regard to how the output was displayed. In addition, all research variables that were included in the questionnaire survey were defined and coded carefully and properly. Nevertheless, different variables may be defined and coded differently. Finally, the complete data was imported from Microsoft Excel 2007 directly into the SPSS software.

5.2.2 Exploratory Data Analysis (EDA)

This is the first step that needs to be looked at in order to select the best statistical analysis techniques that best suit the current study. In addition, this is to ensure that the findings from the study are correctly produced. The main purpose of EDA is to examine and get to know the current data (Morgan, Leech, Gloeckner, & Barrett, 2008), which can be carried out through descriptive statistics, data exploration, manipulating the data, checking the reliability scale of the data and, finally, choosing the right statistics for inferential analysis (Pallant, 2010). Descriptive statistics were used in this current study purposely to describe the characteristics of the sampling data. Useful information such as the number of subjects or cases in the sample and the basic demographics of the subject – such as the company category, the origin of the company, the company's business activities, the number of company employees, the work experience of subjects, the subject's position in the company and company revenues – were obtained through this procedure.

Prior in conducting the EDA, missing values and unengaged responses were checked beforehand through Microsoft Excel 2007 before the data were imported into SPSS. Cases or

participants that did not respond to or answer much of the questionnaire survey were considered as missing values. This can be seen at questions that have been left blank without ticks or marks in the given boxes. Meanwhile, any cases or participants who responded with the exact same value of Likert scale such as 'strongly agree' or 'strongly disagree' for every single question were considered to be unengaged responses. Unengaged response means that there is no variance in a participant's responses, albeit they might be telling the truth, and so their answers are not useful. It is very important to have variance in their responses; therefore, only engaged responses will be included and considered in this study.

Cases with more than 10% missing values were taken out from the study as their presence could have a significant impact on the findings. To be more specific, the proportion of mission values is directly related to the quality of statistical inferences for a particular case or study (Dong & Peng, 2013). In addition, statistical analysis of a particular case or study can be considered biased when the proportion of missing values is more than 10% (Bennett, 2001). Meanwhile, the unengaged responses were based on the standard deviation value in which cases with less than 0.100 were dropped out from the study. Through Microsoft Excel 2007, the above values of missing values and unengaged responses were easily generated. Specifically, COUNTBLANK and STDVEP formulas were employed in order to determine the percentage of missing values and unengaged responses respectively. Subsequently, cleaner data has been successfully produced and are free from missing values and unengaged responses. In addition, screening and cleaning over the categorical and continuous variables were undertaken several times in order to check any mistakes and errors made during the data entry. To conduct these procedures, descriptive and frequency analysis were employed and mistakes or errors were corrected accordingly.

Moreover, a normality test was also conducted in order to explore the distribution patterns of the sampling data. There are two obvious distribution patterns that will determine the selection of the inferential analysis of the study, which are whether the data are normally distributed or are not normally distributed. As for the current study, skewness and kurtosis statistical values were used as indicators to determine the distribution pattern of the data. In addition, outliers were also examined in the current study. Specifically, through the assumption analysis, the univariate and multivariate outliers were detected and identified. Given that these outliers could affect the findings by causing the model of the current study to be biased as they affect the

values of estimated regression coefficients (Field, 2005), therefore, they will be deleted from the study.

Meanwhile, some of the raw data that were gathered from participants needed to be manipulated in advance in order to ensure that future analysis could be conducted properly. Specifically, in the current study the categorical variables of company category: shipping lines, freight forwarders, port/terminal operators and port authorities need to be collapsed into two main company categories: port users and port service providers. From the descriptive statistics analysis, it was found that only a few participants fall into the shipping line category compared to the other three categories. Therefore, it was viewed that it is necessary to collapse the shipping lines and freight forwarders into a single category of port users based on their business natures where they are identified as the main and direct customers of ports. The same approach was also applied to port/terminal operators and port authorities because they are the main service providers for port users.

Given that reliability and validity of the variables and measurements are very important in conducting quantitative research, particularly when a questionnaire survey is employed to collect data from participants, therefore, it is necessary to conduct a reliability test of the scales in order to make sure that they are valid and reliable for the current study. The internal consistency of the scale was checked rigorously through Cronbach's Alpha (α) value. This is one of the procedures that should be considered under the EDA scope. In order to identify the acceptability of the internal consistency of the Cronbach's Alpha of the current study, values of 0.70 or higher should be obtained from the reliability analysis, as widely recommended by Nunnally and Bernstein (1994).

The last EDA that should be conducted before inferential analysis is the selection of the statistical analysis (Pallant, 2010). There are two difference types of statistical analysis technique that could be adopted in the current study; however, the selection depends on several criteria. The decision-making process to identify the right statistical analysis for the current study involved several steps. Firstly, it depends on the research questions and objectives of the study, whether exploring the relationship or exploring the difference between groups. Secondly, the researcher has to look at how the questionnaire items are being measured, how many response options were available and the possible range of scores.

Thirdly, it is essential to identify the nature of the variables included in the questionnaire such as which items are independent and dependent variables. In addition, it is important to know the level of measurement of the variables (such as categorical, continuous, and ordinal) included in the study, as different statistical analysis techniques require different levels of measurement. Fourthly, utilising a diagram (i.e. relationships between variables) or writing down key points for each of the research questions is helpful. Lastly, identifying the pattern of data distribution, whether it is parametric or non-parametric statistics. The former statistical analysis technique will be adopted if the data received from participants are normally distributed and non-parametric statistics are suitable for data that are not normally distributed, where most of the data will be positively or negatively skewed. Thus, the final decision to select the most appropriate statistical analysis technique depends on the above five criteria.

The main purpose of the current study is to investigate the performance of ports by considering factors such as situation and site elements of ports on the periphery, the PSCI strategy and sustainability in the performance of the ports on the periphery. Specifically, it intends to investigate the interactions of the variables between each other and at the same time examine their impacts on the performance of this category of ports. Spatial characteristics or, more specifically, situation and site elements, PSCI strategy and sustainability have been identified as the independent variables of the study. Meanwhile, port performance of ports on the periphery was identified as the dependent variable of those three independent variables. It has also been identified that PSCI strategy and sustainability are the dependent variables of the situation and site elements of spatial characteristics of ports on the periphery.

In addition, the current study has clearly identified that the level of measurement of both independent and dependent variables falls under the continuous category. Given that the theoretical research framework of the current study has been successfully developed in the previous chapter, therefore, it was used to assist the researcher to stay focused on the research questions. In addition, the distributions of the current data are found to be normally distributed and none of the variables are positively or negatively skewed. The normality of the distribution of the data indicates that the most appropriate statistical analysis technique that should be adopted for the current study is parametric. This explanation has eased the decision-making of the statistical analysis technique for inferential analysis.

5.2.3 Inferential Analysis

The above explanations lead to the final conclusion that the most suitable statistical analysis is regression analysis. Sykes (1993) clarifies that regression analysis is a statistical tool for the investigation of relationships between variables. It is a process to ascertain the effect of one variable on another variable. Specifically, it is used to investigate the relationship patterns between a dependent variable and one or more independent variables in a single research framework. Under the regression statistical tool, there are two types of regression analysis: simple and multiple regressions. Given that the current study has more than one independent variables, a dependent variable, and the level of variable measurement is continuous, therefore, MRA was adopted and employed in order to test the relationships in the study. MRA is not only a technique, but it is also a family of techniques that can be used to explore the relationship between one or more continuous independent variables towards continuous dependent variables. Another family technique that can be used to explore the relationship between variables is Logistic Regression Analysis (LRA). This technique is applicable when the level of measurement for independent variable is either categorical or continuous and only if the dependent variable is categorical (e.g. fail/pass, strong/weak, win/lose).

Contrarily, MRA can also be used to statistically control for additional variables or more variables when exploring the predictive ability of the model. Nonetheless, it should be noted that different predictions over the relationship between variables in this study used different types of MRA. To be specific, different types of MRA have been applied and adopted in order to test different research questions or objectives of the study. In particular, standard or simultaneous MRA was applied and adopted in this study in order to analyse the relationships of the variables. To undertake this statistical analysis technique, there are assumptions that should be considered in order to determine whether or not the data violate the given assumptions. To be more specific, there are four assumptions – the sample size, multicollinearity and singularity, outliers and normality, and linearity, homoscedasticity and independence of residuals should be met beforehand in order to avoid any mistake or problem.

Once the assumptions procedures have been completed, the second step is evaluating the model of the study. To do this, the value that should be looked at from the SPSS output is in the Model Summary table, which is R Square. This value indicates that the value (expressed in percentage) of the variance in the dependent variable can be predicted from the independent variables. To re-confirm and get a more significant result, it is suggested to look at the ANOVA

table, in which the significant value is less than 0.05 ($P \leq 0.05$). The last procedure of standard or simultaneous MRA is evaluating each of the predictors or independent variables of the study.

Finally, the decision to accept or reject the hypotheses of the study is through the evaluation of each of the predictors or independent variables. To do this, values under the significant name at the coefficient table need to be determined beforehand. Hypotheses of the study or the predictions of the independent variables towards the dependent variable will be accepted if the significant values are lower than 0.05 or $P \leq 0.05$. On the other hand, if the significant values are higher than the P value, it indicates that the hypotheses are not supported statistically. Therefore, these hypotheses should be rejected.

Given that, there are causal relationships between variables between predictors and dependent variable, thus, Baron & Kenny (1986) suggested a series of regression analysis and the researcher does not need to use hierarchical or stepwise MRA to test the indirect effect between variables (see **Figure 5.3**). Four regression equations have been put forward in order to test the indirect impacts of the causal relationships, in which the independent variables need to be regressed with the dependent variable (a), it is followed with the independent variables with the mediator (b), and the mediator need to be tested on the dependent variable (c), and, finally, the dependent variable will be regressed on both the mediator and predictors or independent variables to detect the indirect relationships between variables.

It is said that, to identify the presence of the mediator between predictors or independent variables and dependent variable, three conditions must hold (Baron & Kenny, 1986). First, there must be a direct effect between predictors or independent variables with the mediator. Second, the predictors must have an effect on the dependent variable in the absent of the mediator. Third, the mediator must affect the dependent variable of the study. Lastly, both independent mediator variables will be run simultaneously on the performance of ports on the periphery. This means that the mediator effect on the dependent variable should weaken the relationship between predictors on the dependent variable. In addition, the perfect presence of the mediator effect can be seen when the relationship between dependent variable and predictors has no significant effect at all. Statistically, the significant value of the presence of the mediator should be looked at in the coefficient table, in which the P value should be less than 0.05 ($P \leq 0.05$). The hypothesis of the presence of the mediator between predictors and dependent variable is unable to be rejected when the P value is lower than 0.05, and if the value

of P is higher than 0.05 it indicates that the mediator has no significant impact on those variables.

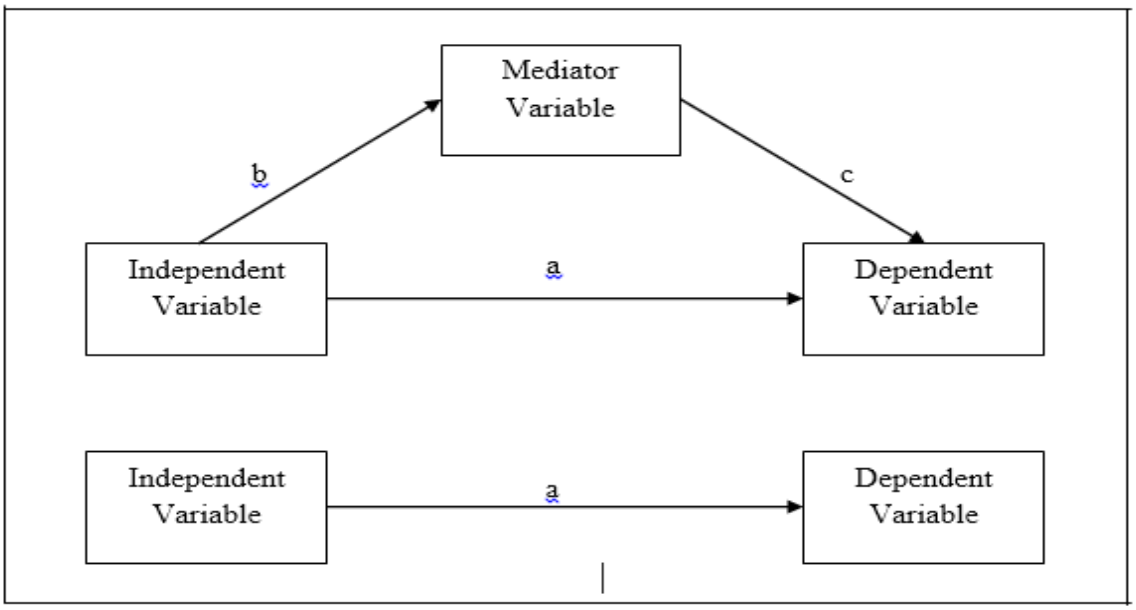


Figure 5.3: The direct and indirect effects of variables

For the current research, as discussed in the Chapter Four, thirteen separate regression coefficients have been put forward in order to test the presence of the direct and indirect relationships and impacts between those identified variables.

5.3 RESEARCH HYPOTHESIS

Principally, a research hypothesis is 'an informed speculation, which is set up to be tested, about the possible relationships between two or more variables'. Hypotheses should be developed to answer research questions and achieve research objectives. In this study, there are mainly thirteen hypotheses that have been developed and proposed concerning the performance of ports on the periphery. The findings of these hypotheses will be revealed in Chapter Six and a detailed discussion will take place in Chapter Seven. The discussion of the findings will be based on the results obtained from the MRA. In addition, the implications and opportunities of this research to both industry and academic sectors will be addressed. Given that hardly any

research is perfectly done, therefore, limitations and future research opportunities will be recommended to be conducted either by the current researcher or anyone who is interested to embark on it for further knowledge.

5.4 SUMMARY

This chapter has discussed the process of data collection and the data analysis that have been adopted and employed in the current study. The research philosophy on which this study relies is the positivism paradigm where its justifications were based on the ontology, epistemology, and data collection techniques which are often adopted. Given that the existing theories were the main resources through which to investigate the phenomenon in which the current research is interested, therefore, it implying that is a deductive research approach. To collect information from participants, questionnaire survey was identified as the most appropriate instrument by which to gather data. Individuals or participants who should receive the questionnaire survey are port stakeholders such as port/terminal operators, port authorities, shipping lines and freight forwarders. They are the main population, sample size and sample frame of this study.

Approximately, 1000 sample size for the current study was identified from Sekaran's table of sample size and a stratified random sampling technique was used in order to ensure that the right individuals or participants were selected from the population size. These identified and selected participants then received a set of questionnaire survey through mail and email. To improve the response rate, several gentle reminders were sent asking them to complete and return the questionnaire survey. The completed and useable data were then used in the data analysis.

A data file was created in order to key in the data received from participants and EDA or preliminary analysis was then conducted in sequence to determine the right statistical analysis technique that should be adopted and employed for the inferential analysis of the current study. MRA was then identified as the main inferential analysis to be used to investigate the impact of the direct and indirect relationships of the identified variables. Specifically, thirteen separate MRA were successfully tested in order to detect both of the relationships. The summary of the process of this methodology chapter is presented in **Table 5.6** below. As the methodology chapter has thoroughly explained and undertaken the necessary steps in collecting the data from

the selected and suitable participants, thus, the next chapter provides the findings that have been generated from the MRA statistical analysis tool.

Table 5.6: Summary of research philosophies and approach

Research design	Selected design
Philosophy	Positivism
Approach	Deductive
Purpose	Explanatory
Strategy	Survey
Sampling	Stratified random sampling
Choice	Mono method
Time Horizon	Cross-sectional
Data Analysis	MRA

CHAPTER 6

DATA ANALYSIS AND FINDINGS

This chapter depicts the process of data analyses that were employed in order to produce the preliminary and inferential findings from the study. It started with the returned surveys being received from the respondents, followed by entering the data into Microsoft Excel 2007. The EDA or preliminary analyses were carried out in order to produce cleaned and better data. This is a compulsory procedure to avoid any mistakes and problems for the inferential analyses. In addition, through Microsoft Excel 2007, missing values of cases and variables and unengaged responses of the questionnaire survey were checked thoroughly. Only cleaned data will be used for further analysis. Given that the aim of the current study is to investigate the direct and indirect impact of variables, therefore, Multiple Regressions Analysis (MRA) was employed as the most appropriate tool for inferential analysis of the study. Specifically, this inferential analysis determines whether or not the findings are able or unable to reject the hypotheses that have been developed from the literature review. Given that 13 hypotheses have been developed in this study, therefore, explanation will be given based on the indicators used to determine and decide whether to reject or accept them. The last section of this chapter provides a summary which will briefly recapitulate the process to generate the findings of this study.

6.0 INTRODUCTION

To achieve the objectives of this study, there are a few important procedures that need to be undertaken. The procedures start with the preparation of the data file. There are three key steps involved in creating the data file, which are checking and modifying the options that SPSS uses to display the data and outputs produced, defining the variables and, lastly, entering the data. Data entry can be done by keying in the data from the useable returned questionnaire survey; they should be sorted beforehand into useable and unusable ones due to several reasons which will be discussed specifically in section 6.1. In addition, the entered data need to be screened in order to identify any errors or mistakes made during the preparation of the data file. Also, correcting errors or mistakes should be addressed in order to avoid any unwanted issues during inferential analysis.

Preliminary analysis is needed in order to inspect the data file and explore the nature of the variables. Specifically, it is a process to produce the descriptive statistics obtained from the analysis. It also helps to identify, eliminate and manipulate any data that could jeopardise the results during the inferential analysis. Also, this analysis addresses the reliability of the data or, more specifically, the reliability scale of the variables that were identified in this current study. On top of that, this preliminary analysis will help the researcher to decide the most appropriate statistical analysis to be employed for inferential analysis according to the distribution of the data, whether parametric or non-parametric. Inferential analysis is analysis that assists the researcher to produce the final results of the study. Specifically, it is a final analysis to achieve the objectives of the study through the acceptance or rejection of the hypotheses that have been developed from the existing theories (see **Figure 6.1**).

Figure 6.1: Process required in analysing data

6.1 PRELIMINARY ANALYSIS FINDINGS

6.1.1 Data Screening and Cleaning

In the previous chapter, port stakeholders (participants) were identified as the main population of the current study. In addition, through Sekaran's table of sampling size, it was shown that a sample size of about 1000 is needed from the total population. Through a stratified random sampling technique, the sampling size was identified and the questionnaire survey was distributed to selected participants in the three countries under study. Four months were allocated to collect data from those participants. In the meantime, a few reminders were sent out to the participants every fortnight in order to alert them to complete and return the questionnaire survey to the researcher. The first reminder was sent on 28 August 2014, followed by 11 & 25 September 2014, 9 & 23 October 2014 and lastly on 6 November 2014.

Upon the frequent reminders sent out to participants, 135 (13.5%) questionnaire survey was returned to the researcher within the four months. The returned questionnaire survey was screened and divided into two categories, useable and non-usable, before further preliminary analysis took place (**Table 6.1**). It was found that, of the 135 questionnaire survey, 22 (16.30%) of them needed to be dropped from the study due to a number of reasons, such as: (1) addressee had gone away (2) unknown addresses (3) incomplete addresses, (4) incomplete surveys (5) the addressee rejected participating in the survey due to company policy and (6) the participants are no longer working (resigned and retired) with the organisation. Therefore, 113 of the returned questionnaire survey was able to be used in the current study for data screening and cleaning.

Table 6.1: Number of disseminated questionnaire survey

Country	Number distributed	Responses received	Response rate received	Valid responses received	Valid response rate
UK	400	47	11.75%	26	6.50%
Malaysia	300	57	19%	57	19%
Nigeria	300	31	10.33%	30	10%
Total	1000	135	13.5%	113	11.3%

These 113 questionnaire survey underwent preliminary analysis through EDA. EDA is very important as it helps the researcher to understand more about the data that have been gathered from participants through questionnaire survey (Field 2005; Morgan et al., 2008; and Pallant 2010). In addition, it is also able to detect any mistakes or errors made during the data entry into the SPSS database. Subsequently, it helps to avoid and prevent any problems that might occur during inferential analysis. Through EDA, the data from the 113 questionnaire survey have been thoroughly screened and cleaned in order to provide only accurate data for further analysis. Specifically, categorical variables and continuous variables were checked via frequency and descriptive statistics respectively in order to find any mistakes or errors made during the data entry. There were a few small mistakes and errors found during the analysis and they were immediately corrected.

Given that collecting data through questionnaire survey involves human beings, it is quite difficult to receive complete data from every case (Pallant, 2010), particularly when it is collected through mail. Therefore, it was necessary to inspect missing data from those data that have been collected from participants in the three countries. To identify missing data, Microsoft Excel 2007 was then employed. Microsoft Excel was used because it can identify the highest missing values for cases and variables easily. Missing data were screened and checked thoroughly via the COUNTBLANKS formula, as recommended by Gaskin (2013). As a rule of thumb, any individual case or observation that has more than 10% of data missing should be deleted, particularly when it involves important variables as the results of the subsequently statistical analyses may be biased (Bennett, 2001). Of the 113 (11.3%) cases inputted into

Microsoft Excel and with the use of the COUNTBLANKS formula, it was found that six individual cases have more than 10% of data missing on important variables. Thus, due to concerns that the missing data would affect the reliability results of the current study, therefore, it was decided that these cases needed to be removed from the analysis.

In addition, Microsoft Excel was also employed in the current study in order to identify any unengaged responses from those data that have been received from participants. Gaskin (2013) indicates that any individual case with low value (less than 0.100) of unengaged responses should be eliminated from the study as it is considered not useful because there is no variation detected in the returned questionnaire survey. To identify any unengaged responses from the data, the STDEVP formula, also known as standard deviation, was used. Through this STDEVP formula, one case was deleted from the analysis as its standard deviation value was lower than 0.100. It was also found that one individual case of the current study ticked the same box for the entire questionnaire survey, with no variation of the answers from that particular respondent. Ultimately, only 106 cases were identified as usable for further data analysis of the study. Therefore, these data were re-exported into SPSS database version 22 where further analysis could be conducted thoroughly.

6.1.2 Screening for Normality

It was then necessary to conduct a normality test on the screened and cleaned data. Normality test is one of the assumptions that should be considered when deciding which statistical analysis should be adopted, and subsequently provides an accurate and reliable conclusion about the study (Ghasemi & Zahediasl, 2010). Given that there are two different types of statistical analysis techniques that could be employed, known as parametric and non-parametric, therefore, it is importance to test the data pattern, whether it is normally distributed or not normally distributed (Garth, 2008). Different patterns of the distribution of the data require different statistical analysis techniques.

The decision to employ the statistical analysis techniques that suit a particular study depends on several assumptions (Field, 2005). Such assumptions are: (1) the distribution of the data, (2) the homogeneity of variance, (3) the interval data and, lastly, (4) the independence of the data, which means that the behaviour of one participant does not influence the behaviour of other participants. If those assumptions are successfully met, thus, the parametric statistical analysis

technique can be comfortably employed, and if the above assumptions are violated, hence, researchers are advised to adopt transform the data such as by taking logarithms, or select a non-parametric statistical analysis technique (Pallant, 2010).

As for the current study, the involved data were successfully tested through the SPSS software package. Specifically, descriptive statistical analysis (explore) was employed to test the distribution of the current data where the *z*-score values of skewness and kurtosis were used as a baseline to determine the distribution pattern. Prior to determining the distribution pattern, there are two important threshold values that should be considered which is +/-1.96 and +/-2.58 for both skewness and kurtosis. However, the selection of the threshold values depends on the sample size of the study. Hair, Black, Babin, & Anderson (2010) suggest that a study with large sample size (200 and more) should rely on the +/-2.58 threshold value and one with small sample size (less than 200) should be based on +/-1.96 threshold value. Given that, the sample size of the current study is less than 200, therefore, the threshold value of skewness and kurtosis is +/-1.96. This indicates that any variables with *z*-score value of skewness (i.e., skewness statistic/ standard error) and the absolute values of kurtosis index more than +/- 1.96 with the significant value of $P < 0.05$ are regarded as 'extremely' skewed and extremely kurtosis and it depicts a serious problem. This explains that any data with smaller *z*-score values than +/-1.96 for both skewness and kurtosis are considered as normally distributed where the distribution graft is in the form of a symmetrical, bell-shaped curve and the greatest frequency scores are in the centre of the graph. As displayed in **Table 6.2**, it was found that none of the data in this study were skewed or kurtosis.

Table 6.2: Skewness and Excess Kurtosis for the study variables (N=106)

Variables	Skewness	Kurtosis
Situation	.25	-.06
Site	.30	-.30
PSCI	.45	.35
Sustainability	.40	.14
Port Performance	.34	.37

Note. *SE* for skewness = .24. and *SE* for kurtosis = .48.

The skewness and kurtosis values for all variables are below three +/-1.96 respectively. Hence, it can be concluded that all the variables in the current study were normally distributed. Based on the rules of thumb that have been mentioned previously, these results indicate that parametric is the most suitable statistical analysis that should be employed for the inferential analysis. In addition, as mentioned in the methodology chapter, there are two different types of statistical technique under the parametric, which are exploring the differences between groups and exploring the relationship between variables. Given that, exploring the relationships of the identified variables over the performance of ports on the periphery is the main objective of the current study, therefore, MRA was employed to test the relationships of the variables as it involves more than one independent variable.

6.1.3 Screening for Outliers

Tabachnik & Findell (2007) defined an outlier as a case with such an extreme value on one variable (a univariate outliers) or such a strange combination of scores on two or more variables (multivariate outliers) that they distort statistics. Given that this study employed parametric statistics, therefore, any univariate and multivariate outliers found from the cases will be removed from the dataset. This was a necessary procedure as the presence of these two categories outliers could lead to Type I and Type II errors and subsequently could affect the reliability results of the study. To conduct this procedure, univariate outliers were screened in the first place, followed by multivariate outliers.

Specifically, for the current study, univariate outliers were detected by first standardising the variables. Cases whose standardised values (z scores) fell above the absolute value of 3.29 were deemed to be univariate outliers (Tabachnick & Findell, 2007). From the analysis, it is recognised that two cases had values above the absolute value of 3.29 ($p < 0.001$, two-tailed test) and these cases were deemed to be univariate outliers. Meanwhile, the multivariate outliers on the x- and y-space were assessed using the Cook's Distance values generated by the linear regression procedure. This Cook's Distance was used to measure the effect of deleting a given observation where data point with large residual and high/low leverage may distort the outcome of a regression (Jagadeeswari & Harini, 2013). Specifically, the dependent variable, port performance, was regressed on the independent and moderating variables. Norušis (1994) indicates that a case is considered as an outlier if it is two standard deviations above the Cook's D mean ($M = 0.016$, $SD = 0.043$). It was found that there are three cases with Cook's D values

above 0.102 and these were deemed to be multivariate outliers. These cases were thus deleted from the dataset.

From the above findings, five outliers of univariate and multivariate were detected during preliminary analysis and the necessary procedures were conducted to identify the reasons for the outliers, where the first procedure was checking the data record in order to identify incorrect data entry. It was found that data were correctly entered into the database. Secondly, missing value codes were checked thoroughly to ensure that they were accurately coded and it is found that all the missing values were coded correctly. Finally, outliers were investigated to see if they were part of the population, and the findings demonstrated that they were. The reasons that could contribute to the outliers were checked and it was found that they are genuine scores. Two solutions were sought to remedy this situation: removing the affected cases and changing the outlying case (Tabachnick & Findell, 2007). However, to resolve the issue, the researcher decided to delete the affected cases instead of changing the score of outliers to less extreme data in order to generate and produce reliable results from the inferential analysis that are completely free from both outliers' data.

6.1.4 Reliability scale

Given that, of 106 cases of the current study, five outliers were identified through data screening and they were successfully removed, it turned out that only 101 cases were useable and useful for further analysis. One of the preliminary analysis procedures that should be conducted in order to produce cleaned data is reliability scale. Yang, Lin, Chan, & Sheu (2010) recommend testing the internal consistency of the latent variables in order to ensure that those variables are reliable for the study. Moreover, a value of 0.70 or higher should be the cut-off point in order to determine its reliability. To identify the said value, Cronbach's alpha was the main centre point of the internal consistency test. Nunnally and Bernstein (1994) mentioned that a measure is considered reliable if the Cronbach's alpha value is at least 0.70 or higher. The higher the value of Cronbach's alpha, the higher the reliability of the latent variables used in a particular study.

As shown in **Table 6.3**, the Cronbach's alpha value for the Situation element measure was 0.86; thus, indicating that the measure was regarded as reliable. The mean of the Situation element score was 4.00 (SD = 0.51). Given that the highest possible score for this measure is

five, the score was relatively high. Meanwhile, the Cronbach's Alpha value for the Site element measure was 0.82; therefore, this measure was also considered reliable for the current study. In addition, the mean Site element score was 4.19 (SD = 0.50) and was slightly higher than the mean Situation element score. The Cronbach's Alpha value for the PSCI strategy measure was relatively higher than both Situation and Site elements, with a score of 0.92, and was thus reliable. As in the other measures, the highest possible score for this measure was five. The mean score was high at 4.27 (SD = 0.38).

Table 6.3: Description statistics and Cronbach's alpha for the study measurements (N=101)

Variables	Range	*M*	*SD*	α
Situation	2.48 to 5.00	4.00	.51	.86
Site	3.00 to 5.00	4.19	.50	.82
PSCI	3.21 to 5.00	4.27	.38	.92
Sustainability	2.43 to 5.00	4.06	.52	.91
Port Performance	2.59 to 5.00	3.95	.50	.94

On the other hand, the Cronbach's Alpha value for the Sustainability measure was high with a score of 0.91; therefore, it is suggested that this latent variable had high internal consistency and is considered reliable for the current study. Since the highest possible score was five, the mean score of 4.06 (*SD* = 0.52) was relatively high. The last latent variable that was tested for its reliability and internal consistency was the performance of ports on the periphery. As displayed in the table, the Cronbach's Alpha for the performance of ports on the periphery measure was very high at 0.94. Therefore, the finding indicates that the latent variable of port performance is the highest among the five latent variables. The mean score of the port performance variable was 3.95 (*SD* = 0.50) and indicated that the sample of respondents worked in companies that were relatively competitive.

6.1.5 Descriptive Statistics of the sample

Generally, the descriptive statistics briefly elaborate the sampling data that have been collected for the current study. This piece of information has helped the researcher to get a better understanding of the demographic characteristics of the study sample. Such demographic characteristics are the company category, port stakeholder groups, the position of the participants, the work experience, the number of employees, the handling commodities, annual volume of throughputs and annual revenue of the company. Findings from **Figure 6.2** below present the involvement of two main categories of port stakeholders in maritime transportation, which are port users and port service providers. Of the two sectors, port service providers recorded the highest involvement with 55.45%, whilst the port user category made up just under half (44.55%) of the total sample.

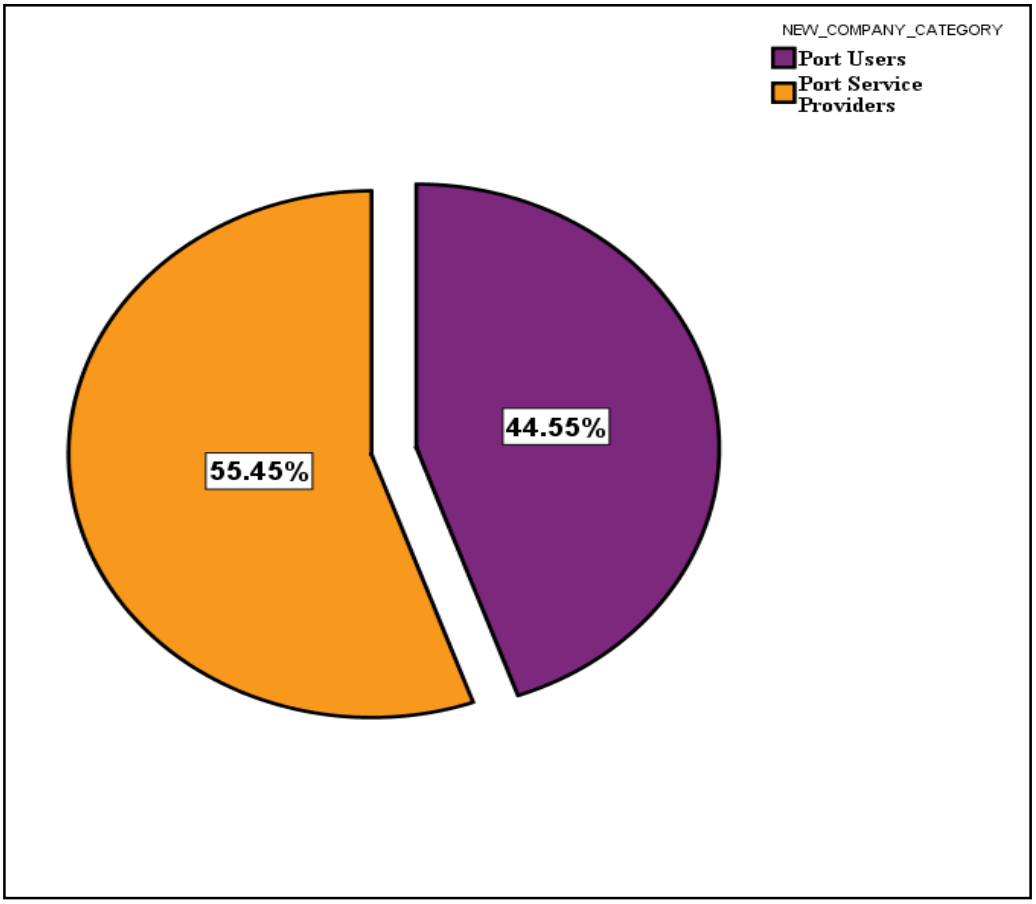


Figure 6.2: Main category of port stakeholders

Meanwhile, the specific group of port stakeholders involved in the current study is illustrated in the bar graph and table below. This is a combined sampling that has been generated from the three countries involved in the study. **Table 6.4** displays the percentage of the involvement of the four types of company in the current study; the highest involvement is from freight forwarders, with almost 36%. Meanwhile, shipping liners recorded the smallest fraction of involvement in the current study, with close to 10%. On the other hand, the involvement of port/terminal operators in this study is slightly lower than port authority, with approximately 23.8%. Another 32% of the current sampling is generated from port authority, which indicates that this category of port stakeholder has the second-highest involvement among the four groups. Similarly, **Figure 6.3** shows the percentage of the sample that fall into each of the port stakeholder groups, with shipping line (9), freight forwarding company (36), port/terminal operator (24) and port authority (32).

Table 6.4: Types of company (N=101)

Type of company	%
Port User	44.6
Shipping Liner	*(8.9)*
Freight Forwarder	*(35.6)*
Port Service Provider	55.4
Port Operator	*(23.8)*
Port Authority	*(31.7)*

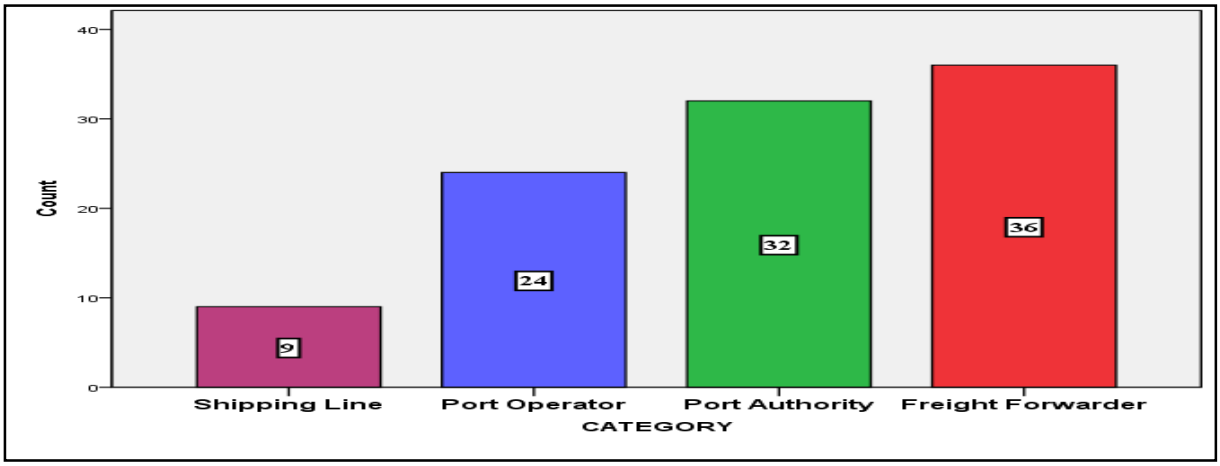


Figure 6.3: Types of company

In the methodology chapter, the researcher mentioned that the most suitable participants that should be involved in this study and subsequently fill in the questionnaire survey are those who are involved in strategic decision-making in a company. Specifically, this refers to those who are in top management positions such as Chief Executive Officer (CEO), Chief Operating Officer (COO), Director and General Manager, to name but a few. These top managers are the main key players in formulating strategies to be adopted and subsequently drive the future direction of the company. They are important people who carefully but thoroughly plan and map the roadmap of the company. The success of the company is determined by these important players. The strategic decision-makers selected in this study are the ones who are the most prominent people in the organisations, who are filled with knowledge and experiences in this field; therefore, it is strongly believed that their opinions, judgments, and cooperation would be very valuable in this study.

It was found that the participants in this study held a variety of positions (see **Figure 6.4**). It shows that approximately 93.5% of the sample is from the top management level. More specifically, about 3.03% are CEOs, 10.10% are Company Directors, 15.15% are Operations Managers and more than 40% hold positions other than those mentioned above. Nevertheless, it does not mean that they are not working in top management. In fact, some of the participants are working at higher positions such as COO, Marketing Director, Chief Port Manager, Port Manager, Senior Executive Manager, Financial Manager, Custom and Operations Manager, Marketing Container Manager, Corporate Communication Manager, Public Relation Manager, and Operations Traffic Manager. This indicates that the questionnaire survey reached and were filled in by the right and suitable participants. In addition, the opinions and views of those participants can be considered reliable and useful as they are involved in the decision-making process of their companies. The reliability and usefulness of their opinions are supported and strengthened by their work experience in the maritime transportation industry. Statistically, 70% of the port stakeholders have been working within the maritime industry for more than fifteen years.

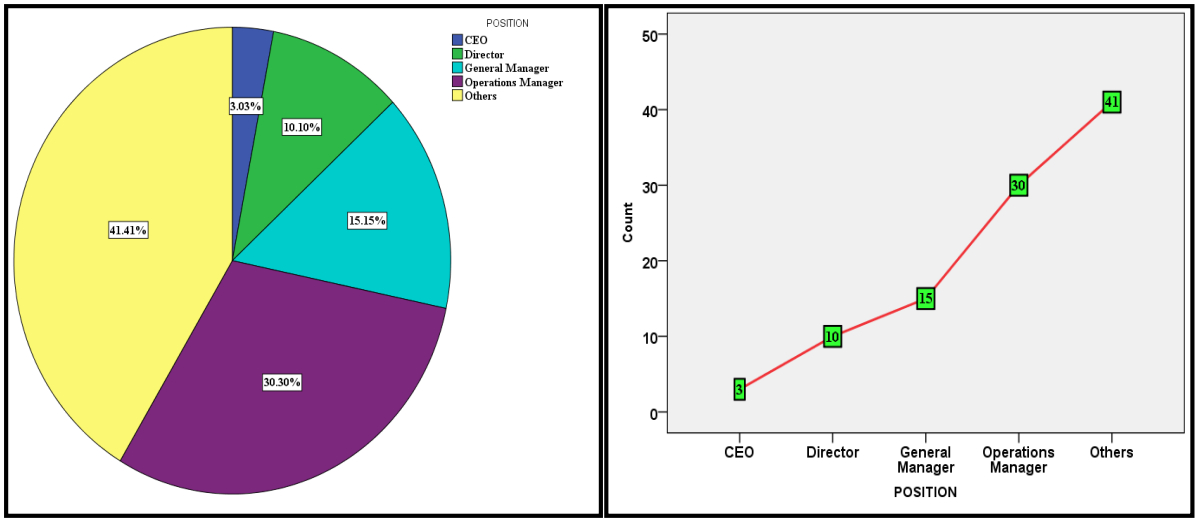


Figure 6.4: Participants' positions

Having more work experience in maritime transportation is believed to contribute to the development of hard and soft skills and competency in influencing the decision-making process in any aspects of the business (see **Table 6.5**). In addition, the ability to foresee and anticipate the future needs in the business also come from valuable work experience. Meanwhile, approximately 20% and 14% of the participants have less than five and 10 years' work experience, respectively, with the companies. Nevertheless, this does not mean that participants do not have the ability to critically determine the direction of the company. Some of the participants have less work experience in the current company simply because they have moved between companies. This is supported by the finding that one of the managing directors has less than five years' work experience with her/his current company. In addition, a similar situation can be seen with the position of general manager, in which three participants have been working with their current company for less than five years.

Table 6.5: Work experience (N=101)

Work experience	*n*	%
Less than 5 years	20	19.8
5 – 10 years	14	13.9
11 – 15 years	9	8.9
More than 15 years	57	56.4

Close to 40% of participants worked in organisations with fewer than 500 employees and almost 43% of participants worked in organisations with more than 1500 employees. Meanwhile, close to 18% of the sample sizes are working with medium-size organisations that have 500 to 1500 employees. Findings from **Figure 6.5** also suggest that the majority of the respondents worked in organisations that earned less than 100 million US$ (48.51%) and between 100 million to 1 billion US$ (34%). Meanwhile, only a small percentage of organisation (8.9%) involved in the study earning higher revenues in the business sector with more than five billion US$. It is viewed that two prominent groups of port stakeholders are making the highest incomes annually: shipping liner and port authority. Conversely, port/terminal operating company, port/terminal operators and freight forwarders generate the smallest percentage of annual revenues compared to the other groups of port stakeholders.

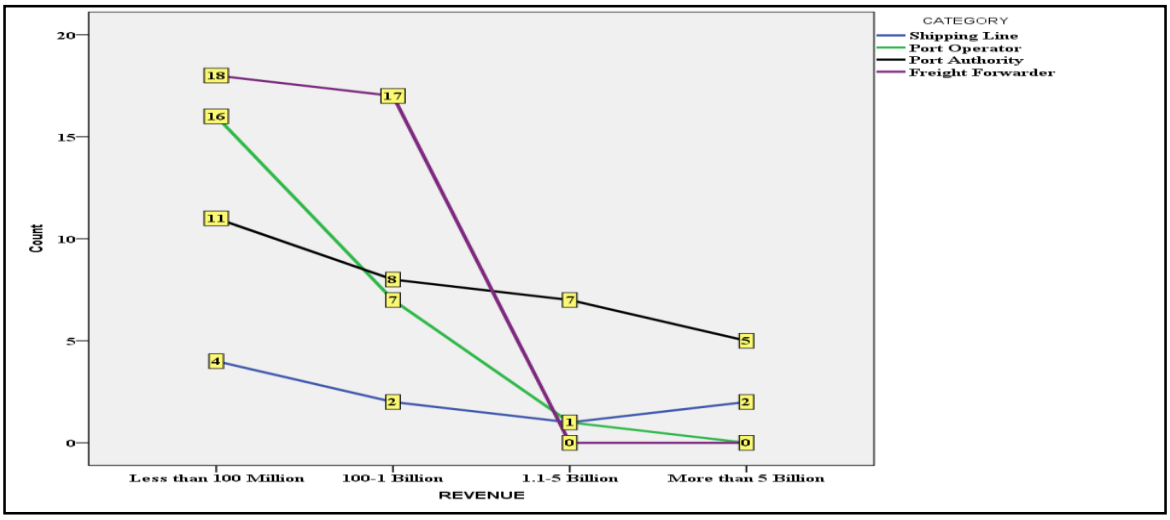


Figure 6.5: Port stakeholder group and company annual revenues

As displayed in **Table 6.6** below, those four groups of port stakeholders are actively involved in container handling commodities in the maritime transportation sector. In addition, the second-largest handling commodity of the current sample size is general cargo, with approximately 69 port stakeholders. About 68 and 63 participants of the current sample size are involved in dry and liquid bulk commodities, respectively, which is dominated by port

authority. On the other hand, the highest groups of port stakeholders involved in Ro-Ro commodity services were freight forwarder and port authority, with a total number of 23 and 21 participants respectively.

Also, the table translates that these five categories or cargoes are the main commodities being handled by these main port stakeholders at many ports. Moreover, some of the port stakeholders are providing specialised handling services to cater for specific types of commodity in their business profile, such as break bulk cargo, passenger and cruise, automotive logistics, offshore inspection, maintenance & repair centre, project cargo/removal, project and conventional, oil and gas equipment and engineering equipment, to name but a few. In particular, of the 101 sample size of the current study, five freight forwarders, three port/terminal operators, and three port authorities are the main companies involved in the specialised handling services; whilst it is found that none of the shipping lines offer and handle the said services to their customers.

Table 6.6: Handling commodity (N=101)

Port Stakeholder	LB	DB	Container	Ro-Ro	GC	Other
Shipping Line	2	2	9	2	2	-
Freight Forwarder	18	20	36	23	20	5
Port/Terminal Operators	19	20	24	11	21	3
Port Authority	24	26	32	21	26	3
Total	**63**	**68**	**101**	**57**	**69**	**11**

Notes: LB (Liquid Bulk), DB (Dry Bulk), GC (General Cargo)

6.1.6 Statistical analysis selection

There are various statistical analysis techniques available for the researcher to choose from and employ for data analysis. However, the selection of the most appropriate analysis technique

depends on several criteria. Such criteria are questionnaire survey measurement, research questions that the researcher wants to address, the level of measurement of the current variables or factors, and the characteristics or nature of the data that have been retrieved from participants (Pallant, 2010). Based on the above criteria, it is found that (1) questionnaire survey in the current study was measured by five-point Likert scale as it is the most common way to measure opinions and attitudes of participants over the variables involved in the current study. In addition, data that were collected through Likert scale are considered as ordinal data, (2) the objective of the study is to investigate the direct and indirect relationships of variables that could affect the performance of ports on the periphery, (3) those identified variables in the current study are regarded as continuous variables and lastly (4) the data in the current study is normally distributed, therefore, parametric was considered as the most significant statistical analysis technique for this study.

Based on Morgan et al.'s (2008) selection inferential analysis flow chart, eight steps were followed in order to decide the best inferential statistics to use to test the relationship of variables or, more specifically, the hypotheses of the study. Given that the current study has five variables, and one dependent variable is considered at a time, and the level of measurement scale is identified as continuous for both independent and dependent variables, therefore, standard MRA was employed. On the other hand, hierarchical MRA was not employed in the current study despite the presence of the indirect relationship between variables. Instead, 13 separate MRA were estimated separately and then tested for the indirect relationship of the identified variable (Yang et al., 2010). Findings from these 13 regression coefficients are presented under the inferential analysis section of the chapter.

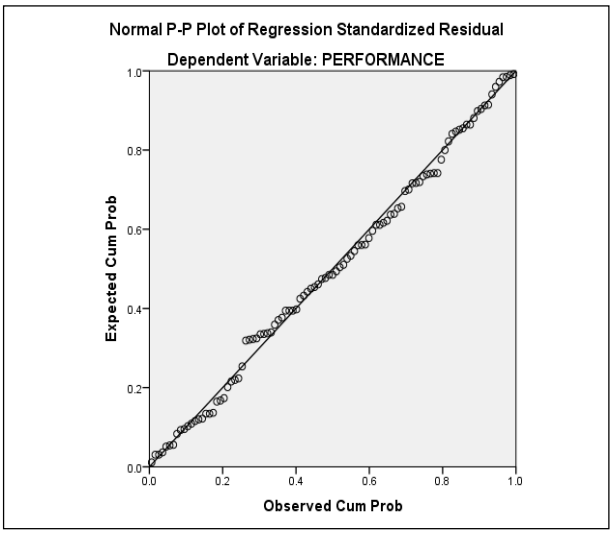
6.2 INFERENTIAL ANALYSIS FINDINGS

As discussed in Chapter Five, MRA was used to test the direct and indirect relationships of the situation element, site element, PSCI strategy, and sustainability advantage towards the performance of ports on the periphery. To conduct the MRA, Baron and Kenny (1986) suggested a series of regression analysis and hierarchical or stepwise MRA is not required to test the indirect effect between variables. Therefore, 13 separate regression coefficients have been estimated in order to test or identify the direct and indirect impact of the relationships between variables.

The details of the findings will be presented, elaborated on, and discussed in the following paragraphs. In addition, imperative tables and figures that were generated from the regression coefficients are also included in this section. Specifically, there are several reasons for the inclusion of these tables and figures in the current study: (1) to confirm that the essential assumptions of the MRA technique such as multicollinearity, normality, outliers, linearity, homoscedasticity and independence of residuals were not violated, (2) to evaluate the model of the regression analysis, (3) to evaluate the value of each of the variables that were included in the study and, lastly, (4) because it is important to reject or be unable to reject the 13 regression coefficients of the current study.

As postulated in the first hypothesis (H1), proximity to large hinterland markets/ situation element would have a positive impact on the performance of ports on the periphery. Prior to evaluating the results, those four assumptions were assessed. Based on the correlation output table, the Pearson correlation value of the situation/ hinterland variable is more than .30, which translates as the presence of the relationship between the variable with the performance of ports on the periphery. In addition, the collinearity diagnostics were also performed, where the values of Tolerance and Variance Inflation Factor (VIF) were sought, and it was found that those values were above .10 and below 10 respectively. These values confirm that the assumption of multicollinearity has been met.

It was also found that the assumption of multivariate outliers was met when the minimum (-2.29) and maximum (2.40) values under the standard residual subheading are less than +/- 3.29. The first chart in **Figure 6.6** below shows that the points were laid reasonably straight along the diagonal line from bottom left to top right. This indicates that the data have no major deviation from normality and have thus met the normality assumption of the current study. Tabachnick & Findell (2007) claimed that, when normality assumption is met, thus the relationships between variables are homoscedastic and this can be seen in the second chart of the **Figure 6.6** below. The last assumption that was tested is independence of residuals and, based on the finding table, the data met the assumption where the Durbin-Watson value is 1.73. The above findings indicate that those four assumptions have been met and none of the data violate the assumptions.



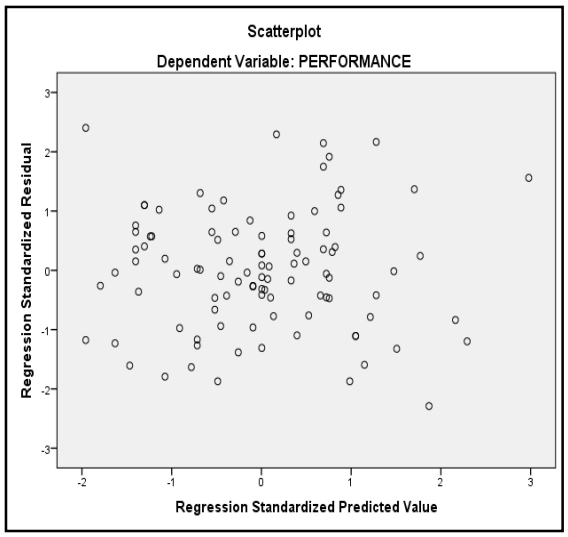


Figure 6.6: Normal P-P Plot of Regression Standardised Residual and Scatterplot for Situation Element and the Performance of Ports on the Periphery (N=101)

Table 6.7: ANOVA MRA Results: Situation Element and the Performance of Ports on the Periphery (N=101)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.672	1	4.672	22.356	**.000**
	Residual	20.690	99	.209		
	Total	25.362	100			

Table 6.8: Coefficients MRA Results: Situation Element and the Performance of Ports on the Periphery (N=101)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.205	.185		6.517	.000
	SITUATION	**.424**	**.090**	**.429**	**4.728**	**.000**

Note. Overall model $F(1, 99) = 22.36$, $p = .001$, $R^2 = .184$.
* ***p* < .05.** ** ***p* < .01.** *** ***p* < .001.**

On the other hand, the analysis also addresses and subsequently evaluates the overall model of the MRA. The ANOVA output table indicates that the current MRA model of H1 is statistically significant (see **Table 6.7**). Thus, the proximity to large hinterland markets/ situation element explains a significant amount of the variance in the performance of ports on the periphery with ($R^2 = .184$, $F(1, 99) = 22.36$, $P < .001$). To accept or reject the hypotheses of the current study, the value of β (value for the regression equation for predicting the independent variable towards the dependent variable) under the column labelled Unstandardised Coefficients is viewed as the current study is more interested in constructing regression equations. Thus, the value of Beta under the column labelled Standardised Coefficients in the same table is ignored because it is appropriate for comparing the most important and influential independent variables toward the dependent variable.

Subsequently, the final results (see **Table 6.8**) from the analysis were sought from the regression coefficients where the value of $\beta = .42$. Meanwhile, the significant value of the regression coefficient is less than 0.05 and this indicates that the proximity to large hinterland markets positively predicted the performance of ports on the periphery, with $p = .001$. Findings from the above analysis, therefore, confirmed that hypothesis one was successfully supported.

The same approach was used in order to test the following hypotheses of the current study. It was hypothesised that the site element of ports on the periphery would have a positive impact on the port performance. This is the second hypothesis of the study that is related to the spatial characteristics of the ports on the periphery. Similarly, assumptions of the MRA coefficients were checked accordingly. Firstly, the levels of measurement of both of the variables were identified as continuous variables. Secondly, the assumption of the second hypothesis was checked and it was found that data were plotted along the diagonal line in the Normal P-P Plot without any unusual outliers deviating from the line (**Figure 6.7**).

Thirdly, the outliers were also checked and it is believed that the data are normally distributed, where both the minimum and maximum values of the standard residual of the current study are -1.94 and 2.54. These two values indicate that the current study has not violated the assumption of outliers. Meanwhile, the independence of errors of the current study was checked and the assumption is met with Durbin-Watson value of 1.65, which is above a value of 1 and lower than a value of 3. Further, the values of collinearity statistics of tolerance and VIF indicate that the assumption was also met when the values are .96 and 1.04, which are above .10 and lower

than 10 respectively. On the other hand, the scatterplot figure of the second hypothesis indicates that the homoscedasticity assumption has been successfully met.

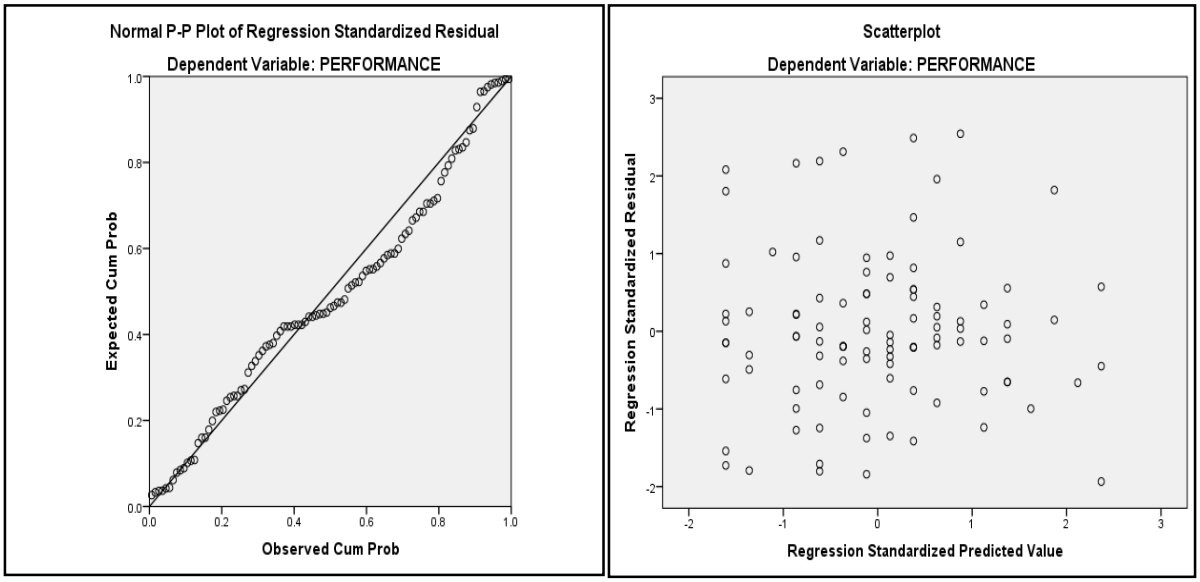


Figure 6.7: Normal P-P Plot of Regression Standardised Residual and Scatterplot for Site Element and the Performance of Ports on the Periphery (N=101)

Accordingly, the site element of ports on the periphery and port performance were evaluated and there is a positive and direct relationship between the two variables. This can be seen in the ANOVA **Table 6.9** below where the model of the regression coefficient is statistically significant with (R^2 = .065, $F(1, 99) = 6.90$, $P < 0.05$). The R^2 value demonstrates that the regression model of site element explains 6.5 per cent of the variance in the performance of ports on the periphery and the value of P is clearly lower than 0.05 which indicates that the regression model is statistically significant. To accept or reject the hypothesis of the study, the values of β and P were sought and it was found that the regression coefficient **Table 6.10** indicates that the value of the analysis is lower than .05 with β = .26 and p = .01. The positive results and the direct relationship between site element and the performance of ports on the periphery indicate that the study has been unable to reject the second hypothesis (H2). In addition, the results confirm the prediction made earlier, that the availability of land and the involvement of GTOs could contribute to the performance of ports on the periphery.

Table 6.9: ANOVA MRA Results: Site Element and the Performance of Ports on the Periphery (N=101)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.650	1	1.650	6.891	**.010**
	Residual	23.711	99	.240		
	Total	25.362	100			

Table 6.10: Coefficients MRA Results: Site Element and the Performance of Ports on the Periphery (N=101)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.590	.183		8.703	.000
	SITE	**.255**	**.097**	**.255**	**2.625**	**.010**

Note. Overall model $F(1, 99) = 6.90$, $p = .01$, $R^2 = .065$
* $p < .05$. ** $p < .01$. *** $p < .001$.

In the third and fourth regression equations, it was hypothesised that proximity to large hinterland markets/ situation element (H3) and site element (H4) would influence the adoption of supply chain integration strategy with other port stakeholders. The necessary assumption testing was successfully conducted and the results indicate that the assumptions have been met and none of the findings violate the condition in order to conduct MRA. Specifically, the data for both of the hypotheses are normally distributed along the linear line under the normal P-P Plot of regression standardised residual and this indirectly translates that the assumption of homoscedasticity is met as well (**Figures 6.8-6.9**). In addition, the values of the standard residual indicate that the assumption of outliers was not violated, with -2.41 (minimum) and 3.02 (maximum) for hypothesis three and -2.20 (minimum) and 2.55 (maximum) for hypothesis four. Meanwhile, the multicollinearity assumption is met for both of the hypotheses when the tolerance and VIF values are 1.0 and 1.0 respectively for hypotheses three and four. The results also show that the data met the assumption of independence errors where the values of Durbin-Watson are within the given range, between 1 and 3 (2.03 and 2.02) for both of the hypotheses.

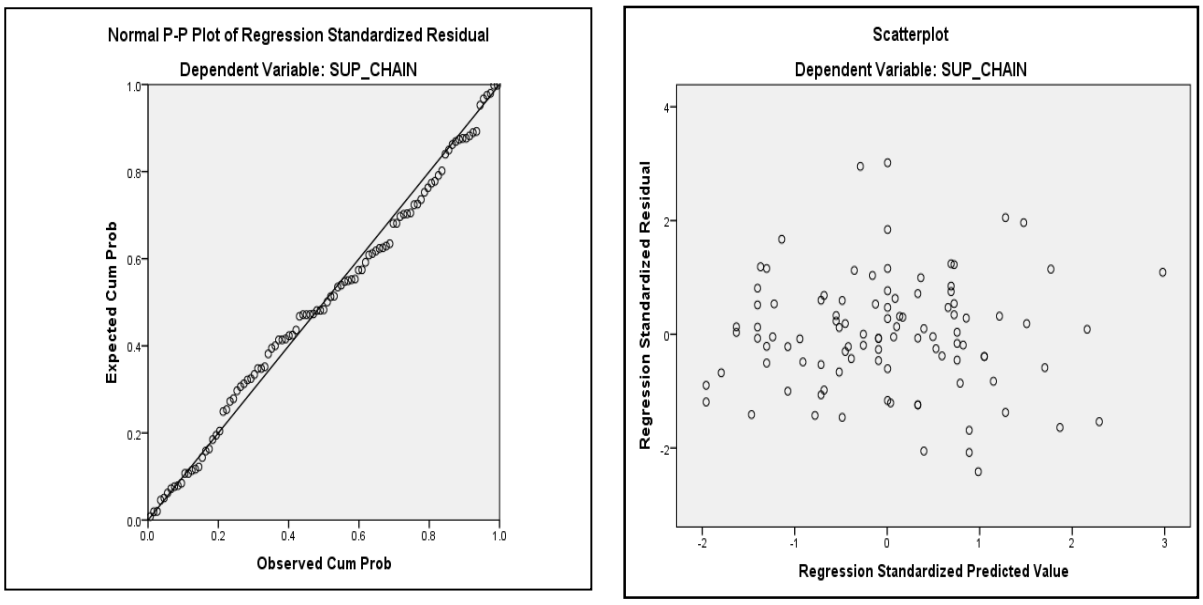


Figure 6.8: Normal P-P Plot of Regression Standardised Residual and Scatterplot for Situation Element and PSCI Strategy (N=101)

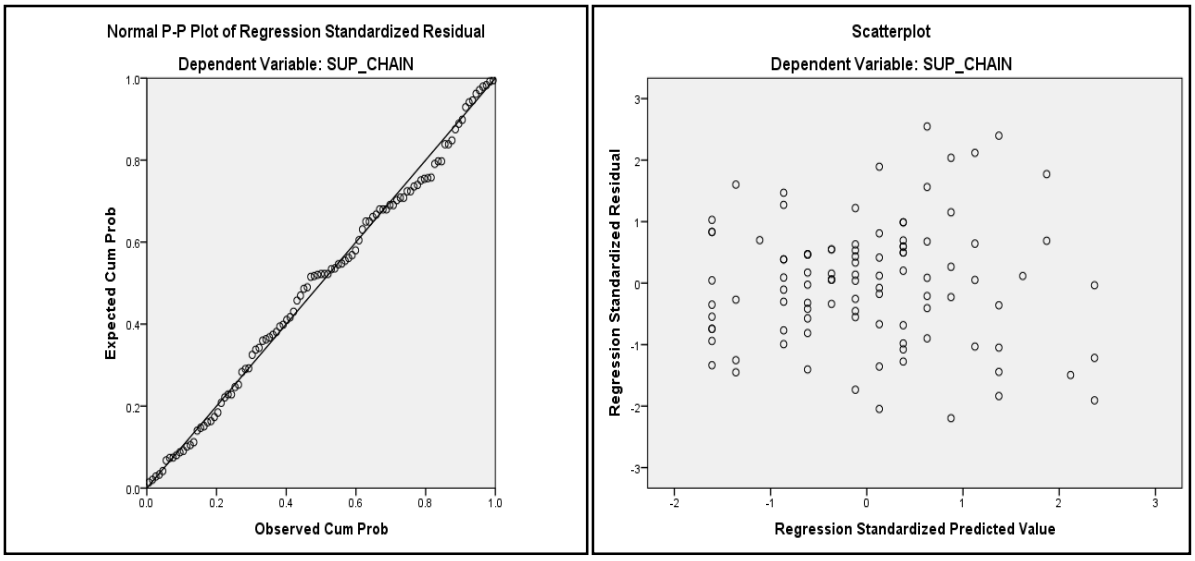


Figure 6.9: Normal P-P Plot of Regression Standardised Residual and Scatterplot for Site Element and PSCI Strategy (N=101)

Through the entry method, the MRA model produces the values of $R^2 = .170$, $F(1, 99) = 20.24$, $P < 0.05$. The R^2 value of the regression model of the H3 explains that there is 17% variance that contributes to the PSCI strategy between port stakeholders under the current research. In

addition, as displayed in the ANOVA **Table 6.11**, the Sig. value indicates that the model of the regression coefficient of the hypothesis is below than 0.05 which confirmed that the current model is statistically significant. Similarly, as displayed in **Table 6.12** the findings from the MRA demonstrate that the proximity to large hinterland markets/ situation element positively influences the adoption of PSCI strategy between supply chain partners, with $\beta = .31$ and $p = .001$. Accordingly, the third hypothesis of this study was also supported. For the following hypothesis (H4), the MRA model produces the values of $R^2 = .180$ (which explains that there is significant variance between site element and the strategy of PSCI between port stakeholders), $F(1, 99) = 21.67$, $P < 0.05$. In addition, the Sig. value in the ANOVA **Table 6.13** confirmed that the regression model of the hypothesis is statistically significant with $P < 0.05$. Moreover, the coefficient **Table 6.14** elucidates that site element also positively predicted the strategy of supply chain integration, in which $\beta = .32$, and the value of $p = .001$. Thus, the fourth hypothesis of the current study was also supported.

Table 6.11: ANOVA MRA Results: Situation Element and PSCI Strategy (N=101)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.512	1	2.512	20.244	**.000**
	Residual	12.286	99	.124		
	Total	14.798	100			

Table 6.12: Coefficients MRA Results: Situation Element and PSCI Strategy (N=101)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.109	.142		7.782	.000
	SITUATION	**.311**	**.069**	**.412**	**4.499**	**.000**

Note. Overall model $F(1, 99) = 20.24$, $p = .001$, $R^2 = .170$
* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 6.13: ANOVA MRA Results: Site Element and PSCI Strategy (N=101)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.658	1	2.658	21.672	**.000**
	Residual	12.140	99	.123		
	Total	14.798	100			

Table 6.14: Coefficients MRA Results: Site Element and PSCI Strategy (N=101)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.143	.131		8.748	.000
	SITE	**.324**	**.070**	**.424**	**4.655**	**.000**

Note. Overall model $F(1, 99) = 21.67$, $p = .001$, $R^2 = .180$
* ***p* < .05.** ** ***p* < .01.** *** ***p* < .001.**

Meanwhile, it was hypothesised that initiatives to integrate with other supply chain companies would contribute to the performance of ports on the periphery. Again, this hypothesis was tested using MRA. In addition, the assumptions of normality, outliers, homoscedasticity, multicollinearity and independence errors were fulfilled without any violation. The statistical findings from regression model indicate that the value of $R^2 = .175$ (which translates that the model of H5 explains about 17.5% of the variance in the performance of ports on the periphery), $F(1, 99) = 20.99$, $P < .001$. Meanwhile, to access the significance of the model, it is necessary to look at the Sig. value in the table labelled ANOVA (see **Table 6.15**). The Sig. value or the P value in the ANOVA table displays that the model of the regression model of the H5 is less than 0.001 which indicates that the model is statistically significant. On the other hand, the findings in the **Table 6.16** reveal that the significant value of regression coefficient is less than .05 (with $\beta = .55$ and $p = .001$). These findings indicate that the predictor makes a significant contribution to the dependent variable. Subsequently, it translates that the PSCI strategy significantly contributes to the performance of ports on the periphery. Thus, the fifth hypothesis of the current study was significantly supported.

Table 6.15: ANOVA MRA Results: PSCI Strategy and the Performance of Ports on the Periphery (N=101)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.436	1	4.436	20.986	**.000**
	Residual	20.926	99	.211		
	Total	25.362	100			

Table 6.16: Coefficients MRA Results: PSCI Strategy and the Performance of Ports on the Periphery (N=101)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.105	.212		5.217	.000
	SUP_CHAIN	**.548**	**.120**	**.418**	**4.581**	**.000**

Note. Overall model $F(1, 99) = 20.99$, $p = .001$, $R^2 = .175$.
* ***p* < .05.** ** ***p* < .01.** *** ***p* < .001.**

Theoretically, it is claimed that proximity to large hinterland markets/ the situation element of ports on the periphery (H6) and site element of ports on the periphery (H7) would have a positive effect on sustainability, in particular environmental, economic, and social sustainability. These two hypotheses were tested using MRA procedure and the assumptions were successfully met. Prior to testing the analysis, the MRA has successfully produced the values of $R^2 = .198$, $F(1, 99) = 24.40$, $P < 0.001$ for H6 and the R^2 value of the current hypothesis explains that there is 19.8% variance between situation element and the sustainability advantage of ports on the periphery. Moreover, the ANOVA findings in **Table 6.17** show that the regression model of the hypothesis is significantly supported with the Sig. value is less than 0.05 ($p = 0.001$) and subsequently, the **Table 6.18** indicates that the proximity to large hinterland markets/ situation element positively predicted sustainability, with $\beta = .45$, $p = .001$. Thus, hypothesis sixth was supported.

Table 6.17: ANOVA MRA Results: Situation Element and Sustainability Advantage (N=101)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.298	1	5.298	24.403	**.000**
	Residual	21.492	99	.217		
	Total	26.790	100			

Table 6.18: Coefficients MRA Results: Situation Element and Sustainability Advantage (N=101)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.042	.188		5.532	.000
	SITUATION	**.452**	**.091**	**.445**	**4.940**	**.000**

Note. Overall model $F(1, 99) = 24.40$, $p = .001$, $R^2 = .198$
* ***p* < .05.** ** ***p* < .01.** *** ***p* < .001.**

Table 6.19: ANOVA MRA Results: Site Element and Sustainability Advantage (N=101)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.095	1	2.095	8.398	**.005**
	Residual	24.695	99	.249		
	Total	26.790	100			

Table 6.20: Coefficients MRA Results: Site Element and Sustainability Advantage (N=101)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.424	.186		7.638	.000
	SITE	**.288**	**.099**	**.280**	**2.898**	**.005**

Note. Overall model $F(1, 99) = 8.40$, $p = .01$, $R^2 = .080$
* ***p* < .05.** ** ***p* < .01.** *** ***p* < .001.**

Through the MRA technique, the analysis is able to produce the regression model values with $R^2 = .078$, $F(1, 99) = 8.40$, $P < 0.01$ for H7 and the R^2 value explains that 7.8 per cent significant amount of the variance between site element and the sustainability advantage. Similarly, in **Table 6.19** and **Table 6.20** above it is demonstrated that the model of the regression is statistically significant with $p < 0.01$ and the site element significantly predicted the sustainability advantage, with $\beta = .29$, $p = .05$ respectively; therefore, hypothesis seventh was also supported. Also, it was hypothesised that the sustainability possessed by the ports on the periphery would have a positive impact on the performance of these ports.

Given that all assumptions of MRA were significantly met, therefore, the findings in **Table 6.22** reveal that sustainability advantage positively predicted the performance of ports on the periphery, with $\beta = .51$, $p = .001$. Prior to accepting or rejecting the eighth hypothesis, the model of the regression coefficient is reviewed in order to ensure that the model is significantly supported. Through MRA technique, the analysis successfully produced the regression model with the values of $R^2 = .272$, $F(1, 99) = 36.90$, $P < .001$. This indicates that there is a significant amount of variance that can be found between sustainability advantage and the performance of ports on the periphery. Thus, in the ANOVA **Table 6.21**, the Sig. value shows that the model is positively significant with the $p = 0.001$. Hence, the eighth hypothesis of the study was strongly supported.

Table 6.21: ANOVA MRA Results: Sustainability Advantage and the Performance of Ports on the Periphery (N=101)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.886	1	6.886	36.896	**.000**
	Residual	18.476	99	.187		
	Total	25.362	100			

Table 6.22: Coefficients MRA Results: Sustainability Advantage and the Performance of Ports on the Periphery (N=101)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.066	.168		6.350	.000
	SUSTAIN	**.507**	**.083**	**.521**	**6.074**	**.000**

Note. Overall model $F(1, 99) = 36.90$, $p = .001$, $R^2 = .272$
* ***p* < .05.** ** ***p* < .01.** *** ***p* < .001.**

In the literature, it is viewed that there are indirect relationships present between independent and dependent variables. In particular, it is identified that indirect relationships are detected between situation element, site element, PSCI strategy and the performance of ports on the periphery. Therefore, it was hypothesised that PSCI would mediate the relationship between situation and site elements and the performance of ports on the periphery. To test this hypothesis, several regressions were conducted (Baron & Kenny, 1986).

As suggested by Baron and Kenny (1986), three sets of regressions have to be conducted: a procedure where the mediator (i.e., PSCI) is regressed on the independent variables; a procedure where the dependent variable (i.e., the performance of ports on the periphery) is regressed on the independent variables; and, lastly, a procedure where the dependent variable is regressed on the independent and mediating variables concurrently. A variable is deemed to be a mediator when four conditions are met: the independent variables are significantly related to the mediating variable; the independent variables are significantly related to the dependent variable; the mediating variable is significantly related to the dependent variable; and the magnitude of the relationship between the independent and dependent variable is less strong (partial mediation) or no longer significant (full mediation) once the mediating variable is included in the regression model.

Similar to other hypotheses in this study, assumptions of the regression analysis should be conducted before further analysis can be carried out. The coefficient output indicates that the data were not violated and this translates that the first assumption of multicollinearity is met

when the values of Tolerance and VIF are above 0.1 and below 10. In addition, the findings for the second assumption, multivariate outliers of hypotheses nine and ten are met given that both of the standard residual values are below +/- 3.29. This can be seen when the value of minimum and maximum under the standard residual subheading for hypothesis nine are -1.88 and 2.78 respectively. Similarly, the standard residual values for hypothesis ten are -1.660 and 3.016 respectively. Thirdly, the assumption of the regression analysis for these hypotheses is the distribution of the data. The figures of Normal P-P Plot Regression Standardised Residual and Scatterplot (see **Figure 6.10** and **Figure 6.11**) below show that the data for both hypotheses are normally distributed. No outliers were detected during the assumption test for both hypotheses. In addition, indirectly the homoscedasticity assumption is met as well. Lastly, the assumption of independent errors for both hypotheses are successfully met when the values of Durbin-Watson is between 1 and 3.

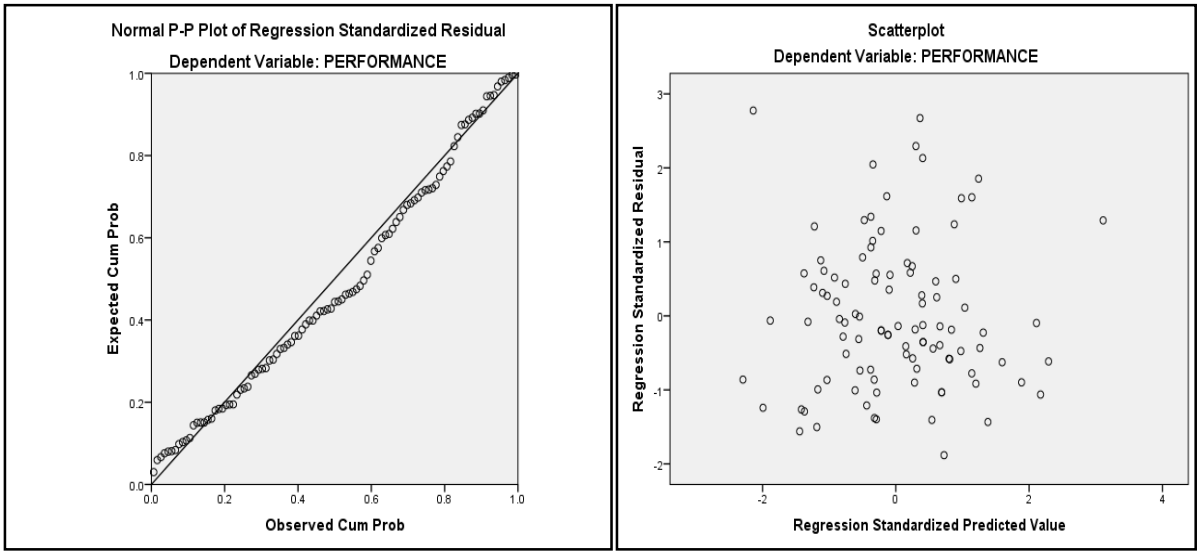


Figure 6.10: Normal P-P Plot Regression Standardised Residual and Scatterplot for Indirect Effect of PSCI Strategy between Situation Element and the Performance of Ports on the Periphery (N=101)

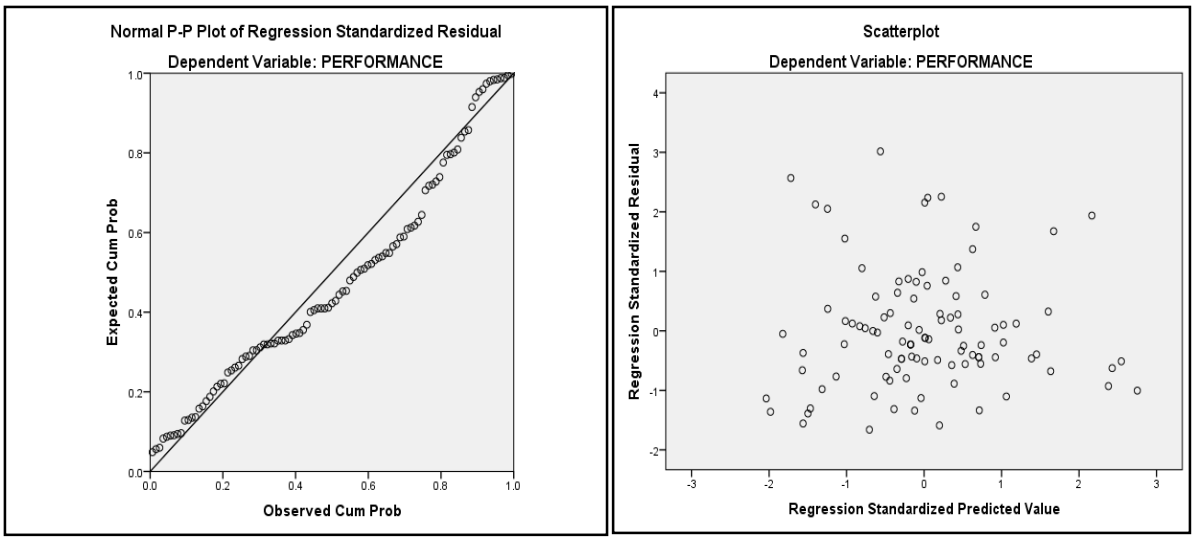


Figure 6.11 Normal P-P Plot of Regression Standardised Residual and Scatterplot for Indirect Effect of PSCI Strategy between Site Element and the Performance of Ports on the Periphery (N=101)

As established in the third and fourth hypotheses (see **Table 6.12** and **Table 6.14**), hinterlands/ situation element significantly influenced the adoption of the PSCI strategy with other port stakeholders, with β = .31, *p* = .001. Meanwhile, the site element also significantly predicted the adoption of the PSCI strategy with other port stakeholders, with β = .32, *p* = .001. Therefore, the first criterion of mediation for both of the hypotheses was met. As established in the first hypothesis (see **Table 6.8**), the hinterlands/ situation element significantly predicted the performance of ports on the periphery, β = .42, *p* = .001. Therefore, the second criterion for establishing mediation was met. In addition, as tested previously, the site element of the second hypothesis also significantly predicted the performance of ports on the periphery (see **Table 6.10**), with β = .26, *p* = 0.01, and subsequently met the second criterion for mediation; therefore, it will also be included in subsequent analyses. The findings in the **Table 6.16** show that PSCI strategy positively predicted the performance of ports on the periphery, with β = .55, *p* = .001. Thus, the third criterion for establishing mediation was met.

Similar to other hypotheses, it is necessary to look at the regression model that has been produced through the MRA technique with the values of $R^2 = .254$, $F(2, 98) = 16.72$, $P < 0.001$. This R^2 value from the regression model found that the situation element and PSCI strategy explain the presence of a significant amount of variance in the performance of ports on the

periphery. In addition, based on the ANOVA table the model of the Sig. value (see **Table 6.23)** of the regression model is less than 0.05 (with $p = 0.001$) which demonstrates that the model is statistically significant. Moreover, the findings in the **Table 6.24** further reveal that, when PSCI strategy was included in the regression model, the magnitude of the relationship between the hinterlands/ situation element and the performance of ports on the periphery decreased ever so slightly, with $\beta = .31$, $p = .002$. Therefore, the fourth criterion for establishing mediation was met. As such, PSCI strategy partially mediated the relationship between the hinterlands/ situation element and the performance of ports on the periphery as the relationship between the variables is less strong.

Table 6.23: ANOVA MRA Results: Situation Element, PSCI Strategy and the Performance of Ports on the Periphery (N=101)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.452	2	3.226	16.718	**.000**
	Residual	18.910	98	.193		
	Total	25.362	100			

Table 6.24: Coefficients MRA Results: Situation Element, PSCI Strategy and the Performance of Ports on the Periphery (N=101)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.783	.226		3.471	.001
	SITUATION	**.306**	**.095**	**.309**	**3.232**	**.002**
	SUP_CHAIN	**.381**	**.125**	**.291**	**3.037**	**.003**

Note. Overall model $F(2, 98) = 16.72$, $p = .001$, $R^2 = .254$
* $p < .05$. ** $p < .01$. *** $p < .001$.

The summary of the regression model of the H10 has produced the value of $R^2 = .182$, $F(2, 98) = 10.92$, $P < 0.001$. Likewise other hypotheses, the value of R^2 of the current model indicates that the situation element and PSCI strategy have a significant amount of variance that contributes to the performance of ports on the periphery. In order to determine the significance of the regression model of the H10, **Table 6.25** is sought and the Sig. value clearly indicates that the model is significantly supported with the P value is less than .001. Meanwhile, in order to reject or accept the hypothesis, **Table 6.26** provides all important and useful information. The information from the table reveals that PSCI strategy also significantly mediates the relationship between site element and the performance of ports on the periphery when the relationship of site element and the performance of ports on the periphery is no longer significant, where the p value is higher than .05 and the value of $\beta = .10$, $p = .35$. This clearly indicates that the tenth hypothesis of the study is strongly supported.

Table 6.25: ANOVA MRA Results: Site Element, PSCI Strategy and the Performance of Ports on the Periphery (N=101)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.623	2	2.312	10.924	**.000**
	Residual	20.738	98	.212		
	Total	25.362	100			

Table 6.26: Coefficients MRA Results: Site Element, PSCI Strategy and the Performance of Ports on the Periphery (N=101)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.024	.229		4.479	.000
	SITE	**.095**	**.101**	**.095**	**.941**	**.349**
	SUP_CHAIN	**.495**	**.132**	**.378**	**3.748**	**.000**

Note. Overall model $F(2, 98) = 10.92$, $p = .001$, $R^2 = .182$
* $p < .05$. ** $p < .01$. *** $p < .001$.

As was hypothesised for the eleventh hypothesis (H11), the initiatives to integrate with other supply chain companies would have a positive impact on sustainability. This hypothesis was tested using MRA procedures. Prior to testing the relationship between the PSCI strategy and sustainability, assumptions of MRA should be carried out in order to ensure that the data is not violated. Similar to other hypothesis testing normality was assessed via the normal probability plot. Per Norušis (1994), multivariate normality is fulfilled if the points are clustered towards the diagonal. Meanwhile, linearity and homoscedasticity assumptions are met if the scatterplot of the standardised predicted values by the studentised deleted residuals results in a random scatter. These assumptions were fulfilled and can be spotted in the **Figures 6.12**.

The regression model for the H11 as shown in the **Table 6.27** labelled as ANOVA demonstrates that the Sig. value is less than 0.05. Thus, the regression model is statistically proven to be significance. In addition, the R^2 value of the current regression model clarifies the presence of a significant amount of variance between PSCI and sustainability (with the overall model values of $R^2 = .246$, $F(1, 99) = 32.28$, $P < 0.001$). Statistically, this means that the model (PSCI strategy) explains 24.6% of the variance in sustainability advantage. Moreover, the findings as shown in the **Table 6.28** prove that PSCI strategy significantly predicted sustainability advantage with $\beta = .67$, $p = 0.001$. Of the PSCI activities, it is found that VAS and ICS are the highest contributions to the sustainability with $\beta = .30$, $p = .007$ and $\beta = .32$, $p = .004$ respectively. Therefore, peripheral ports should focus more on these two elements in order to attract more customers from foreland and hinterland through the sustainability advantage.

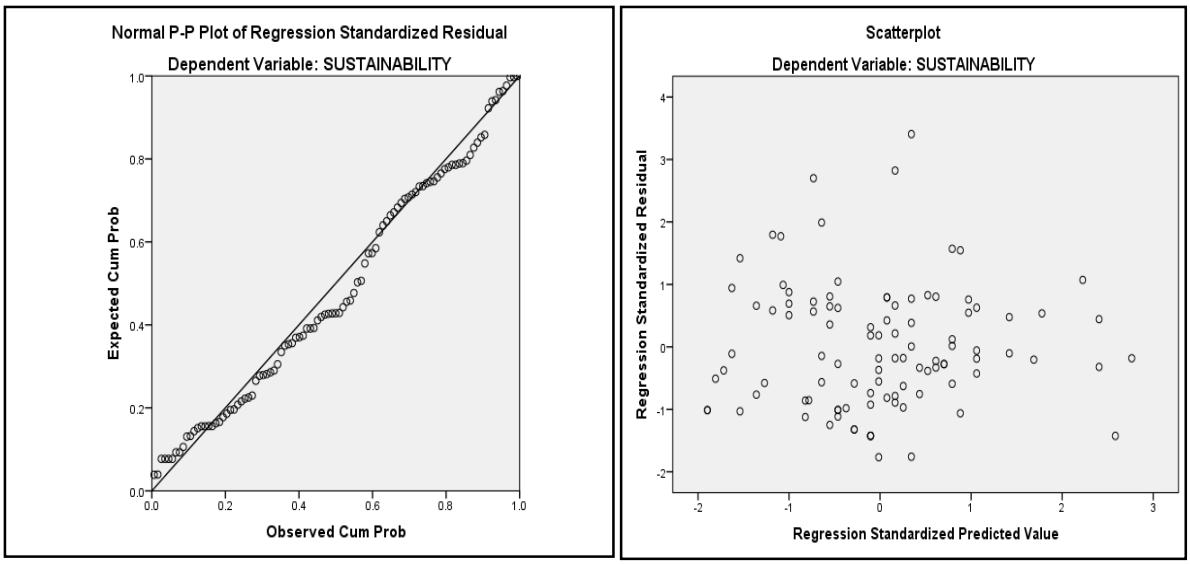


Figure 6.12: Normal P-P Plot of Regression Standardised Residual and Scatterplot for PSCI Strategy and Sustainability Advantage (N=101)

Table 6.27: ANOVA MRA Results: PSCI Strategy and Sustainability Advantage (N=101)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.588	1	6.588	32.284	**.000**
	Residual	20.202	99	.204		
	Total	26.790	100			

Table 6.28: Coefficients MRA Results: PSCI Strategy and Sustainability Advantage (N=101)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.790	.208		3.798	.000
	SUP_CHAIN	**.667**	.117	.496	5.682	**.000**

Note. Overall model $F(1, 99) = 32.28$, $p = .001$, $R^2 = .246$
* $p < .05$. ** $p < .01$. *** $p < .001$.

Meanwhile, for hypotheses twelve (H12) and thirteen (H13), it was hypothesised that supply chain integration would mediate the relationship between situation element, site element, and the sustainability advantage. To test these hypotheses, several regressions were conducted (Baron & Kenny, 1986). As suggested by Baron and Kenny (1986), three sets of regressions have to be conducted: a procedure where the mediator (i.e., PSCI) is regressed on the independent variables; a procedure where the dependent variable (i.e., sustainability) is regressed on the independent variables; and a procedure where the dependent variable is regressed on the independent and mediating variables. A variable is deemed to be a mediator when four conditions are met: the independent variables are significantly related to the mediating variable; the independent variables are significantly related to the dependent variable; the mediating variable is significantly related to the dependent variable; and the magnitude of the relationship between the independent and dependent variable is less strong (partial mediation) or no longer significant (full mediation) once the mediating variable is included in the regression model. Prior to establishing the MRA, assumptions should be conducted and it is found that the assumptions are met (see **Figure 6.13 and 6.14**).

Firstly, as established in the third hypothesis (see **Table 6.12**), proximity to hinterlands market significantly predicted the PSCI strategy, $\beta = .31$, $p = .001$. Site element also significantly predicted the PSCI, $\beta = .32$, $p = .001$ (see **Table 6.14**) Therefore, the first criterion for mediation was met. Secondly, as established in the sixth and seventh hypotheses (see **Table 6.18** and **Table 6.20**), proximity to hinterlands market significantly predicted the sustainability, $\beta = .45$, $p = .001$. Also, site element showed a significant relationship with the sustainability, $\beta = .29$, $p = .005$. Therefore, the second criterion for establishing mediation for both situation and site elements were met. Thirdly, as shown in **Table 6.28**, PSCI positively predicted sustainability, $\beta = .67$, $p = .001$. Thus, the third criterion for establishing mediation was met.

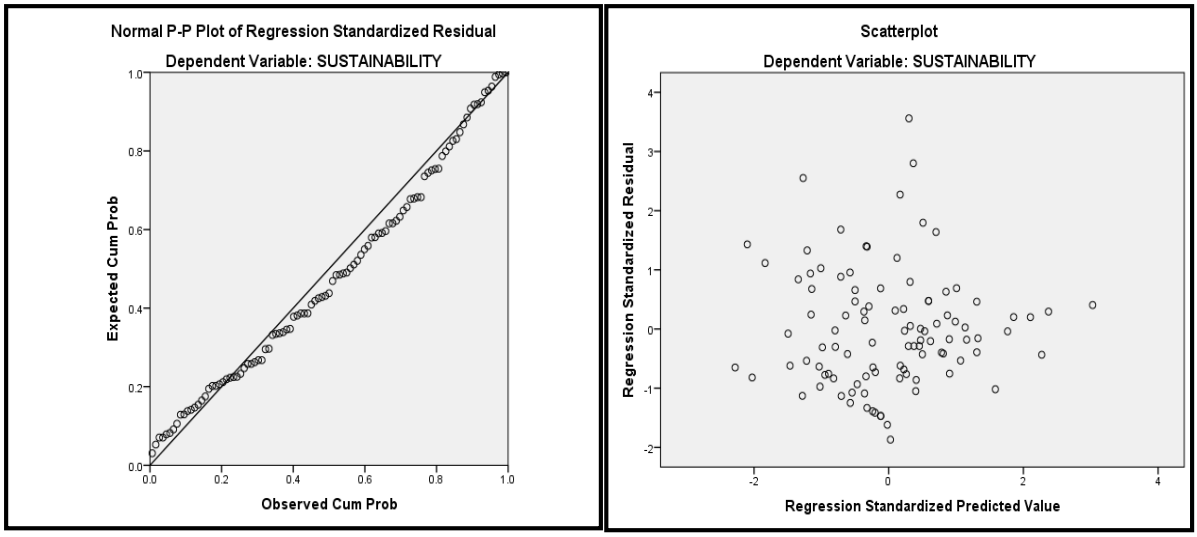


Figure 6.13: Normal P-P Plot of Regression Standardised Residual and Scatterplot for Indirect Effect of PSCI Strategy between Situation Element and Sustainability Advantage (N=101)

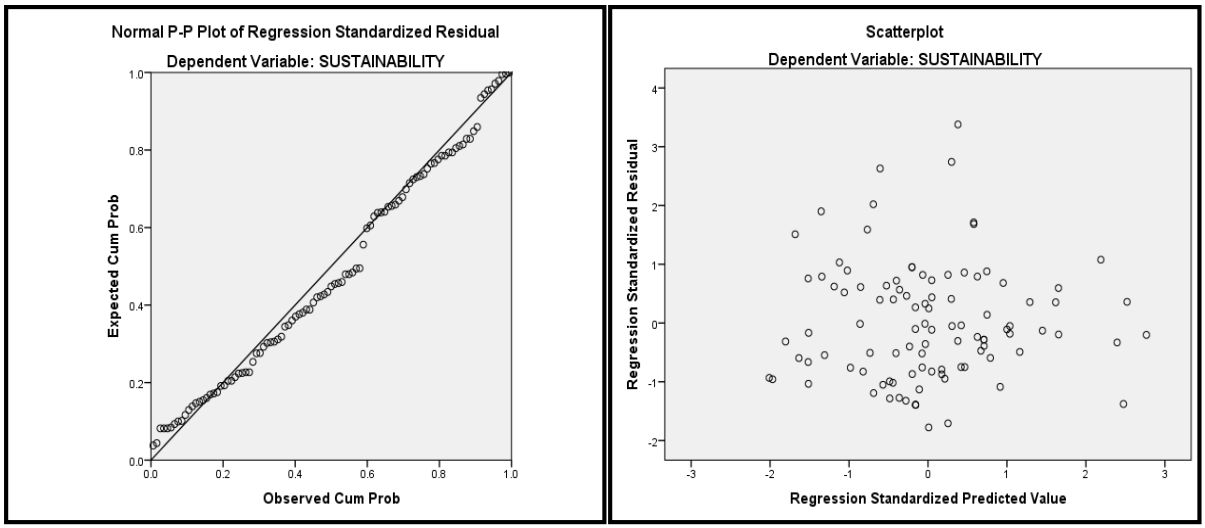


Figure 6.14: Normal P-P Plot of Regression Standardised Residual and Scatterplot for Indirect Effect of PSCI Strategy between Site Element and Sustainability Advantage (N=101)

Through the MRA technique, this study is able to produce the regression model summary of the H12 and H13. The overall model summary for both hypotheses demonstrates the presence of the variance between situation element, site element and sustainability advantage ($R^2 = .315$, $F(2, 98) = 22.59$, $P < 0.001$ (H12) and $R^2 = .252$, $F(2, 98) = 16.49$, $P < 0.001$ (H13)).

Statistically, the situation element explains 31.5% of the variance in sustainability advantage. Similarly, the site element explains 25.2% of the variance in sustainability advantage. Subsequently, the ANOVA **Table 6.29** and **Table 6.31** demonstrate that the regression models for both hypotheses are significantly supported with the P value being less than .001. Lastly, the findings in **Table 6.30** (below) and **Table 6.32** (below) further reveal that when supply chain integration was included in the regression model, the magnitude of the relationship between hinterland markets and site element of peripheral ports and the sustainability decreased with $\beta = .30$, $p = .002$ and $\beta = .09$, $p = .382$ respectively. Therefore, the fourth criterion for establishing mediation was met. As such, PSCI strategy partially mediated the relationship between proximity to hinterlands market and sustainability as the magnitude relationship between the two variables is perceived to be less strong. On the other hand, there is a strong mediating effect of PSCI between site element and sustainability as the relationship of site element and sustainability has been significantly weakened with the insertion of PSCI into the regression coefficient.

Table 6.29: ANOVA MRA Results: Situation Element, PSCI Strategy and Sustainability Advantage (N=101)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.452	2	4.226	22.585	**.000**
	Residual	18.338	98	.187		
	Total	26.790	100			

Table 6.30: Coefficients MRA Results: Situation Element, PSCI Strategy and Sustainability Advantage (N=101)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.481	.222		2.164	.033
	SITUATION	**.294**	**.093**	**.290**	**3.156**	**.002**
	SUP_CHAIN	**.507**	**.123**	**.377**	**4.106**	**.000**

Note. Overall model $F(2, 98) = 22.59$, $p = .001$, $R^2 = .315$

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 6.31: ANOVA MRA Results: Site Element, PSCI Strategy and Sustainability Advantage (N=101)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.746	2	3.373	16.490	.000[b]
	Residual	20.045	98	.205		
	Total	26.790	100			

Table 6.32: Coefficients MRA Results: Site Element, PSCI and Sustainability Advantage (N=101)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.716	.225		3.186	.002
	SITE	**.087**	.099	.085	.878	**.382**
	SUP_CHAIN	**.619**	.130	.460	4.768	**.000**

Note. Overall model $F(2, 98) = 16.50$, $p = .001$, $R^2 = .252$
* ***p* < .05.** ** ***p* < .01.** *** ***p* < .001.**

The above findings (H1-H13) have shown that the performance of ports on the periphery is not only depending on its spatial characteristics, in particular the situation and site elements, but also depending on other factors that have been perceived as having the direct and indirect impacts to port performance. Such factors are the sustainability advantage as a trade-off of the lack of intermediacy and the proximity to hinterland markets as well as the initiative of the peripheral ports to integrate its business through close cooperation with other supply chain entities in supply chain networks. To portray a clear picture of their impacts on logistics service providers and port users, port of Liverpool and ports in Scotland are the closest examples that could be used to depict the situation. Looking at port of Liverpool situation, most of the import and export cargo coming into the UK will be loading and unloading at the southern ports (Monios & Wilmsmeier, 2012). These ports strategically reside at the main maritime transportation network that connects Europe and Far East markets. Whilst Liverpool port is far away from the main maritime transportation network but it has a unique advantage. Other than offering the most efficient and cost effective route, Liverpool port also offers greener supply

chain distribution network to the heart of the UK market as it is closer to half of the UK and Ireland population. Fifty per cent of the cargo demand in the UK is closer to Liverpool port and in the North region (Danks, et al., 2014).

As a matter of fact, 92% of the goods in the UK is distributed by road and only 8 per cent is distributed using multimodal transportation (Hanafi, 2012). In addition, road transportation from southern ports to the main market of the UK takes more than five hours by HGV. However, only one to three hours are needed to transport goods by road from Liverpool port to the same market (Danks, et al., 2014). Therefore, southern ports are seen as a less efficient supply chain distribution network due to the longer distance, higher cost incurred, and more carbon emissions produced. Given that, almost 92% of the proportion of freight goods movement in the UK are carried by road and it contributes approximately 67% of GHG emissions into the environment on the hinterland (GOV.UK, 2014). Therefore, it is envisaged that logisticians would change their practice, behaviour, and strategy in order to comply with the current business environment. Changing the logistics practices by port users from southern ports to Liverpool port is a prudent decision as it is more efficient in time and cost as well as greener.

Kellogs, Regatta, Typhoo, and Global Sport Brand are some of the top brands that have switched from southern ports to Liverpool port as their main entrance in the UK market (PeelPorts, 2015). Reduction in carbon footprint, road usage, and maximised commitment to cost effectiveness and energy efficiency are the main reasons that made them change the transportation practice and strategy. Kellogs, for instance, saves 40,000 miles of road transportation and 61,000 kg of carbon emissions is removed from its supply chain networks annually. The same benefits are also shared by Global Sport Brand, where it saves 70,000 road miles a year, while saving 133,000 kg of carbon emissions a year and reducing their carbon footprint by 70%. The changing network route from southern ports to Liverpool is a smarter decision and a more profitable way to run a better business. It is expected that with the access to 150 million consumers within a radius of 150 miles, Liverpool port will assist port users and logistics service providers to eliminate approximately 150 million rail and inland miles as well as saving about 140,000 tonnes of CO_2 pollution every year.

Another big retailer in the UK that has switched from road to greener mode of transportation is Tesco. It has started to use inland waterway, known as Manchester Canal system to move

containerised wine that is imported through the Liverpool port and bottled in Manchester. The 60-kilometer long inland waterway stretching from Liverpool port to Manchester has helped Tesco to eliminate approximately 50 lorry journeys every week by using Manchester barge canal (Woodburn & Whiteing, 2015). A statistic produced by the Department for Environment, Food, and Rural Affairs (Defra) indicates that inland waterway/ shipping emits only 22 gram of carbon for each tonne-km (Reed, 2007), thus, the using of the Manchester ship canal has helped Tesco cut its carbon emissions by 80% compared to its traditional method and it also results in 1.1 million fewer heavy truck journeys annually. Instead of being transported for 225 miles by heavy truck vehicles from Southampton port to Manchester, Liverpool port offers only 40 miles to Manchester by barge (Yudelson, 2009). Tesco has shown that the re-routing of imported containerised wine to an alternative port that is closer to its main market and employing inland waterway have not only caused them to produce less CO2 emission but also less costs. Tesco's business strategy in mitigating the environmental impact is similar to a study conducted by (Rodrigues, et al., 2015).

Meanwhile, ports in Scotland, in the UK, are located at the northern region of the country. Ports of Rosyth, Grangemouth, and Glasgow, to name but a few, are some of the ports that are severely impacted from the low accessibility of direct maritime transportation network. Similar with Liverpool port, the development, competitiveness, and performance of ports in Scotland are hampered by the shipping lines' practice and preferability to use southern ports of the UK. In addition, evidence presented and discussed by Monios & Wilmsmeier (2012) in their recent publication indicated that Scotland ports also suffer from the lack of infrastructures and government initiatives to promote the direct link. As mentioned earlier, most of the cargoes coming into the UK are through the southern ports of the country. The fraction of external unitised freights to and from Scotland are mostly carried by road and rail transportation networks from English port and some of these freights are distributed through Regional Distribution Centre (RDC) that resides in England territory (Monios & Wilmsmeier, 2012). This distribution of freight is continuously practiced despite the fact that water transportation (through feeder) from southern to Scottish ports is cheaper, resilient, has a more stable price, and is greener than road and rail transportation (Association, 2012). Logically, water transportation should be the main transportation mode in transporting goods from southern region to Scotland territory. In addition, to reduce the transportation costs and be greener in reducing carbon emissions, goods from European market should be shipped via maritime shipping instead of road and rail at hinterland distribution networks.

Parallel with the UK and Scottish governments' desires and commitments to reduce carbon emissions by 80% by 2050 against a 1990 base line, port users, particularly the logistics companies are urged to get onto carbon emissions reduction pathway that will help both governments to accomplish their aim. The Logistics Carbon Scheme (LCRS), for instance, has been established and managed by the Freight Transport Association (FTA) in 2009 in the UK and logistics companies are strongly encouraged to record, report, and reduce their carbon emissions from logistical activities (Report, 2010). Therefore, more modal shift should be the main approach and practice in combatting the carbon emissions reduction and at the same time able to achieve the ambitions of the governments and FTA.

6.3 SUMMARY

This section summarises the data analysis and findings that have been conducted thoroughly through a selected statistical analysis technique and tool. Of 135 questionnaire survey, approximately 113 were found to be useable. Data screening and cleaning was carried out in order to produce only clean data for the inferential analysis. Through preliminary analysis such as normality, outlier, missing data, reliability scale and descriptive statistics only 101 questionnaire survey remained useable for the current study.

The effective response rate received was 10.6% (106/1000); however, the useable response rate from respondents of this study was only 10.1% (101/1000). In addition, through the preliminary analysis, the researcher managed to identify the most suitable and appropriate statistical analysis technique to be employed for the study. In particular, given that the assumptions of parametric analysis technique were met and the objectives of the current study are to explore the direct and indirect relationships that might occur between variables, therefore, MRA was employed to carry out this task.

Thirteen separate regression coefficients were estimated through the MRA technique where assumptions of the regression techniques such as multicollinearity, multivariate outliers, normality, homoscedasticity, and independence of errors were successfully met and none of the data included in this study were violated. Findings from those 13 separate MRA coefficients revealed that those hypotheses were both partially and fully supported. Given that this chapter has presented the findings of the study through the data analysis, thus, in the following chapter

the overall findings of this research are discussed in detail and the achievement of the objectives of the current study will be presented.

CHAPTER 7

DISCUSSION AND CONCLUSION

7.0 INTRODUCTION

This chapter presents the overall discussion and conclusion of the study based on the findings that have been generated from the previous chapters. To begin with, this chapter will address the aim and the objectives of the study, and followed by how the research objectives have been successfully achieved in the second section of the chapter. In the third section, the contribution of the research to the body of knowledge is also presented. Then, it is followed by the research limitations and recommendations for possible future research work in this area. Last but not least, the conclusion of the overall study is presented.

7.1 AIM AND OBJECTIVES OF THE STUDY

As indicated in Chapter One, the purpose of the current study is to investigate the competitive performance of ports on the periphery through spatial characteristics, inter-organisational cooperation (PSCI) and sustainability advantage. In particular, it tries to assess the direct and indirect effects of sustainability advantage and the inter-firm collaboration through PSCI strategy with other port stakeholders between spatial characteristics and the performance ports that are not on the main maritime shipping routes (no intermediacy) and facing challenges in attracting port users to make port of calls, regardless of being proximate to large hinterland markets (centrality), known as ports on the periphery. To achieve the aim of this study, several objectives are developed and listed as shown in **Table 7.1**. There are six research objectives that the researcher wishes to accomplish in order to achieve the purpose of the study. In particular, the sequence of the objectives was achieved through the different chapters of the research. Thus, the following section discusses the findings of this study based on the research objectives.

Table 7.1: Objectives of the study

No.	Objective
1st Objective	To identify and explore the appropriate potential strategies that are able to bring continuous prosperity to the business performance of ports on the periphery.
2nd Objective	To synthesise the theoretical relationships that might be present between spatial characteristics through situation and site elements, sustainability advantage, and the performance of ports on the periphery.
3rd Objective	To synthesise the theoretical relationships that might be present between port supply chain integration strategy, spatial characteristics through situation and site elements, and sustainability advantage.
4th Objective	To construct a conceptual strategic business model that could continuously contribute to the business performance of ports on the periphery.
5th Objective	To examine the direct and indirect impact of the causal relationships of spatial characteristics through situation and site elements on the sustainability advantage and subsequently on the performance of ports on the periphery.
6th Objective	To assess the direct and indirect impact of the causal relationships of the port supply chain integration strategy on the relationship between spatial characteristics through situation and site elements and the sustainability advantage.

7.2 THE ACCOMPLISHMENT OF RESEARCH OBJECTIVES

Given that the previous section (7.1) of this chapter has listed six main research objectives, thus, this section is devoted to discussing in detail the achievement of the research objectives and how each of the objectives was obtained. There are four main separate sections that will discuss those six research objectives. In particular, the research objective one will be discussed in the first section. This section explains the identification of the potential strategy that could give significant impact on the port performance of peripheral ports. It is followed by the second and third research objectives where the theoretical relationships of PSCI strategy and sustainability advantage are covered. The conceptual strategic business model of this study is presented in the third section in order to show the achievement of the fourth research objective and in the last section, the findings of the impacts of the causal relationships of sustainability and PSCI strategy between spatial characteristics and port performance of peripheral ports are discussed and subsequently covering the objective number 5 and 6.

7.2.1 Potential strategy that contribute to the performance of ports on the periphery

The first research objective of the study was to identify and explore the potential strategy that could contribute to the competitive performance of peripheral port. This research objective was successfully achieved through reviewing the literature. As mentioned earlier, ports on the periphery are not on the main maritime shipping routes and they face challenges in attracting port users to make port of calls (poor in intermediacy), regardless of being proximate to large hinterland markets (centrality). Though, it is claimed that these ports struggle to serve the shipper's need yet this category of ports do have a chance to develop into a port with a complementary function (Brooks et al., 2010) such as by serving the dominant ports in the multi-port gateway region (Feng & Notteboom, 2013). Through reviewing the literature, this study found several potential approaches that could facilitate the peripheral ports in attracting port users from both hinterland and foreland area. The potential approaches are (1) inter-organisational cooperation through PSCI strategy, (2) sustainability (environmental sustainability, economic sustainability, and social sustainability) and spatial characteristics of peripheral ports.

In literature, cooperation is one of the promising strategy that could facilitate and contribute to the performance of the firm. One of the greatest advantages when two firms are working together is the opportunity to use partner's complementary strengths. Nevertheless, the success of the cooperation strongly depends on the types of the strategy, either horizontal (complementary cooperation/ coopetition) or vertical, as different type of strategy has different pros and cons (Song, Cheon, & Pire, 2015). As for the current research, the focus is on the vertical strategy where the cooperation is along the line with supply chain partners that have related business scopes. On the other hand, the second potential approach that could contribute to the performance of peripheral ports is the sustainability benefits to environment, economy, and society. With the global challenge on climate change and the increasing customer interests in environmental sustainability, greater opportunities may be seen for ports, including smaller ports that have been peripheral that can add environmental benefits to the supply chains of the customers. This can be achieved through reduction of GHG emissions, in particular the CO2 emission, besides reducing the fuel consumption, the distance, the time, and also the costs incurred in transporting the goods by promoting and offering the sustainable supply chain distribution network to port users. This translates that, the potential strategy that could contribute to the performance of peripheral ports also relies on their spatial characteristics

which play a significant role in assisting port stakeholders, in particular the port users in selecting the most efficient and green distribution networks in order to transport their goods.

7.2.2 Theoretical relationship between variables

The second and third objectives of the study are to synthesise the theoretical relationship of the spatial characteristics of peripheral ports, PSCI strategy, sustainability and port performance. These objectives were successfully achieved through the lens of resource-based view theory that explain the opportunities and benefits that can be generated from the integration of those strategies in order to achieve the sustainable competitive advantage and subsequently port performance. Through the resource-based view lens, the combination of physical and organisational resources of ports on the periphery, in particular, the adjacent location of this category of port to hinterland markets and the availability of land side space for future development and inter-organisational cooperation with other supply chain entities are apparent opportunity to sustain the business in intense competition. The physical resources become valuable in the context of environmental sustainability where the GHG emissions can be reduced through short-distance travel between manufacturing sites or import/ export activities and port location. Also, inter-organisational resources become valuable in the context of information sharing (how the information is being analysed and used) and VAS for environmental and economic purposes in order achieve and sustain the competitive advantage and subsequently contribute to the business performance of peripheral ports.

7.2.3 The conceptualisation of the strategic business model for peripheral ports

The fourth objective of the current study is associated with the building of strategic business model for peripheral ports and this objective has been achieved through the literature review. In order to analyse the relationship effects of the sustainability and inter-organisational cooperation through PSCI strategy between spatial characteristics and port performance, this study has conceptualised a strategic business model for peripheral ports based on the previous and current literature. In particular, the elements of situation and site under the spatial characteristics scope of ports on the periphery were used for main independent variable, meanwhile the port performance served as the main dependent variable of the study.

Through further reading of the literature, it is viewed that causal relationships occurred between the spatial characteristics, PSCI strategy, sustainability, and port performance. This indicates

that PSCI strategy and sustainability were not only performing as independent variables but also dependent variables. In particular, prior to literature review there is a direct relationship effect between spatial characteristics of peripheral ports and port performance. Secondly, there is a direct relationship effect between spatial characteristics and ports supply chain integration strategy. Similarly, a direct relationship effect could be found between spatial characteristics of peripheral ports and sustainability. Both PSCI strategy and sustainability have a direct positive relationship with port performance. On the other hand, the relationship between spatial characteristics and port performance is facilitated by the mediating effect of PSCI strategy as ports are now an integral part of the supply chain rather than monopolising the industry. The interaction of ports with other supply chain partners are not only important for business performance but also imperative in adding more sustainability benefits. Lastly, it is understood that the spatial characteristics could add more sustainability benefits through the mediating effect of the inter-organisational cooperation.

The construction of the strategic business model is shown in the form of figure as demonstrated in Chapter Four (see **Figure 4.1** and **4.2**). This conceptualisation study has contributed to the hypothesis development which has been analysed accordingly in Chapter Six and the impact of the relationships is presented in the next section.

7.2.4 The evaluation impacts of the direct and indirect relationships of the potential strategy with spatial characteristics and port performance

Table 7.2 summarises the findings from the MRA. In general, the findings support the direct and indirect relationship effect of the potential strategic factors, namely PSCI strategy and sustainability benefits, between spatial characteristics and performance of ports on the periphery. As conceptualised in the strategic business model, the first hypothesis (H1) and second hypothesis (H2) indicate that the situation element which is the proximity to hinterland markets and the presence of significant site element do have positive relationship effects on the performance of ports on the periphery. The findings from the data analysis served to support the predicted hypotheses. These results are in line with the claim made by Hayuth & Fleming (1994) which was recently confirmed by McCalla (2008) in which the closeness of ports to hinterland main market and the significant site elements are still important to port users, particularly those in the hinterland. With shorter distance between ports on the periphery and

major markets, the port users are able to reduce the cost incurred. Given that the hinterland-transport coordination is inefficient and the costs are generally higher than maritime-transport costs (Horst & Langen, 2008), unnecessary bottlenecks and costs can be reduced by delivery from/to the ports on the periphery.

Table 7.2: Summary of the hypotheses results

Hypothesis	Result
H1: Situation element and port performance	Supported
H2: Site element and port performance	Supported
H3: Situation element and PSCI strategy	Supported
H4: Site element and PSCI strategy	Supported
H5: PSCI and port performance	Supported
H6: Situation element and sustainability	Supported
H7: Site element and sustainability	Supported
H8: Sustainability and port performance	Supported
H9: Indirect effect of PSCI strategy between situation element and port performance	Partially supported
H10: Indirect effect of PSCI strategy between site element and port performance	Supported
H11: PSCI strategy and sustainability	Supported
H12: Indirect effect of PSCI strategy between situation element and sustainability	Partially supported
H13: Indirect effect of PSCI strategy between site element and sustainability	Supported

As hypothesised in the third hypothesis (H3) and fourth hypothesis (H4), ports that are on the periphery, but are closer to hinterland markets require closer collaboration and coordination with other supply chain partners. It is found that these two hypotheses are positively supported.

This indicates that, the insertion of ports on the periphery into the larger supply chain is an imperative strategy. Although, literature claims that the supply chain integration strategy is limited to large ports, however, the findings demonstrated that the supply chain integration strategy can be adopted and implemented regardless of the size of the ports and the commodities handled by the ports. In addition, the situation element and site element of ports on the periphery do not only represent the proximity to hinterland markets, but they also demonstrate that this category of ports have closer link with hinterland connections through multi-modal transport and consequently provide a better, cleaner, and greener supply chain distribution networks in improving their performance. Moreover, given that, the ports on the periphery are rich with inland-side space, they are not only a platform to provide value-added services, but also to establish closer relationship with other port stakeholders. Subsequently, these integration practices would be a catalyst for logisticians to have a long term relationship through collaboration or cooperation.

It is identified that PSCI strategy is able to facilitate a firm's ability to respond to customers' needs and demands (Droge, et al., 2012). This occurs when the partners collaborate closely in a harmony of circumstances and this brings together the promising advantages not only to the end customers, but also to the whole supply chain and consequently facilitates the firms to move towards the achievement of sustainable competitive advantage (Kocoglu, Imamoglu, Ince, & Keskin, 2011). The aforementioned literature is in line with the findings from this study in which the integration of ports into supply chain does have a positive impact on the performance of ports in several areas such as operations, cost and consumer orientation. Robinson (2002), added that the improvement of the port through the integration activity results from the elimination of the inefficient operations and the value will be gained and delivered to other supply chain members and customers. The findings for fifth hypothesis (H5) also revealed that the success of ports in today's intense business environment is influenced by the integration activities between business partners.

As shown in the conceptualised strategic business model, the sustainability benefits are considered as both dependent and independent variable between spatial characteristics and port performance. To understand the interaction and the effects of the relationship, there are several hypotheses that need to be tested separately, comprising H6, H7, and H8. As hypothesised in sixth hypothesis (H6), the sustainability benefits can be retrieved from the maritime locational disadvantage of peripheral ports as its location is proximate to hinterland markets. Given that,

the distance of ports on the periphery is closer to hinterland markets where most of the population inhabits at a particular country, carbon emissions and other types of emission could be reduced. In addition, ports on the periphery are reckoned as free from congestion and bottleneck either at hinterland or foreland compared to large ports that are often associated with the congestion issue, and this allows the efficient operations at ports and indirectly contributes to the environmental sustainability. Moreover, with the presence of environmental regulations such as carbon emissions trading, ports on the periphery are seen as being able to strengthen their position and simultaneously securing their competitive advantage. Furthermore, the proximity of ports from/ to hinterland markets does not only reduce the environmental impacts, but also contributes to economic performance through the reduction of fuel consumption, costs, and improved business image. Similarly, the finding supports the seventh hypothesis (H7) of the study in which the availability of land-side space and the involvement of GTOs in port management are seen as a potential contributor to the environmental, economic as well as social sustainability for ports on periphery through logistics service activities (such as port-centric logistics, distripark, or free trade zone activities), and it also influences the increase in port of call from shipping lines to the ports. The results are in line with Liao, Tseng, & Lu (2009), Liao, Tseng, Cullinane, & Lu (2010) and Liao, Lu, & Tseng (2011) in which the sustainability benefits can be generated from the spatial characteristics of port through the reduction of carbon emissions, fuel consumption, and costs. The current findings also parallel with a study conducted by Rodrigues et. al (2014) which stated that the overall carbon emissions could be significantly reduced by re-routing the container movement away and using the rail network instead of road network from the traditional and large ports resided at the southern region of the UK to the northern region of the UK.

As for the eighth hypothesis (H8), it was hypothesised that the sustainability benefits could contribute to port performance if it is treated as business opportunities. It is found that the finding from the current study is consistent with Rao & Holt (2005) in which the sustainability can be a stepping stone for a firm to enhance its performance. This would help ports to distinguish themselves from competitors, while reducing costs, improving services to conscious customers, and ultimately improving the performance in the long run. The finding translates that the sustainability benefits of ports on the periphery can be a significant contribution to their business performance. The sustainability benefits, in particular the environmental sustainability is a huge opportunity for ports on the periphery to promote themselves as a sustainable distribution network in order to attract hinterland and foreland users

to make port of calls at this category of ports. This opportunity becomes clearer as the tighthening of environmental regulations and the growing awareness of environmental issues in recent years will increase the pressure which will encourage and gradually change the logisticians' mind, behaviours, practices, and strategy to improve its current supply chain distribution network to sustainable, greener, and environmental friendly distribution networks in order to optimise the efficiency of transport and logistics and subsequently contribute to the performance of peripheral ports through environmental performance, increasing operational productivity, and cost efficiency. The implementation of carbon emissions policy, in particular the carbon emissions trading, for instance, could change the logisticians' supply chain network behaviour when the carbon emissions charge is higher (Hanafi, 2012).

In addition, to avoid any undesirable impacts, port users are advised to change their business practices, behaviours, and their strategy in many ways. For example, choosing a greener and cleaner transportation mode is one of the best environmental practices that could be adopted (Gonzalez-Benito & Gonzalez-Benito, 2006). The changing of business practices to more sustainable and greener distribution networks will also change the transportation networks as a whole. As a result, logistics service providers and port users are indirectly impacted from this transition where they will gradually follow the movement of cargo. Hence, maximising water transport route to the centre of the market is better in saving cost and carbon footprint than longer inland road miles. Therefore, greener supply chain distribution networks if treated astutely can be a good business opportunity in many ways and this would not only benefit port users but also other port community members.

Similar to the role played by sustainability benefits, PSCI strategy is not only considered as both independent and dependent variables, but also as the mediating factor that facilitates the relationship between spatial characteristics and port performance. From the MRA results, it is confirmed that the ninth hypothesis (H9) and tenth hypothesis (H10) are supported. These results are in line with the study conducted by Woo et al. (2011) where PSCI strategy has an indirect relationship with port performance. Similarly, the finding is also consistent with a study conducted by Chiang & Hwang (2013) pertaining to the indirect role play by integration strategy towards the regional port competitiveness. These findings indicate that the performance of ports on the periphery is achieved through integration activities with other supply chain partners in a larger supply chain network by providing more efficient distribution with lower cost and more added value services offered to customers. Given that, the

enhancement of the performance of ports on the periphery is indirectly influenced by the involvement of ports in the supply chain integration strategy, and port managers are recommended to be more dynamic in their business strategy, particularly in the current business environment where customers are more demanding on the services offered. The cooperation strategy between partners can improve both parties' customer responsiveness by identifying ways to reduce or remove redundant costs, and also to improve quality and reliability as well as increase speed and flexibility. Therefore, port managers should be more aware of lean and agile approaches in their business operations that will give positive impacts to their customers particularly port stakeholders, such as the cost efficiency. This is an advantage to peripheral ports as they are more agile and flexible than large ports in dealing with the market-based challenges (Feng & Notteboom, 2013).

Many studies have shown that the supply chain integration strategy with suppliers and customers is not only important in contributing to the performance of ports, but it is also an imperative strategy to reduce the environmental impacts along the supply chain. As in the eleventh hypothesis (H11), the study claims that the sustainability benefits of ports on the periphery can also be achieved from the supply chain integration activities of the port with other partners along the supply chain. The findings from MRA revealed that the hypothesis positively predicted the effect of supply chain integration strategy towards the sustainability benefits. In addition, it is understood that the value-added services and ICS play an important role between partners in adding more sustainability benefits to ports on the periphery. Through ICS, ports and other supply chain partners could exchange important and reliable information pertaining to distribution and operational activities which could facilitate both partners to alleviate the environmental impacts.

The inter-organisational cooperation through supply chain integration strategy with other partners does not only have a direct relationship effect with sustainability, but it also has an indirect relationship effect between spatial characteristics and sustainability benefits. The indirect relationships were hypothesised in hypothesis twelve (H12) and hypothesis thirteen (H13) which can be found in Chapter Four. To test these hypotheses, several regression coefficients were conducted thoroughly between spatial characteristics, sustainability benefits, and PSCI strategy. In particular, to identify the presence of the indirect relationship effect of the PSCI strategy: firstly, spatial characteristics are regressed on the PSCI strategy, secondly, the spatial characteristics are regressed on the sustainability and lastly, the spatial

characteristics are regressed on the PSCI strategy and sustainability. Subsequently, results that have been generated in Chapter Six revealed that inter-organisational cooperation through PSCI strategy has indirectly added more sustainability benefits to ports on the periphery and has consequently contributed to the environmental and economic performance. This study is in line and consistent with a study conducted by Zhang and Wang (2014) that inter-organisational collaboration with both suppliers and customers along the supply chain as well as with industrial symbiosis is able to reduce the environmental degradation while simultaneously increasing the economic performance. This indicates that, although the sustainability benefits can be directly generated from spatial characteristics of peripheral ports, it is not without the cooperation strategy with other related port stakeholders. This translates that working alone in achieving the sustainability impact is insufficient as GHG emission is coming from many sources along the supply chain. Hence, in improving the sustainability in production, supply, distribution, materials and technology, and other operational activities, peripheral ports can opt to collaborate with other port stakeholders either at the futuristic level or progressive level (Ramanathan, Bentley, & Pang, 2014).

In summary, the findings are in line with what has been proposed by Gilman (2003) in which the sustainable distribution network should be embraced in order to improve the efficiency of distribution, minimise congestion, minimise pollution and GHG emissions, manage development pressures on the landscape for both natural and artificial, make better use of transport infrastructure, reduce noise and disturbance from freight movement, reduce the road freight intensity and of economic growth, and reduce the number of accidents, injuries, and case of ill health associated with freight movement.

7.3 RESEARCH NOVELTY

This study contributes to the body of knowledge in several ways.

1. Academics

Maritime transportation is one of the world‘s most important international industries, in particular the performance port sector and there are abundant researches that have been devoted to the studies of such port, especially large and established ports around the globe. However, the research on the performance of ports that have locational disadvantage (usually called as secondary ports, assisting ports and small medium-sized ports and peripheral ports) has lagged behind considerably. Their importance, however, often goes quite unnoticed, because all

attention goes to the larger ports that are engaged in the rat race for ever more tonnes, or ever more boxes. In addition, like in fiction, in real life ´minor´ characters also are often thought to be playing a secondary part. Therefore, their logistics and socio-economic role is still largely undefined and underestimated in literature and in policies, too. In addition, their visibility is limited and their voice is often weak. However, the function of these ports is essential. Thus, this research attempted to fill the gap and contribute to the literature as follows:

Firstly, as previous studies pertaining to the performance of ports have been focused more on the large and established ports that have location advantage and very limited studies have been devoted to investigate the performance of peripheral ports, thus this research has filled the gap of the study by investigating the performance of ports on the periphery by considering influential factors that are perceived as able to contribute to the performance of such ports. To be more specific, this research has been able to identify the potential advantages that peripheral ports could rely on in order to enhance their performance. These potential advantages are retrieved from their geographical features, namely spatial characteristics (site and situation), sustainability and at the same time through the supply chain collaboration advantage which can assist peripheral ports to become the protagonists. This unique research has allowed similar ports or ports that have similar geographical features in different country and region to learn from each other in enhancing the performance of ports.

Secondly, this research has contributed to the body of maritime transportation literature by considering the sustainability aspect, in particular the environmental, economic and social. Previously, the performance of ports generally was examined through the strength of internal and external KPIs of large and established ports, but very few studies consider the sustainability issue as a platform for ports to improve the performance of ports, in particular for ports on the periphery. This research has empirically tested that sustainability aspect is one of the factors that could contribute to the performance of peripheral ports through environmental sustainability which subsequently leads to the economic and social sustainability. It also offers an understanding and new insight to the body of knowledge that the geographical features of peripheral ports can be a source of sustainability advantage not only to the peripheral ports but also to other port users.

Thirdly, literature indicates that not all ports are able to apply and adopt the PSCI strategy as it requires large volume of throughput. This represents that the strategy is not applicable to

smaller size of ports, including ports on the periphery. On the other hand, there are other views from literature that PSCI strategy is applicable to smaller ports because the port competition is no longer between firms, instead it is between supply chains. Nonetheless, the views are only discussed theoretically, but not empirically. Thus, the empirical finding has enriched the literature that port supply chain does play a significant role in contributing to the performance of peripheral ports. It becomes apparent for peripheral ports or other small size of ports to vigilantly seek collaboration with other supply chain partners to stay competitive in the chain networks as their visibility, voices and importance are weak. This is also provides a new perspective in the literature on how the PSCI strategy plays an important role to peripheral ports.

Fourthly, previously, the spatial characteristics (situation and site factors) of ports, sustainability and PSCI strategy that could contribute to the performance of ports are being studied separately. However, in the current study, those potential strategies are included in a single study as there are causal relationships that exist between the identified potential strategies where their impacts on the performance of ports are investigated. The finding contributes to the enrichment of the literature that the performance of peripheral ports is not only depending on the spatial characteristics, but also on the PSCI activities with other supply chain partners in chain networks and sustainability advantage as a trade-off of the geographical disadvantage of peripheral ports.

Fifthly, the findings from this research could possibly be generalised and made applicable to other ports on the periphery at other parts of the world that face similar problems or barriers, eventually for identifying port development policies and strategies, as ports on the periphery are representative of other secondary ports, assisting ports, minor ports and small and medium-size of ports.

2. Practitioners

Similar to the academic knowledge contributions, the current study also provides contributions to the practitioners.

Firstly, as the main aim of the current research is to aid the peripheral ports in enhancing their performance, thus the findings will assist the managers of peripheral ports in formulating their

business operations and strategies. Moreover, this research will be a good guideline to the managers of peripheral ports to promote their ports as a sustainable supply chain distribution network in association with spatial characteristics, sustainability advantage and the strategy of PSCI. Given that, most peripheral ports do not have a concrete port marketing strategy, therefore, the port marketing should play a significant role in promoting the peripheral ports through sustainable distribution networks and through collaboration with other supply chain partners. This advantage can be a huge springboard for peripheral ports to strengthen their position and performance since regulation on environmental issues has become an important agenda, not only among government sectors and NGOs but also among suppliers and customers in contending the GHG emissions by logistics activities and operations. Also, port managers of peripheral ports should take advantage of the benefits of the supply chain integration in particular the ICS and VAS not only to provide effective and efficient business activities which could attract more port users from foreland and hinterland area and subsequently contribute to the performance of ports but also for the sustainability aspect.

Secondly, the contribution of the current research to the practitioners is in terms of port choice behaviour. In particular, the findings of the current study would be a useful roadmap for users in selecting the most efficient and greenest routes in order to ship their goods. Indirectly, port managers of peripheral ports could assist port users in reducing the environmental impact that could jeopardise their business opportunities and images. This finding has enriched the port choice or port selection literature as one of the current and new factors that will be considered by and influence port users when selecting port to make a call either from foreland or hinterland.

The results from the research will be very useful for those ports that encounter the similar situation. This research will also be a guideline to promote peripheral ports as a sustainable supply chain distribution network in association with spatial characteristics, the strategy of PSCI, and the sustainability benefits. This advantage can be a huge and attractive springboard for such ports to strengthen their performance since regulation on environmental issue has become an important agenda, not only among government sectors (regulatory pressures) and NGOs (communities pressures) but also among suppliers and customers (market pressures-port users) in contending the GHG emissions, in particular the carbon gas emitted by logistics activities and operations. Similarly, the findings would be a useful roadmap for port users in selecting the most efficient and greenest routes in order to ship their goods. In particular, it

would assist port users in reducing the environmental impact that could jeopardise their business opportunities and images.

3. Government

It is clear that the proximity of peripheral ports to main hinterland markets has an environmental advantage that contributes to the reduction of GHG emissions, in particular the CO2. Shifting to longer maritime route rather than longer inland transportation network would be a better option where the CO2 is concerned. This is because maritime shipping has been recognised as the least contributor to the environmental pollution. Given that maritime transportation is exempted from any carbon emissions regulations and is not included as one of the targeted sectors to reduce the CO2, thus, this could bring more opportunities to peripheral ports in attracting more customers from hinterland markets. In order to promote and encourage the use of peripheral ports that are closer to main hinterland markets, policy makers could play a significant role in helping such port increase their market share by receiving more shifting or the movement of cargoes or containers from established and large ports to ports on the periphery.

7.4 LIMITATIONS AND FUTURE RESEARCH

It should be noted that there are hardly any researches that are free from limitations. Nevertheless, it is not an indicator to judge and evaluate the credibility of a particular research. Instead, the limitation is a key that could provide an opportunity for others to embark the loopholes left by previous researchers. There are reasons that hinder a research to be perfectly done. It is viewed that time, cost, location, and accessibility, to name but a few, are some of the factors that contribute to the presence of the limitation in a particular research. Similar to other previous studies that have been conducted, the current research also holds some limitations that will need to be explored in the future either by the same researcher or other researchers who are interested in this study.

One of the limitations found in this study is the sampling frame. Although the sampling frame of this study involves a group of port stakeholders, but the current study only focuses on port operators, port authorities, freight forwarders, and shipping lines. Given that, in maritime transportation there are five main port stakeholders that have direct and indirect business activities with port operations. These port stakeholders are identified as (1) Port service

provider (such as freight forwarders), (2) Port Authority/ Operator (such as port managers), (3) Shipper (such as importers and exporters or consignors/ consignees) (4) Shipping line (carriers), and (5) Other related agencies that have direct or indirect relationship or business activities with port operations (government [local/ regional/ national governments] and non-government agencies [such as local environmental groups]).

The selection of current sampling frame is because the researcher is only interested in getting a view from main port stakeholders who have direct business activities with ports. Therefore, freight forwarders, shipping lines, port operators, and port authorities are selected to be involved in this current study as they are the main port stakeholders that have direct business activities at ports. However, shippers or importers and exporters or also known as consignors/ consignees are excluded in this sampling frame. The underlying reason as to why they are excluded in this study is because most of them have indirect business activities with ports particularly those shippers that are involved with SMEs. It is also because most of them have a tendency to employ agents or freight forwarders to transport their products or goods either in small or large volume. Meanwhile, similar to shippers, government and non-government agencies are excluded from this study. It is because these two agencies are identified as the port stakeholders with the least direct affiliations or relationships with port activities and operations.

Therefore, in order to get a complete view of the performance of ports on the periphery, it is recommended to include those port stakeholders as mentioned above. Assuming that, different port stakeholders may have different views and opinions on how they perceive the importance of ports to their business activities which consequently could affect the performance of ports. In addition, they might also have different views or opinions on the activities and services offered to them. Given that, some port stakeholders may perceive port activities and services as being inadequate or inefficient which could cause them higher costs. Hence, with bigger circles of sampling frames, it would help researchers to identify the differences and find the best resolutions to improve any weakness found at any level of port activities or operations. This consequently will produce a holistic view on how the performance of ports on the periphery can be presented to public interests.

Another limitation found in this research is the location of the study. The current research location involves ports on the periphery at three different locations around the globe such as in Europe (UK), Africa (Nigeria), and Asia (Malaysia). Assuming that, ports on the periphery do

not only exist in those selected countries, instead, there are many other ports around the world that have the similar problems or issues and their presence sometimes is ignored in the research context. Given that, this research only concentrates on those countries, therefore, the findings are limited to these insights only. For further research, it would be valuable if other locations can be treasured as well. Specifically, a similar research could be conducted at one specific location such as a country (such as New Zealand, Indonesia, Thailand and etc.) or a region (such as Southeast Asia or Northeast Asia).

Undertaking similar study for future research at different locations could give additional information or data pertaining to the scope of the study. Given that, the business practices and approaches of one port to another or one country to another or one continent to another might not necessarily be similar due to many reasons such as policies, rules and regulations, port ownerships, or port business culture, to name but a few. Therefore, the findings obtained from different locations might produce similar or different outcomes depending on the sampling frame of the study. A research that includes all five main port stakeholders that have been identified in the literature may generate different findings than those without.

Different outcomes due to different locations do not mean or bring negative issues or problems. Instead, it is a good opportunity for future research to be discovered. One might investigate the underlying reasons that might be the contributing factors to the different outcomes produced through a series of researches at different locations. These outcomes are not a bunch of waste but it can be regarded as contributions to the study either at the academic or practical level. Therefore, different locations and different outcomes provide a comprehensive view of the importance of the performance of ports on the periphery, not only to ports per se, but also to other aspects such as local and regional economy where its prosperity can be improved.

Given that the current study only investigates the impact of the potential strategies/ variables on the performance of ports on the periphery, therefore, it could be a good approach for future research to make a comparative study on the different impacts of the strategies on the performance of ports on the periphery for different groups of port stakeholders. Given that, different port stakeholders have different views on the identified potential strategies, hence, a work is worth to be conducted and produced in order to provide a valuable perception of port stakeholders towards the PSCI strategy and the sustainability advantage of ports on the periphery. To conduct this analysis, independent t-test could be employed by comparing the

means of the different groups in order to reveal the outcomes of the analysis. Prior to the t-test, several assumptions, including (1) dependent variable must be continuous, (2) independent variable must be categorical, (3) independent observation must be present, (4) no significant outliers, (5) data should be normal, and (6) homogeneity of variance should be met in order to conduct the analysis.

From explanations above, it can be concluded that the limitations of a particular study or research are unavoidable. It is also reviewed that limitations are a great opportunity for future research to be explored and treasured. This is a continuous process and it is obviously a never ending story for researchers. More explorations and explanations will be undertaken and presented in order to provide the public with interesting discoveries.

7.5 SUMMARY OF THE DISCUSSION

Table 7.2 summarises the findings from the MRA. In general, the findings support the direct and indirect relationships of PSCI and sustainability benefits between spatial characteristics and the performance of peripheral ports. In addition, the discussion of the potential strategies in improving the competitive performance of ports on the periphery can be a good guideline for port stakeholders to be more dynamic and responsive in collaboration and coordination with other supply chain partners.

Moreover, it is worth to mention that this research is one of its kind that includes environmental advantage as an opportunity for ports on the periphery to promote themselves as sustainable distribution networks in order to attract more port users to make port of calls. This is a good opportunity for port stakeholders to be more environmental oriented towards the customers' need and distribution networks through the implementation of the strategies, thus enhancing their business activities and subsequently their performance. Cost and carbon emissions can be simultaneously reduced when port stakeholders actively collaborate and coordinate with supply chain networks and be more responsible in regard to environmental issues.

Also, in this discussion chapter, a specific section was devoted in order to identify and explain the limitations that researchers have encountered while conducting the research. To the best of researcher's knowledge, there are three main limitations that have been found that require further research to take them into account. Such limitations are sampling frame, location, and

comparative study between groups of port stakeholders. Given that, research limitations are a great opportunity to be explored, therefore, interested researchers could embark the future research separately or combine them in a single study. The discussion section is completed with the summarisation of the topic. To recap this research, the next section provides the final conclusion of the current research that have been conducted for several years to be completed.

7.6 CONCLUSION OF THE STUDY

The aim of the current study is to investigate the impact of the potential strategies on the performance of ports that are not on the main maritime shipping routes and facing challenges in attracting port users to make port of calls, nevertheless, proximate large hinterland markets, namely ports on the periphery. Specifically, the study intends to examine the potential direct and indirect impacts of the potential strategies between PSCI, sustainability advantage, spatial characteristics (situation and site elements) and the performance of such ports.

To realise the aim of the study, Chapter One has briefly explained the background of the current study. This chapter provides a brief summary as an introduction to the whole thesis. This chapter also provides readers with a clear picture of what the thesis is about. Nevertheless, to realise the objectives and aim of the current study, a comprehensive literature was reviewed in order to present what has been done to date over the research area that the researcher is interested in. The literature review of the present study is covered in Chapter Two and Chapter Three. Prior to literature review in Chapter Two and Three, hypothesis development was carried out and presented in Chapter Four. Chapter Five is an independent chapter where the methodology of the thesis was precisely explained and presented. This chapter has been a good guideline for researcher on how to conduct data collection and data analysis of the present study. The findings of the current study are presented in Chapter Six where the rejection or acceptance of the hypotheses can be carried out. Lastly, Chapter Seven is the discussion of the findings that have been generated from the previous chapters. Also, a brief conclusion was included in order to close the report of the study.

A conclusive result from the analysis confirms that the identified potential strategies, in particular the spatial characteristics, cooperation and sustainability have significant direct and indirect impacts on the performance of ports on the periphery. This is supported by the inability

of the MRA to reject those thirteen formulated hypotheses of the study that have been generated from the MRA that is presented in Chapter Six.

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APPENDIX A

SURVEY

Thank you for your participation.

We would like to invite you to participate in a research project related to strategies of feeder (peripheral) ports. The purpose of the project is to determine the best strategies to enhance the competitiveness of feeder ports. **We can define the feeder (peripheral) ports of this project as those which are far from main shipping routes, but which may be close to the huge domestic market**. Your answers will help the feeder ports in providing effective and efficient services, so as to enhance their competitiveness. The survey only takes about 20 minutes of your time. Your participation is voluntary. Your answers and contact information will be kept strictly confidential. The data collected in the project is only for research purpose. However, you can always terminate your participation at anytime.

If you know someone who may be interested to participate in the research, could you please forward this questionnaire so that they could contact me for participation in the survey? For any question on this research, kindly please contact the research officer of this project (if there is any dissatisfaction or complaint, please contact Research Management Department, Tel: (+44) 151-7948290, E-mail address: ethics@liv.ac.uk. Please list the name of project and the relevant research officer during your contact).

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Notes

The ***feeder port*** of the research project is a port which is not on the main shipping routes, but which is close to the huge domestic market.

Local / Direct hinterland - The goods distribution area exclusive to the port

Extended hinterland - refers to hinterland shared by two or more ports, namely the overlapped portion among areas of attraction of several ports.

PART A: USER'S STATISTICS / COMPANY BACKGROUND

1. Your company is under the category of:

   a. Shipping Line ☐
   b. Port Operator ☐
   c. Ports Authority ☐
   d. Logistics Service Provider ☐

   e. Others (please specify): _____

2. Your company is based at:

   a. Local ☐
   b. International ☐

   c. Others (please specify): _____

3. Your position in the company:

   a. CEO ☐
   b. Director ☐
   c. General Manager ☐
   d. Operations Manager ☐

   e. Others (please specify):_____

4. Your years of practice:

   a. Less than 5 years ☐
   b. 5-10 years ☐
   c. 11-15 years ☐
   d. More than 15 years ☐

5. The current number of employees of your company:

   a. Less than 500 ☐
   b. 500-1000 ☐
   c. 1001-1500 ☐
   d. More than 1500 ☐

6. What types of bulk commodities transporting is your company engaged in? Multiple choice questions ☐

   a. Liquid Bulk
   b. Dry Bulk ☐
   c. Container ☐
   d. Ro-Ro ☐
   e. General Cargo ☐

   f. Others (please specify): _____

7. What type of market does your company's transportation business come from? Multiple choice questions

   a. Local / Direct market ☐
   b. Regional market ☐
   c. Half the globe ☐
   d. Global market ☐

8. Your company's annual revenues (US dollars) are:

   a. less than 100 million ☐
   b. 100 million -1billion ☐
   c. 1.1 billion -5 billion ☐
   d. more than 5 billion ☐

9. Please answer both questions 8.1 and 8.2, if it concerns your company's business scope.

9.1. Annual throughput (TEU)

a. Less than 10 million ☐
b. 10-20 million ☐
c. 21-30 million ☐
d. More than 30 million ☐

9.2. Annual cargo handling capacity

a. less than 10 million tons ☐
b. 10-20 million tons ☐
c. 21-30 million tons ☐
d. more than 30 million tons ☐

PART B: CONCENTRATION OF PORT

You can define the "concentration" in this research project as the position of market region served by the port, and it refers to the ability to attract and to create demand for transport service to the hinterland region (or from the hinterland region) .

For the concentration of port, please select to what extent you agree or disagree with each of the following related statements (single answer).

	Strongly Agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
The port of your choice:					
Serves similar population as to that of major transshipment port, or slightly differ					
Serves larger market region than that of the main transshipment port in the area, or slightly differ					
Has greater proximity to major markets compared to major transshipment port in the area, or slightly differ					
High concentration of your port choice:					
Able to generate large transport demand for local and direct hinterland					
Able to generate great transport needs for the expansion of hinterland					

Able to generate large transport needs for regional hinterland					
High concentration of your port choice:					
Generates real transport needs between origin and destination traffic from and to local or neighboring hinterland					
Able to forge close tie with major carriers / importers / exporters					
Able to forge close tie with consumption area of carriers / importers / exporters					
Able to promote efficient connection of inland transport networks, such as rail, inland waterways, and roads					
Helpful for efficient use of inland transport networks such as rail, inland waterways, and roads to direct access to the market					

PART C: VENUE OF PORT

"Venue" can be defined as the characteristics of port area, such as land, infrastructure, port operators, and so on.

As far as the venue is concerned, for the importance of each factor to your business activities please select to what extent you agree or disagree with the following related statements (single answer).

	Strongly Agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Availability of certain quantity (large-scale) and quality of land is very important for the subsequent development of the port					
Availability of certain quantity (large-scale) and quality of land is very important for the subsequent development of cargo / container yard					
Availability of certain quantity (large-scale) and quality of land is very important for the development of subsequent distribution business of the port					
Availability of certain quantity (large-scale) and quality of land is very important for the subsequent cargo / container handling of the port					
Global terminal operators are more efficient in management and operations					
Global terminal operators possess a more solid technical capability					
Global terminal operators Have very solid capacity for replacement of equipments					
Global terminal operators have richer expertise and keep an efficient service commitment					

PART D: INTEGRATION OF PORT SUPPLY CHAIN

"Integration of port supply chain" refers to the strategy adopted by various departments and organizations of harbour / port in integrating the supply chain in order to build a complete supply chain. The port supply chain integration index consists of five elements, namely multimodal transport operations, value-added services, supply chain integration services, information and communication system, and relationship with the other supply chain actors.

1. Multimodal Operations

As far as multimodal transport operations at port are concerned, to what extent do you perceive the importance each of the statement below to your business activities (single answer)?

	Very Important	**Important**	**Neutral**	**Unimportant**	**Very Unimportant**
Able to transport goods through intermodal route and /or mode in the shortest time possible					
Able to provide a variety of services, realizing cargo transport in different ways					
Sufficient contact channels are available for multimodal transport connections					
Provide reliable services for multimodal transport connection					
Provide low-cost and high quality multimodal transport services					
Provide multimodal transport routes with lowest carbon emissions					
Critical assess the provision of alternative routes of more efficient multimodal transport services for container through our harbours					

2. Value-Added Services

From your point of view, to what extent do you perceive the importance each of the statement below pertaining to value added services at port to your business activities (single answer)?

	Very Important	**Important**	**Neutral**	**Unimportant**	**Very Unimportant**
Have adequate facilities to provide value-added services, such as assembling, packaging, and etc.					

Have adequate facilities for users to reduce cost, for example warehouse required for the enterprise's flexible goods supply to demand, equipments required for on-demand repackaging, and etc.					
Able to provide flexible logistics services to user's requirements as demand arises.					
Able to provide the widest possible range of highway / railway access to the hinterland					
Able to handle different types of goods					
Able to transport goods to end users within the shortest time possible, through diversified routes and / or modes					
Able to provide a variety of services in achieving efficient cargo transfer between different modes of transport					
Able to provide more personalized services for different market segments					
Able to adjust schedules quickly, modify orders, and change designs process in order to make decisions which meet customer's demand					

3. Supply Chain Integration Services

From your point of view, to what extent do you perceive the importance each of the statement below pertaining to supply chain integration practices to your business activities (single answer)?

	Very Important	**Important**	**Neutral**	**Unimportant**	**Very Unimportant**
Working with supply chain partners to carry out planning for large-scale supply chain optimization					
Giving effort to identify other competitive container supply chain operations that possibly going on through the ports					
Comparing with the competitors in term of cargo transportation cost and time of to improve performance					
Giving effort to identifying the cheapest way to transport goods to hinterland destinations					

Ongoing assessment of the performance of the available modes of transport connecting our port and its hinterland destinations					
Comparing port with its competitors for identifying alternative routes for better logistics/ supply chain solutions					

4. Information and Communication System

From your point of view, to what extent do you perceive the importance each of the statement below pertaining to information and communication system to your business activities (single answer)?

	Very Important	**Important**	**Neutral**	**Unimportant**	**Very Unimportant**
Provide information on cargo transport and tracking					
Sharing inventory management information with supply chain members					
Exchange information on supply and demand forecasting with supply chain members					
Exchange information on marketing strategy with supply chain members					
Communicate with supply chain partners using integrated electronic data interchange (EDI) system					
Integrated information system is used to share information with supply chain partners					
Use supply chain operations automated service system					
Support supply chain management objectives using the latest technology					
Information exchange with partners are timely, accurate, complete, adequate, and reliable					

5. Relationship with Other Supply Chain Actors

From your point of view, to what extent do you perceive the importance each of the statement below pertaining to relationship with other supply chain actors to your business activities (single answer)?

	Very Important	**Important**	**Neutral**	**Unimportant**	**Very Unimportant**
Simplify channels to work closely with selected supply chain members					
Promote strong, long-term supply chain relationships, and enhance level of cooperation					
Establish guidelines to develop and maintain long-term cooperative relationships with supply chain members					
Establish cooperative relationships with supply chain members based on mutual trust – not contractual obligation					

PART E: SUSTAINABILITY

"Sustainability" refers to ‘being able to satisfy current needs of the enterprise and its stakeholders today, while protecting, sustaining and enhancing the human and natural resources that will be needed in the future’. Sustainability includes the triple bottom line (3BL) of environmental, economic and social aspects

1. Environmental Sustainability

For each of the following statements on the advantage of feeder ports, please select to what extent you agree or disagree (single answer).

From your point of view, to what extent do you agree or disagree that the government policies relating to the environment and the enterprise’s pursuit of its own sustainable development strategy will:

	Strongly Agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Provide new market opportunities for ocean shipping and ports					
Encourage business to pursue best practice and innovation					
Port users increase their emphasis on environmental protection, conducive to the demand for environmentally friendly logistics activities					

Promote integration of multimodal transport for best possible improvement of transport efficiency					
Promote the use of energy-efficient transport equipments to reduce energy waste					
Promote improved transport routes and time in order to optimize the efficiency of transport and logistics					
Promote the use of feeder ports, taking advantage of their proximity to regional market in order to reduce carbon emissions of inland transport (road and rail)					
Make continual expansion difficult for major transshipment ports due to possible impact on the environment. This is advantageous to feeder ports					

2. Economic Sustainability

From your point of view, to what extent do you agree or disagree that the rationale use of feeder ports: (single answer)?

	Strongly Agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Around major transshipment ports is favorable to support regional industrial development					
Promote industrial development so as to support port development. This will be the catalyst for many industries to grow around the port naturally					
Attract more foreign direct investments (FDIs) to the vicinity of the port					
Enhance a country's regional GDP					
Improve local and regional traffic condition					
Minimize demand for inland traffic because it is closer to huge domestic market					

3. Social Sustainability

From your point of view, to what extent do you agree or disagree that the rationale use of feeder ports: (single answer).

	Strongly Agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Create job opportunities in the region					
Cause environmental problems of major transshipment port to have less impact on human health					

Minimize the morbidity and mortality of inland transport accidents, so as to enhance safety and security, since it is closer to huge domestic market.					
Help reduce greenhouse gas emissions at large ports					
Help reduce noise pollution at large ports					

Part F: Competitiveness

Based on your previous and current experiences with port operations, to what extent do you agree or disagree with each of the statement below given by port (single answer)?

	Strongly Agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
We provide consistent and reliable services					
We handle cargoes according to the forecast or estimated time					
We handle cargoes according to our customer's time requirements					
Our service delivery time is better than main competitors					
We provide accurate shipping information					
Our customer satisfaction has been improving					
We have a good corporate reputation					
We are striving to protect the environment					
We have given efforts to reducing carbon emissions					
We strive to make management more adaptable to any changes in environment-related policies					
We are able to retain existing customers and attract new customers					
We respond quickly to customer needs					
We have fast decision-making process					
We are flexible in term of volume and type of cargoes handled					
We handle unexpected events or circumstances properly					
We offer services at low cost similar to competitors, or even lower					
Our service charges are lower than major competitors					
Our cargo handling service charges are lower than major competitors					
We provide auxiliary services and charge lower than major competitors					
Our transit mode time is shorter					
Vehicles entry are immediately allowed for shipment of cargoes					

In our ports, the retention time for goods from entry to exit is shorter than that of main competitors					

<40 TEUs = Poor

40-60 TEUs = Fair

61-80 TEUs = Neutral

81-100 TEUs = Good

>100 TEUs = Excellent

Based on your previous and current experiences with port operations, to what extent do you perceive the average berth productivity of port: (single answer)?

The average productivity per berth	**Poor**	**Fair**	**Neutral**	**Good**	**Excellent**
For vessels less than 8,000 TEUs					
For vessels more than 8,000 TEUs					

APPENDIX B

Conference Paper Presented at British Academy *of* Management (BAM 2013)

THE COMPETITIVENESS OF PORTS ON THE PERIPHERY

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ABSTRACT

There is abundant research into the competitiveness of maritime transportation and the port industry in general. However, it is identified that there is little research into how to make 'ports on the periphery' more competitive although they face particularly strong threats in a highly competitive environment. This paper addresses this gap.

Keywords: Ports on the periphery, Intermediacy, Centrality, Port supply chain integration, Sustainability development

Introduction

Ports are desperately searching for new ways to increase performance and gain a sustainable edge in today's dynamic and competitive business environment (Almotairi and Lumsden, 2009). Since competition between ports is intense, many studies have investigated factors contributing to the competitiveness of ports and strategies to increase competitiveness. These studies have been centered on the major, established ports such as Singapore, Hong Kong and Busan located on the main maritime networks/routes, for example (Chou et al, 2003)(Yeo and Song, 2005)(Tongzon and Heng, 2005)(Yeo et al, 2008)(Acosta et al, 2007)(Yeo et al, 2007)(Choi et al, 2007)(Tongzon and Sawant, 2007)(Yeo, 2010) (Yuen et al, 2012)(Yeo et al, 2011). In contrast, ports facing geographical disadvantage, hereafter called 'ports on the periphery' have been overlooked. However, with innovative thinking, such as port supply chain integration, and changing market conditions, such as the need to reduce carbon emissions, there are opportunities for ports on the periphery to become competitive.

Ports on the Periphery

In the maritime transportation literature it has been recognized that there are two important factors determining the fundamental competitiveness of a port. These are site and situation. These two factors are the initial determinants of where strategically important ports have grown, particularly large transshipment hubs. Site refers to features of a port's infrastructure

such as depth of water, number of berths, cargo handling equipment, intermodal connections, and efficiency and effectiveness of the port operator. Situation refers to the spatial relationships of intermediacy and centrality, i.e. proximity to major shipping lanes and proximity to hinterland markets respectively. Of the two factors, situation has been identified as the most significant contributor to ports flourishing (McCalla, 2008). For example, Hong Kong is one of the busiest and most efficient ports in the world as it benefits from a strategic commercial location, due to its intermediacy on the main corridor to Europe and the East Coast of the USA, and centrality as its hinterland generates millions of tons of container loads (Fleming, 1997).

Ports on the periphery are defined as ports that are off the main international maritime shipping networks/routes (no intermediacy) or not located close to a large domestic market (no centrality), as illustrated in Figure 1 (Brooks et al, 2010). Take Scotland for example, it suffers from poor direct maritime access to continental Europe due to being far from the main maritime routes. Intermediacy is not the only barrier to Scotland, lagging infrastructure development and lack of sufficient government initiatives to promote direct links have also been identified (Monios & Wilmsmeier, 2012). These barriers hinder Scottish ports in becoming more competitive. Studies of ports on the periphery can be found in the literature, for example (Slack and Wang, 2002)(Brooks et al, 2010)(Monios and Wilmsmeier, 2012)(Wilmsmeier and Monios, 2013). However, these are focused on the development of ports rather than on how to make them more competitive, which is particularly a concern for ports that lack intermediacy but have good centrality, i.e. a hinterland or natural market that they can serve.

		Centrality	
		Yes	***No***
Intermediacy	***Yes***	Successful Ports	Ports on Periphery
	No	Ports on Periphery	Struggling Ports

Figure 1: Situation of port (Brooks et al, 2010)

Larger Vessels and Higher Fuel Prices

The competitive environment of maritime transport has changed dramatically in recent years due to developments in technology and global economic conditions. In particular, the increasing size of container vessels up to 15,000 TEU and bunker fuel prices have changed the way maritime business is being conducted. The number of ports of call has been reduced and shipping lines are only concentrating on the specific ports for which the deviation distance is minimal. This is demonstrated by data on trade between the Far East and North Europe, which show the average number of ports of call falling from 4.9 in 1989 to 3.4 in 2009 (Ducruet and Notteboom, 2012) with the increasing size of ships, despite overall grow in cargo volumes.

Some ports have found it difficult to respond competitively to these changes due to their site and situation, so that some that were once leaders have lost much of their attractiveness and

importance to shipping lines; whilst others that were previously minor have grown into major ports and container hubs. It is ports on the periphery that have suffered most either because they are too far from the main shipping lines or their hinterland cannot sustain the capacity of larger vessels. This is compounded by fierce competition in the market that drives on competitors with better sites and situations.

As described by Rodrigue et al (1998), "maritime deviation" is the additional distance taken away from the main shipping routes to visit a port. The greater this deviation the more reluctant shipping companies are to use a port along their major pendulum routes, unless the port has significant hinterland demands as abundant cargos can offset the deviation costs, particularly the operating cost. The operating cost can be divided into three broad categories: fixed daily cost (e.g. cost of crews, supplies, insurance, maintenance and fuel for auxiliary engines); cost of bunker fuel for the main engines which is dependent upon the cruising speed of the ship; port charges which are constant for a specific voyage. The bunker fuel price is volatile due to imbalances between oil supply and demand in the market (Ronen, 1982). Its volatility was seen clearly as it increased sharply from $28 to $147 per barrel between 2003 and 2008, before falling back to $40 in January 2009 and rising again to $100 in 2011.

Many shipping lines have been introducing speed controls to offset higher bunker fuel prices. For example, reducing ship cruising speed by 20% can reduce fuel consumption by about 50%. However, the trade-off is longer voyage times. The shipping line Hapag-Lloyd took action to reduce fuel costs by reducing ships' speeds from 23.5 to 20 knots on the round trip between Hamburg and ports in the Far East, but at the cost of increasing voyage times from 56 to 64 days. This longer voyage time meant higher operating costs, charter costs, interest costs and other monetary losses (Kirschbaum, 2008). Shippers (customers) are unhappy with these longer journey times, as they have had to build up their inventory levels and adjust their supply chains resulting in higher costs (Faber et al., 2012). This situation makes shipping lines even more reluctant to go to ports on the periphery as the long distances deviated from the main shipping routes would make journey times even longer.

Research Questions

The fundamental research question is, "How can ports on the periphery be made more competitive?" If the current weakness is a lack on intermediacy, then there is nothing the port can do to reposition itself closer to the major shipping routes. However, another solution would be to find an opportunity to exploit that would offset the cost of deviation, i.e. "How can a port on the periphery offer more value to merit the cost of deviation?" Whilst answers to this question are still to be explored exhaustively, one major opportunity that looms large is sustainability. This can be divided into three types: environmental, economic, and social. From the environmental perspective, maritime is seen as a greener form of transport compared to road or rail, so it follows that it should be used to get products as close to market as possible rather than using more distant ports and subsequent land transport. This can be achieved by deviation from major shipping routes to ports on the periphery or the use of a hub and spoke model. In such a model one of the existing major ports would act as the hub, whilst smaller vessels would feed the periphery ports, eliminating long land journeys. From the economic perspective, the use of a periphery port will cause the development of industries to support the port and it will act as a catalyst to industries that naturally locate themselves near to ports, such as food, chemicals, and power stations. This will also have the social benefit of creating good quality jobs in the region of the port. Apart from sustainability, being integrated with supply chains is identified as one of the best solutions to be considered by ports in order to remain

competitive. Contemporary supply chain management is increasingly requiring the integration and coordination of actvitities both internally and externally, with suppliers and customers, upstream and downstream, to reduce waste, to increase delivery speeds, to reduce unit costs and to increase flexibility and responsiveness to meet market demands (Hosseini, et al., 2012). Moreover, Slack (2001) suggested that in combating the current challenges in maritime transportation, seaports should expand their scope to work closely with other actors in the logistics chain, treating them as stakeholders and working together to develop the competitiveness and attractiveness of the entire port-based logistics package. Ports should be proactive in developing partnerships with these other actors to create an integrated port-based service looking more like a 'one-stop shop'. Such integrated development can be driven by wider regional development as seen in the Liverpool Superport project.

Conclusion

The competitive environment of maritime transport with features such as increasing vessel sizes and volatile, but generally increasing bunker fuel pries, has led to a decline in use of ports on the periphery as shipping lines focus on large ports with intermediacy and centrality. If the ports on the periphery are to survive then we must find ways to make them more competitive. This can be viewed as offering more value to offset higher costs. Sustainability and port supply chain integration could be the basis of this added value and the basis upon which ports on the periphery may compete.

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