THE EFFECTS OF DRY PORT-SEAPORT INTEGRATION ON SEA PORT PERFORMANCE IN VIETNAM

A thesis submitted in fulfilment of the requirements for the degree of

Doctor of Philosophy

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DECLARATION

I certify that except where due acknowledgement has been made, the work is that of the author alone; the work has not been submitted previously, in whole or in part, to qualify for any other academic award; the content of the thesis is the result of work which has been carried out since the official commencement date of the approved research program; any editorial work, paid or unpaid, carried out by a third party is acknowledged; and, ethics procedures and guidelines have been followed.

Thi Ngoc My Nguyen

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LIST OF ABBREVIATIONS

BFP	Buyer financial performance	OP	Operational performance
BP	Business performance	P	Productivity
CA	Collaborative advantage	PbS	Product-based service
CaS	Customer action-based service	PD	Product co-development
ClC	Collaborative communication	PI	Product innovation
CC	Competitive capabilities	PM	Product modularity
CI	Customer integration	PP	Product performance
CP	Cost performance	PPTI	Product-process technology integration
CrI	Cross-enterprise integration	PSQ	Port service quality
CS	Customer satisfaction	QP	Quality performance
CSI	Corporate strategy integration	RBV	Resource base view
DP	Delivery performance	RS	Resource sharing
DPSP-I	Dry port-seaport integration	RV	Relational view
EC	External collaboration	SA	Supplier assessment
FP	Financial performance	SCI	Supply chain integration
FiP	Firm performance	SEP	Sourcing enterprise performance
FlP	Flexibility performance	SI	Strategic integration
FWCI	Firm-wide cross-functional integration	StrP	Strategic performance
GCD	Goal congruence decision	SuI	Supplier integration
IA	Incentive alignment	SP	Support performance
IS	Information sharing	SPsI	Supplier process integration
IT	Information technology	SPtI	Supplier product integration
JKC	Joint knowledge creation	SSI	Strategic supplier integration
LI	Logistics integration	TCE	Transaction cost economics
OC	Operational coordination	VPA	Vietnam Seaports Association

ABSTRACT

Maritime transport, with its ability to facilitate the transportation of large volumes of cargo over long distances at low costs, remains the backbone of globalisation and international trade. However, the literature shows that inefficiencies exist, especially in the container shipping sector, due to a lack of coordination and cooperation between players in the maritime supply chain (for example, between shipping companies and seaports and between seaports and other hinterland operators, such as dry ports), which may negatively affect their performance. Particularly, there is knowledge missing from the existing literature on how the integration between dry ports and seaports, which are key players in the maritime supply chain, impacts seaport performance. To address these gaps in the existing literature, this research aims to explore the dry port - seaport integration (DPSP-I) and its impacts on seaport's performance, especially on port service quality, customer satisfaction, and financial performance in the maritime supply chain and, specifically, the container port context. This study, therefore, poses the following research questions:

RQ1: What is the current status of dry port–seaport integration in Vietnam?

RQ2: How does dry port–seaport integration impact seaport performance in terms of service quality, customer satisfaction, and financial performance in the context of Vietnam?

The results of the comprehensive literature review on maritime supply chain integration and its effects on firm performance indicate that there are many differences between studies in terms of their definitions and measurement criteria of supply chain integration (SCI). Besides that, research in the context of DPSP-I and its impact on seaport performance is scant, especially in developing countries. To address these literature gaps, a conceptual framework depicting the components of DPSP-I and its impacts on seaport performance, specifically service quality, customer satisfaction, and financial performance, was developed under the light of underpinning theories: transaction cost economics (TCE) and relational view (RV). Under TCE theory, integration between dry ports and seaports may be an intermediate form of hybrid governance because relational integration implies the adoption of a strategic connection among ports (dry ports and seaports) characterised by trust, commitment, long-term orientation, and goodwill which can help to avoid opportunistic behaviour, and optimise mutual interest. Meanwhile, from the relational view theory perspective, information, operational, relationship, and geographical integration-components of DPSP-I-may reach beyond firm boundaries and

are critical resources that may enhance the competitive advantage of the supply chain and enhance seaport performance.

To achieve the research purposes, a sequential mixed method, combining both qualitative and quantitative approaches is employed. The qualitative approach helps to overcome the limitations in the literature of DPSP-I in container seaport systems, while the quantitative approach validates the results from the qualitative method and analyses the effects of DPSP-I on seaport performance. With these considerations, the unit of analysis in this research are members of the maritime supply chain. Specifically, the units of analysis in the first phase are seaport operators, dry port operators, shipping lines, and logistics service providers aiming to qualitatively explore the interrelationships between research variables in the proposed conceptual framework. In the second phase of the study, which aims to examine the impact of DPSP-I on seaport service quality, customer satisfaction and financial performance, the chosen unit of analysis is seaport operators.

In the qualitative phase, the snowball sampling method and NVivo_11 software were deployed to collect and analyse the qualitative data collected from fourteen in-depth interviews with senior managers working in the maritime sector in Vietnam. The findings align with the literature in showing that the DPSP-I in Vietnam can be measured through information integration, operational integration, relationship integration, and a newly discovered factor: geographical integration. In addition, it was found that the level of integration varies from low to high, and that DPSP-I has an impact on seaport performance. Consequently, the conceptual framework was revised following the qualitative results, and the survey questionnaire was then constructed accordingly.

In the second phase of this research, a survey questionnaire was distributed to 102 container seaports via Qualtrics and with the help of the Vietnam Seaport Association to examine the level of DPSP-I and its impacts on seaports performance in Vietnam. The collected data were coded and prepared, and 88 remaining valid cases were analysed using SPSS and partial least squares structural equation modelling (PLS-SEM) statistical packages. Dry port – seaport integration is found to be a four-factor construct, and all four factors (information integration, operational integration, relationship integration, and geographical integration) were reliable and valid. However, in the context of the maritime sector in Vietnam, in line with the qualitative finding, the practice of DPSP-I varies. Specifically, the most common practice of integration between dry ports and seaports is relationship integration, followed by operational information

and geographical integration. The quantitative findings also illustrate that DPSP-I has a significant positive direct effect on port service quality and customer satisfaction. Interestingly, this integration also significantly indirect affected financial performance, mediated by port service quality.

This research contributes to the literature in several ways. First, it is one of the first studies to quantitatively examine the integration of dry ports and seaports and its impact on seaport performance in a developing country like Vietnam; it thus enriches the integration literature in the maritime supply chain domain. Findings from this research also extend the application of the TCE and RV theories in maritime SCI, particularly in the context of developing countries. Meanwhile, understanding how the integration of dry ports and seaports is measured and how it influences seaport performance can help policymakers, port authorities, and operators in Vietnam devise policies and strategies to improve their ports' competitiveness. Specifically, policies and strategies to increase the level of information, operational, and relationship integration can be formulated to help enhance seaports' service quality, customer satisfaction, and financial performance. Findings from this research can also be a useful reference for ports in other countries in advancing the integration and performance of their seaport and dry port systems.

Keywords: *Dry port, seaport, integration, port service quality, customer satisfaction, financial performance.*

LIST OF PUBLICATIONS

Refereed conference papers.

Nguyen, M., Thai, V. V. and Chan, C., 2018, 'The effects of dry port–seaport integration on seaport performance: A conceptual model', in *Proceedings of the 11th International Conference on Asian Shipping and Logistics*, June 21–23, Incheon National University, South Korea.

Nguyen, M., Thai, V. V. and Chan, C., 2019, 'The effects of dry port–seaport integration on seaport performance: An exploratory study in Vietnam', in *Proceedings of the 12th International Conference on Asian Shipping and Logistics*, June 27–29, RMIT Vietnam University, Vietnam.

Chapter 1. INTRODUCTION

1.1. Research background

Maritime transport remains the backbone of globalisation and international trade, thanks to its capability in facilitating the transport of large volumes of cargo over long distances at low costs. It is estimated that more than 80 percent of the world's trade, in terms of volume, is transported at one stage or another by sea (International Maritime Organization, 2020), and thus whether this sector is operated and managed effectively and efficiently can make or break the global trading system. However, the literature shows that inefficiencies exist, especially in the container shipping sector, including a lack of information integrity, poor access to hinterland (Woo, Pettit and Beresford, 2013). One of the main reasons for these inefficiencies is the lack of coordination and cooperation between players in the maritime supply chain (for example, between shipping companies and seaports and between seaports and other hinterland operators, such as dry ports), which may negatively affect their performance (Gumuskaya *et al.*, 2020). In the extant literature, the dyadic relationship between seaports and dry ports and its impact on seaport performance is an under-investigated area.

In the maritime industry, the effort to blur the boundary lines between seaport forelands and hinterlands has met some significant challenges during recent decades due to the sustained increase of international trade and the establishment of multi-modal supply chains (Ng, Padilha and Pallis, 2013). The intensified competition has been seen in terms of seaports' capability in communication with their inland markets via efficiencies in information flow and the movement of physical cargo. In order to achieve efficient operations in multi-modal supply chains, it is necessary that some activities related to cargo processing, storage, consolidation, distribution and customs brokerage are carried out at inland terminals before cargo is transferred to seaports. In this context, increased integration between dry ports and seaports is suggested as an optimal solution to facilitate physical cargo flows and the administrative activities of seaports within the chains (Roso, Woxenius and Lumsden, 2009; Ng, Padilha and Pallis, 2013).

There are many studies in the existing literature that demonstrate the positive relationship between supply chain integration (SCI) and firm operational performance in general. In addition, some research also shows the positive impact of dry ports on seaports. In this context, SCI is defined as the strategic collaboration that a focal company carries out with its partners

within a supply chain and in which it collaboratively manages intra- and inter-organisational processes (Flynn, Huo and Zhao, 2010). Supply chain integration is also considered a potential tool of management to generate competitive advantages for organisations (Flynn, Huo and Zhao, 2010; Liao, Hu and Ding, 2017).

An organisation taking advantage of SCI can complement its resources with those of its partners and, thus, improve organisational performance all round. Most of the empirical studies in the recent literature that analyse the relationship between SCI and firm performance show positive results for the effects of SCI on firm performance (Leuschner, Rogers and Charvet, 2013), although the dimensions of SCI constructs are quite diverse. The dimensions of SCI can essentially be grouped into three categories: customer, supplier and internal integration. Customer and supplier integration are commonly referred to as external integration; this describes the degree to which a firm structures inter-organisational strategies, practices and processes into collaborative, synchronised processes with its external partners.

Customer integration involves core competencies derived from coordination with critical customers, whereas supplier integration involves core competencies related to coordination with critical suppliers (Kam Fai Yuen and Thai, 2016). In contrast, internal integration focuses on the coordination and integration of activities by the various business units within a firm. In the context of the maritime industry, dry ports, as integral nodes in the maritime supply chain, have been essential over past decades in enhancing seaport efficiency in many ways, including providing solutions for seaport terminal congestion (Roso, 2007; Roso, Woxenius and Lumsden, 2009; Bergqvist, 2013), reducing freight costs (Maibach *et al.*, 2007; Henttu and Hilmola, 2011; Lättilä, Henttu and Hilmola, 2013), contributing to a better ecological environment (Roso, 2007; Panayides and Song, 2008; Trupac and Twrdy, 2010), and others. However, the studies listed have mainly examined the coordination between dry ports and seaports from the theoretical perspective, and empirical research on that coordination is scarce. Additionally, existing studies in this research area have focused mainly on the operational performance of seaports, leaving the effects of DPSP-I on seaport performance less well investigated.

In summary, the existing literature lacks knowledge on how the integration between dry ports and seaports, which are key players in the maritime supply chain, impact seaport performance, specifically service quality, customer satisfaction and financial performance. It is important to understand how customer performance, as the external dimension of seaport performance, can

be influenced by the way seaports integrate with their key supply chain partner – dry ports. Such an understanding can inform seaport managers on how to enhance their integration with dry ports in an effective and efficient manner. Findings from this research are expected to enhance the knowledge of SCI within the maritime supply chain, while also helping container port managers to understand areas of integration that can positively influence their customer performance, enabling them to design and implement appropriate integration strategies and methods.

1.2. The context of Vietnam

1.2.1. The seaport system in Vietnam

With a coastline stretching more than 3,200 km along the country, Vietnam is well placed to develop its transport system by sea. The port system in Vietnam is based both along the coastline and the country's rivers (Banomyong, Thai and Yuen, 2015). According to the Vietnam Maritime Administration (VINAMARINE, 2021c), there are currently 31 seaports able to accommodate vessels on international voyages and 13 offshore oil terminals. In total, there are currently 263 terminals in Vietnam, including 102 container terminals with an aggregated berth length of 59.4 km. In 2020, the total cargo throughput of seaports in Vietnam was 692.292 million tons, which includes 22.418 million twenty-foot equivalent units (TEUs) (VINAMARINE, 2021b).

The port system in Vietnam can be divided according to regions: the North, the Centre and the South - each serving a large hinterland. Hai Phong Port is the main port and is considered the gateway to the country in the north. To serve the hinterland in the Red River Delta in Vietnam and Yunnan province in China, the shortest and most economical way for cargo to be transported from Hai Phong Port is by barge. The main ports in the Centre are those in Danang and Quy Nhon serving import and export demand in the region. The ports in the Centre serve both Centre Delta, the highland region of Vietnam and Lao PDR, which is a landlocked country. The import and export activities of Lao PDR are conducted through port gateways either in Thailand or Vietnam; in particular, large volumes of cargo are transited every year through the ports of Vung Ang and Da Nang in the Centre. Meanwhile, the ports in the South, especially those located in Ho Chi Minh city, Dong Nai and Ba Ria Vung Tau areas, are the main gateways for the region and the country as a whole. For example, based on the statistical data recorded in 2019 by Vietnam Seaports Association (VPA, n.d), the total container

throughput of ports in these areas was 11,362,649 TEUs which accounts for more than 72.8% percent of the VPA's total container port throughput. The primary ports in Ho Chi Minh city are Saigon Newport, Saigon Port, Ben Nghe Port, Vietnam International Container Terminals (VICT) and Saigon Premier Container Terminal (SPCT). These play a vital role as gateways for the Mekong Delta region in transiting cargo to and from Cambodia.

In terms of state administration, Vietnam's seaports (Figure 1.1) are divided into five groups according to the Prime Minister's Decision No. 1579/QD-TTg (Vietnam Government Information Gateway, 2021) regarding the revision of the master development plan for Vietnamese seaports during 2021-2030 with orientation to 2050, which is the latest revision at the time of this research. Group 1 consists the ports of Hai Phong, Quang Ninh, Thai Binh, Nam Dinh and Ninh Binh; Group 2 includethose of Tanh Hoa, Nghe An, Ha Tinh, Quang Binh, Quang and Thua Thien Hue; Group 3 includes ports of Da Nang, Quang Nam, Quang Ngai, Binh Dinh, Phu Yen, Khanh Hoa, Ninh Thuan and Binh Thuan; Group 4 consists of ports of Hochiminh City, Dong Nai, Ba Ria Vung Tau, Binh Duong and Long An; Group 5 includes those of Can Tho, Dong Thap, Tien Giang, Vinh Long, Ben Tre, An Giang, Hau Giang, Soc Trang, Tra Vinh, Ca Mau, Bac Lieu and Kien Giang (VINAMARINE, 2021a).

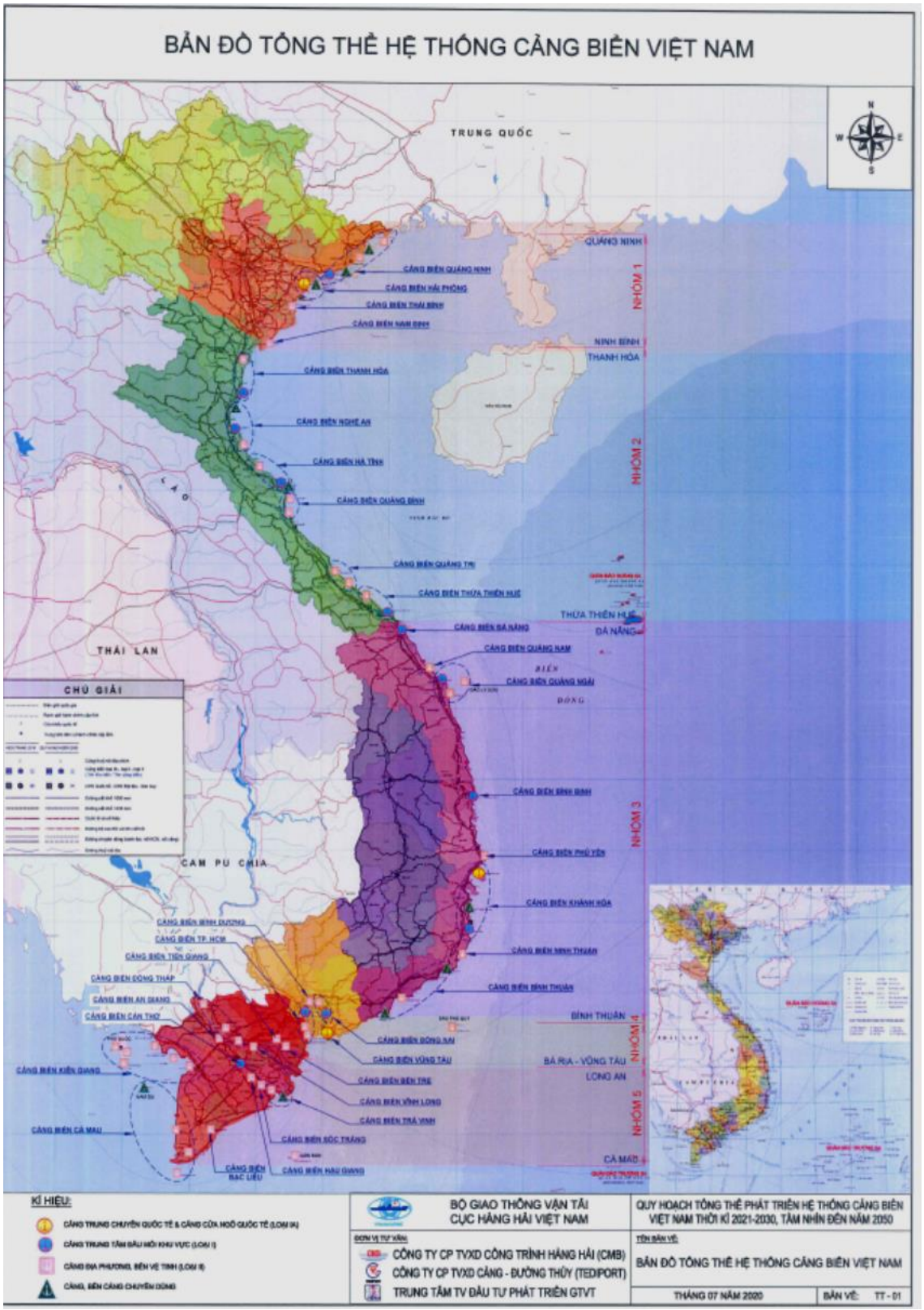


Figure 1.1- Current seaport system of Vietnam (Vinamarine, 2021a)

1.2.2. The dry port system in Vietnam

There are several definitions of a dry port in earlier research on the terminal facilities. This study adopts the definition proposed by Leveque and Roso (2002, p.8): "A dry port is an inland intermodal terminal directly connected to seaport(s) with high capacity transport mean(s), where customers can leave/pick up their standardised units as if directly to a seaport".

Dry ports in Vietnam are known as inland container depots or inland clearance depots (ICDs) and are equipped to handle and temporarily store full and empty containers. Although these facilities were constructed decades ago, they have only functioned as ICDs since the 1970s, when the container port system was developed. The network of ICDs has developed continuously since 2003 (Nguyen and Notteboom, 2016b).

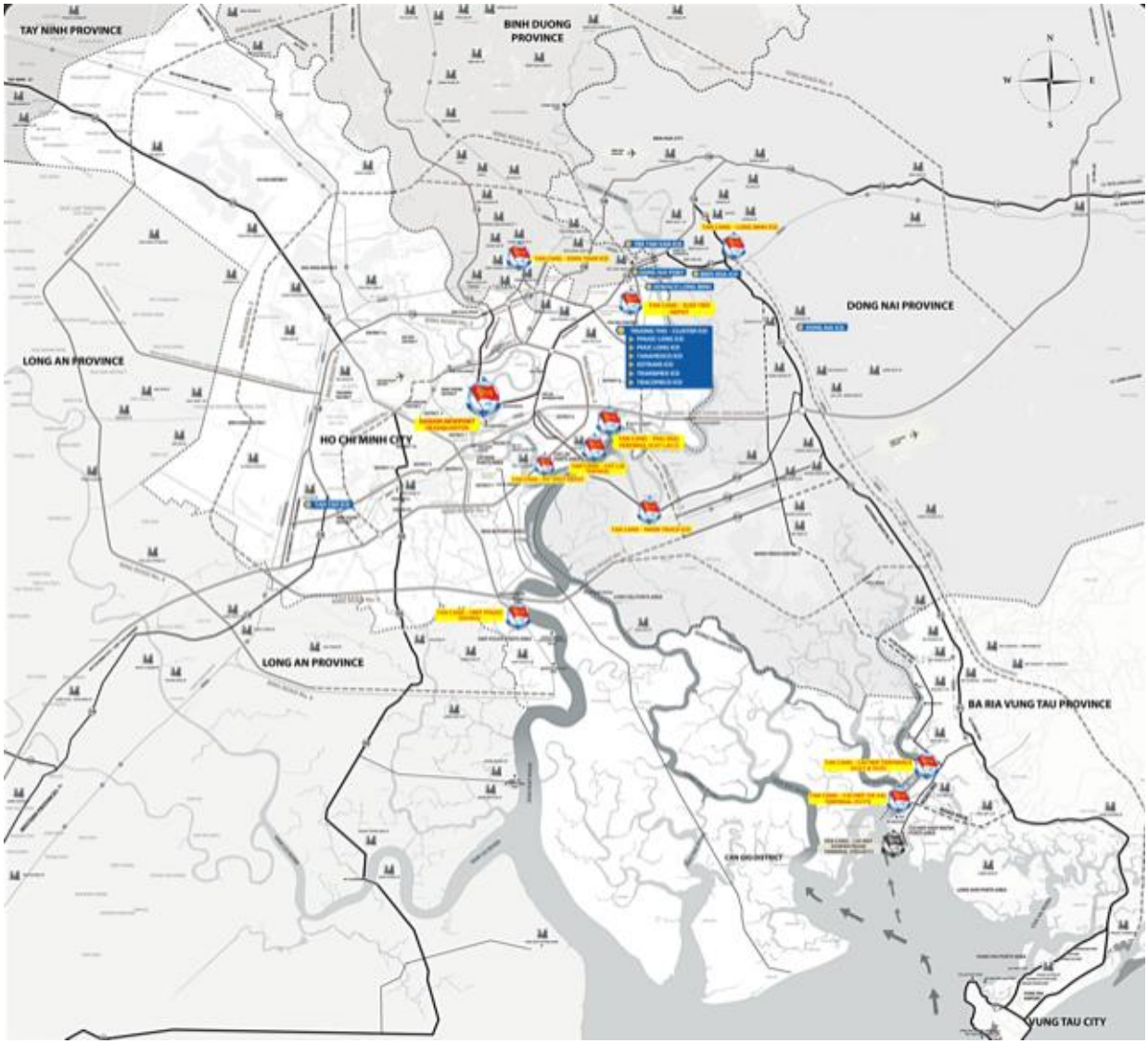


Figure 1.2- Inland container depot system in the south of Vietnam (Saigon New Port, 2021)

According to Banomyong, Thai and Yuen (2015), Vietnam has 17 ICDs, located mainly in the north and the south. There are eight ICDs in the north, which are connected with seaports in Hai Phong and the surrounding areas. The nine ICDs in the south are linked to the seaports of Ho Chi Minh City and Vung Tau, and seven of them are connected via domestic waterways. Generally, a shortage of effective connections between Vietnam's dry ports and low-cost transportation modes, such as railways or waterways, results in operational inefficiencies. Many ICDs in the north use road transport services and storage, as they lack direct links with sea, river and rail transport. Operations are more efficient in the south, where ICDs have helped

seaports to handle up to 80% of the national cargo throughput. However, some ICDs are located within cities, causing urban traffic congestion.

In order to meet the urgent demand of dry ports in Vietnam, in late 2011, the Government promulgated Decision No. 2223/QD-TTg to set strategic goals for the development of dry ports in Vietnam to 2020 with orientation to 2030. However, there is a backlog in the current dry port system. The spontaneous nature of its development, without overall planning, has led to diversity in the port–hinterland systems and in the relationships between dry ports and seaports (Nguyen and Notteboom, 2016a). It is in this context that the proposed research on DPSP-I will contribute to enriching the knowledge on dry port and seaport development in Vietnam, which is limited in the extant literature.

1.3. Research objectives

This research addresses the above-mentioned gaps in the existing literature and aims to examine the relationship between DPSP-I and seaport performance in the maritime supply chain and, in particular, the container port context. Specifically, the objectives of this research are as follows:

- To propose and validate a conceptual model of dry port–seaport integration and its effects on seaport performance;
- To examine the current status of dry port–seaport integration in Vietnam;
- To investigate how the dry port–seaport integration impact on container seaport performance in Vietnam; and
- To make recommendations to port managers regarding areas of improvement so as to enhance the impact of dry port–seaport integration on seaport performance and facilitate appropriate policy and strategy formulation.

1.4. Research questions

This study poses the following research questions and sub-questions, corresponding to the research objectives:

RQ1: What is the current status of dry port–seaport integration in Vietnam?

RQ2: How does dry port–seaport integration impact seaport performance in the context of Vietnam?

SRQ2.1: How does dry port–seaport integration impact seaport service quality in the context of Vietnam?

SRQ2.2: How does dry port–seaport integration impact seaport customer satisfaction in the context of Vietnam?

SRQ2.3: How does dry port–seaport integration impact seaport financial performance in the context of Vietnam?

1.5. Research methodology

The aim of the current study is to investigate the integration between dry ports and seaports and its impact on seaport performance in Vietnam. Therefore, the pragmatic paradigm, which supposes that there are many different ways to interpret the world and undertake research, that no single point of view can ever give the entire picture and that there may be multiple realities (Saunders, Lewis and Thornhill, 2019), is utilised. Instead of focusing on methods, researchers with a pragmatic worldview emphasise the problem and use all approaches available to understand it.

As there are few studies examining DPSP-I, further exploration is needed to enrich knowledge in this sector. An inductive approach is suitable for exploring research issues via a qualitative approach (Creswell and Poth, 2017). Explanatory research is also required to examine the relationship between DPSP-I and its effects on seaport performance, specifically in terms of service quality, customer satisfaction and financial performance. A deductive approach is thus necessary to address the research questions in this study and to understand the causes determining effects (Creswell, 2009). Consequently, a combination of qualitative and quantitative methods will be employed to collect data with which to answer the research questions and address the objectives. The research design of this study is illustrated in Figure 1.3.

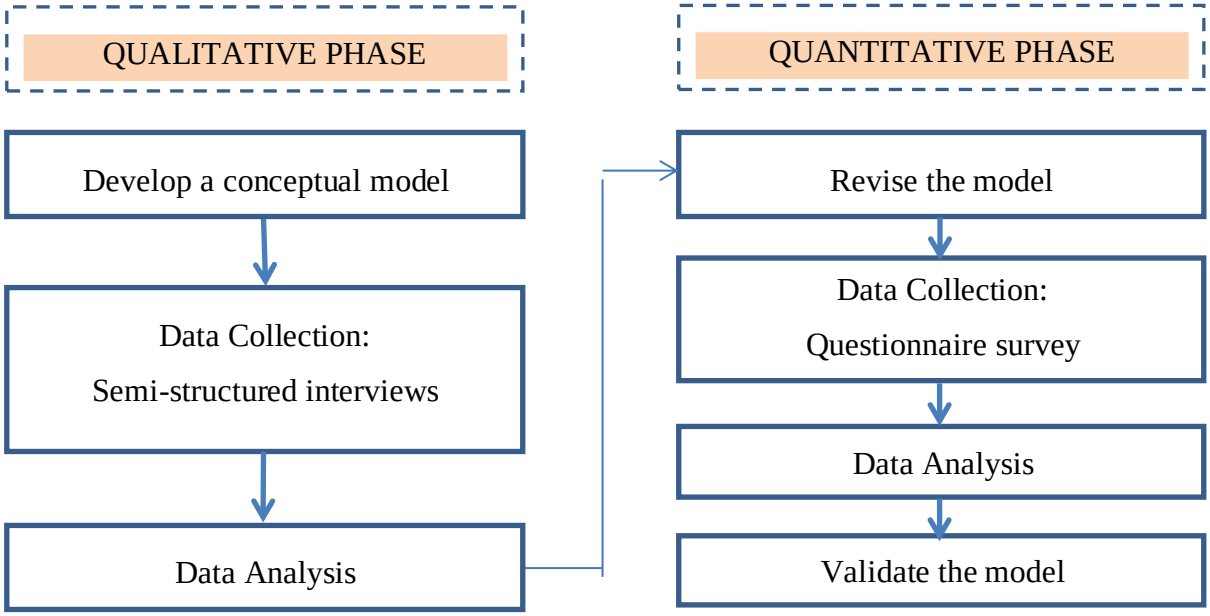


Figure 1.3-Research design

The first phase of this research aims to qualitatively validate the proposed conceptual model. The unit of analysis comprises seaport operators, dry port operators, shipping lines and logistics service providers. In the second phase of the study, which aims to examine the impact of DPSP-I on the operational and customer performance of seaports, the chosen unit of analysis is seaport operators.

In the qualitative phase, semi-structured interviews of 30 to 60 minutes were conducted face to face with interviewees with working experience as senior managers in the maritime sector; the interviews were recorded. Subsequently, they were transcribed and subjected to content and thematic analysis using NVivo 11 software. The initial findings, together with findings from the literature review, were used to revise the conceptual model.

Based on the revised conceptual model, a survey questionnaire was designed. It was pretested with academics at RMIT University to ensure clarity of language and check for syntax errors. Then, it was translated from English to Vietnamese and back from Vietnamese to English. The original and translated English versions were compared for consistency before the questionnaire was piloted with senior managers working in container ports in Vietnam. It was then distributed on Qualtrics and by mail to container ports in Vietnam via the VPA. To fit the complexity of the conceptual model, structural equation modelling (SEM), particularly partial least squares structural equation modelling (PLS-SEM), was applied as a comprehensive

technique to analyse the collected data to address all the research questions of the study. The latest version of the software packages utilised for statistical data analysis is the PLS-SEM SmartPLS 3.3. This study is more suited to the use of PLS-SEM than covariance-based SEM (CB-SEM) for three main reasons. First, in terms of the research objectives, the integration of dry ports and seaports needs to be explored, and PLS-SEM can be applied in exploratory and confirmatory research based on an insufficient theoretical base, while CB-SEM is useful strictly for confirmatory research based on a sufficient theoretical base (Hair, Babin and Krey, 2017). Second, in terms of model specifications, the model of this research includes both formative and reflective constructs; because CB-SEM is applicable only to reflective relationships, PLS-SEM has the advantage (Hair *et al.*, 2014). Last, the sample size of this study (under 100) makes it suitable for PLS-SEM (which requires a minimum sample size of 20); CB-SEM requires a large sample size (over 200) (Henseler, Ringle and Sinkovics, 2009). The research methodology and methods of data analysis are presented in more detail in Chapter 3.

1.6. Contribution and significance of the study

This study explores the current status of DPSP-I in Vietnam and its effect on seaport performance in terms of port service quality, customer satisfaction and financial performance. As few studies exist on the integration between dry ports and seaports, this research will make significant contributions to the body of knowledge in relation to the unique resources resulting from DPSP-I and its impact on seaport performance in the context of developing countries. Moreover, this study will practically support organisations to increase the quality and efficiency of port services by providing information on long-term goals and strategies as well as enhancing understanding of the relationships involved.

The findings of this study will help policymakers, port authorities and operators in Vietnam to devise policies and strategies to improve their ports' competitiveness through SCI. In particular, specific policies and strategies can be formulated to increase the level of information, operational and relationship integration; this will, in turn, enhance the performance of seaports in terms of port service quality, customer satisfaction and financial performance. Findings from this research will also provide a useful reference for ports in other countries with similar dry port development attributes in advancing the integration and performance of their seaport and dry port systems. Thus, this study will be relevant to academic researchers, research students and practitioners, as well as top managers in the maritime sector.

1.7. Organisation of the thesis

The thesis comprises seven chapters: (1) Introduction, (2) Literature review, (3) Research methodology, (4) Findings from interviews, (5) Findings from surveys, (6) Discussion and (7) Conclusion. The contents of each chapter are summarised as below. Figure 1.3 illustrates the structure of the thesis.

Chapter 1 provides an introduction to the research background, the context and a statement of the research problem, in which the rationale for conducting this study is presented. The research objectives and questions are listed to highlight the directions of the research. A brief introduction to the research methods, contributions and significance of the study are also presented in the first chapter, along with the organisation of the thesis.

Chapter 2 includes a thematic review of previous studies on SCI and firm performance, in general and in the port sector. It also provides critical analysis and discussion of the previous literature to identify the research gaps. The conceptual framework and hypotheses are then presented in the final section of Chapter 2.

Chapter 3 introduces the research paradigm and provides justifications for the research approach chosen. The issues involved in mixed methods, including research instrument development, semi-structured interview questions, questionnaire design, sampling design and survey administration, are logically presented. Then detailed guidelines are given for methods of data analysis, including six steps that facilitate the step-by-step reporting of the research findings presented in Chapters 4 and 5.

Chapters 4 and 5 report the results of the interviews and the main survey-based data, including descriptive statistics analysis, exploratory factor analysis, measurement models evaluation, structural model evaluation and mediating effects analysis.

Chapter 6 reviews the major findings and discusses them in accordance with the research objectives and questions outlined in Chapter 1. Finally, in Chapter 7, the research findings are discussed in relation to previous research to highlight the contribution of this study to theory and practice. The thesis concludes by highlighting achieved objectives, research limitations and recommended directions for further research.

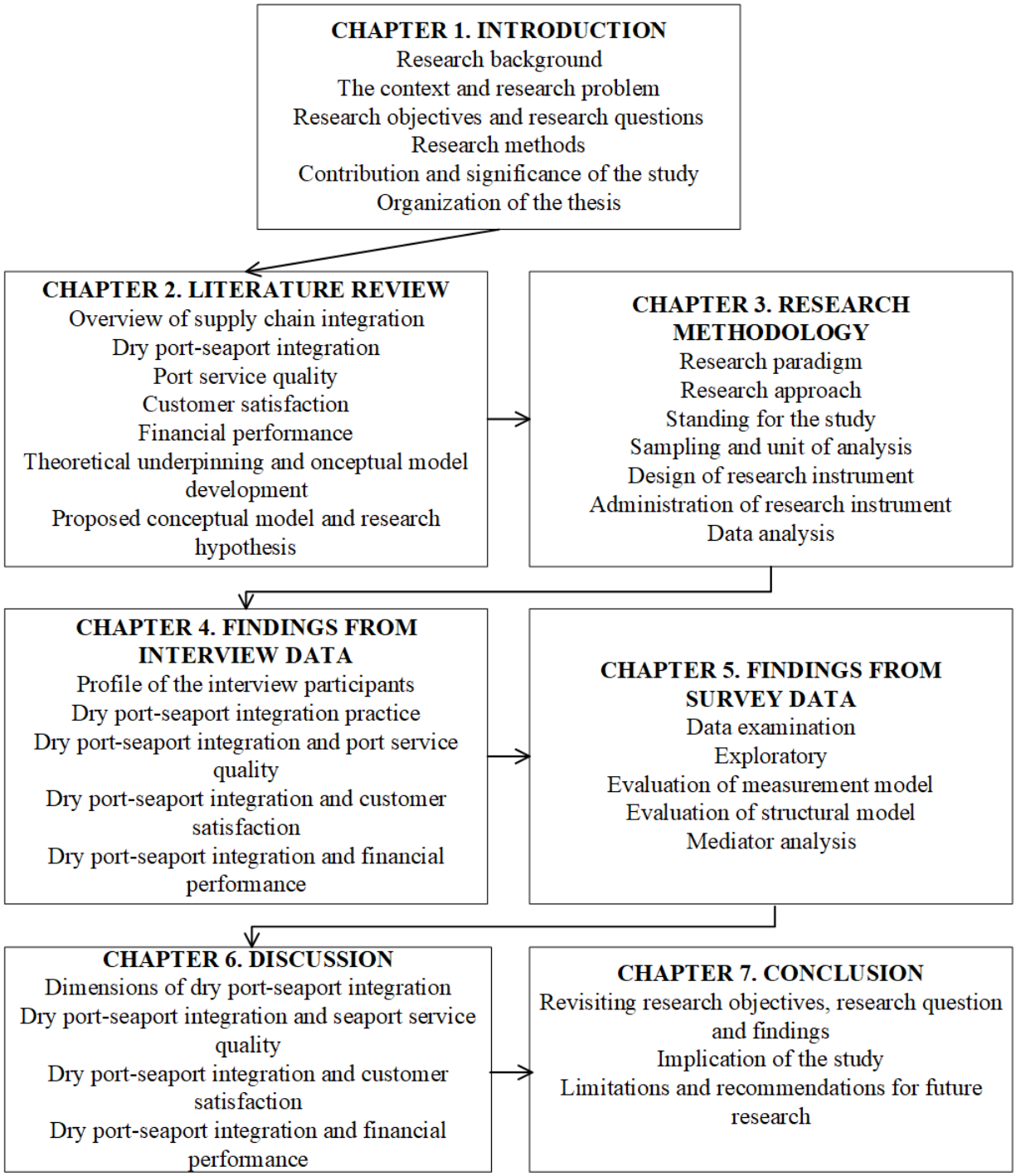


Figure 1.4- Structure of the thesis

Chapter 2. LITERATURE REVIEW

2.1. Introduction

This chapter, the literature review, provides a comprehensive understanding of how knowledge gaps in the literature were identified in relation to supply chain integration in general and dry port-seaport integration in particular, as well as introducing the theoretical foundations employed to develop conceptual frameworks and hypotheses in this study. It presents overviews of supply chain integration *(Section 2.2)*, supply chain integration in the maritime industry (Section 2.3), dry port-seaport integration (*Section 2.4*) and of the relationship between supply chain integration and port service quality (*Section 2.5*), customer satisfaction (*Sections 2.6*) and financial performance (*Section 2.7*). In addition, the theoretical underpinning and development of the conceptual model is presented in *Section 2.8*. *Section 2.9* describes the proposed conceptual model, and *Section 2.10* gives the research hypotheses. Section 2.10 is the conclusion.

2.2. Supply chain Integration

Recent years have seen an increase in research on dry ports within the maritime sector; however, scholars have focused on the definition of a dry port (Roso, Woxenius and Lumsden, 2009) and its roles (Cronje, Krugell and Matthee, 2009; Roso, 2013), functions and operation modes (Jaržemskis and Vasiliauskas, 2007; Nguyen and Notteboom, 2016a). Studies investigating the integrated relationship between dry ports and seaports are relatively few in number. Jeevan and Roso (2019) studied the relationship in which dry ports play a supporting role in enhancing seaports to meet the increase of vessel size; however, this study is the first exploring the unique resources resulting from DPSP-I (in which dry ports are supposed to be key partners of seaports) and how these resources impact seaport performance in terms of port service quality, customer satisfaction and financial performance.

Although there is scant literature on the relationship between dry ports and seaports, these are critical nodes of the maritime supply chain. As research on SCI has a decades-long history in a variety of areas, the study of the integration between dry ports and seaports is placed within the supply chain context. Therefore, the literature, including that related to SCI, the supply chain in the port sector and DPSP-I, is reviewed before a conceptual model and hypotheses concerning the effect of this integration on seaport performance are proposed.

2.2.1. Definition of supply chain integration

Supply chain integration has been studied for decades, with researchers focusing on supply chain relationships and examining the collaborative relationships between manufacturers or service providers and either their customers or suppliers, or both (Paulraj, Lado and Chen, 2008; Huo, 2012; Kim, 2013; Tseng and Po-Hsing, 2015; Yuen and Thai, 2017). While some prioritise the relationships between manufacturers and supply chain partners, others focus on managing the supply chain as a single system, rather than attempting to individually optimise fragmented subsystems (Bask *et al.*, 2014). While some define SCI as integrated flows of materials and parts, others focus more on flows of information, resources and cash (Zhang, Vonderembse and Lim, 2006; Tseng and Po-Hsing, 2015). Again, SCI is defined by some as a formalised process of partnership or collaboration (Cao *et al.*, 2010), while others view SCI as a set of practices that involve shared resources and shared information across internal departments and external organisations (Swink, Narasimhan and Wang, 2007). Although these descriptions touch on many of the critical elements of SCI, they are broad in focus, and the strategic nature of SCI seems not to have been addressed.

Building upon the existing literature, Flynn, Huo and Zhao (2010) propose SCI as a construct including integration between various functional business units within a manufacturer (internal integration) and extending in both upstream and downstream directions (supplier and customer integration). The term "integration" is defined as "the unified control of a number of successive or similar economic or especially industrial processes formerly carried on independently" (Webster, cited in Flynn, Huo and Zhao 2010, p 59). The term is applied in the supply chain context to define SCI as the degree to which a manufacturer strategically collaborates with its partners in supply chain and collaboratively manages intra- and inter-organisation processes. Thanks to SCI, the effective and efficient flows of products and services, information, money and decisions, to provide maximum value to the customer at low cost and high speed, is achievable (Flynn, Huo and Zhao, 2010). There are several vital elements in this definition. First, strategic collaboration which is an ongoing partnership is essential in order to achieve mutually strategic benefit. It engenders mutual trust, increases contract duration and encourages efficient conflict resolution and sharing of information, rewards and risks (Zhou and Benton Jr, 2007; Wakolbinger and Cruz, 2011). Strategic collaboration leads to not only operational but also strategic benefits while operational collaboration provides operational benefits (Sanders, 2008). Second, this definition also emphasises intra- and inter-organisation

processes, since SCI is comprehensive and encompasses a variety of activities, including many that are focused on materials, transportation and administrative tasks (Liao, Hu and Ding, 2017). Finally, SCI emphasises the customer-facing nature of the partnership, stating that its primary objective is to provide maximum value for the customer (Yu *et al.*, 2013).

2.2.2. Dimensions of supply chain integration

Although SCI has been studied intensively in the literature in recent decades, the definition and measurement of this concept vary. Focusing on the SCI framework, Alfalla-luque, Medina-Lopez and Dey (2013) conclude, after reviewing 36 journal articles, that there is a lack of clear definitions and understanding of the concept of SCI, and that a great variety of dimensions and variables and a broad spectrum of scales have been used for measuring it. Jorge and Jerónimo (2016), who reviewed 72 relevant studies, came to a similar conclusion – that there is a lack of consensus in measuring SCI, either as a unidimensional or multidimensional construct, or even as a set of practices that are used to evaluate the integration of a supply chain.

These differences in measuring SCI may be illustrated through a number of studies. For example, Rosenzweig, Roth and Dean (2003) used a five-point categorical scale (from 'none' to medium and high levels) to measure SCI through the responses to a question asking about: (a) integration within the organisation (e.g. cross-functional management), (b) integration with raw material suppliers, (c) integration with distributors/retailers, and (d) integration with customers. This form of question raises an issue of methodology, as different participants may have different perceptions of integration. Many other researchers, like Lii and Kuo (2016), have used sets of indirect questions relating to two main categories, internal and external integration, while yet others have focused on particular content – for example, Gu, Jitpaipoon and Yang (2017) focused on information integration.

A comprehensive review of the literature of the last two decades shows that there are three main groups of studies. The first measures SCI using geographical dimensions, i.e. internal and external (supplier and customer) integration. The second group uses the content of integration as the dimensions: information integration, resource integration, operational integration, etc. Such differences may be seen in a review by Alfalla-luque, Medina-Lopez and Dey (2013). In this paper, the authors propose a framework for evaluating SCI using three dimensions – information integration, coordination and resource sharing and organisational relationship linkage – each of which has three sub-criteria, i.e. with customers, internal and with suppliers.

Taking another approach, Cao *et al.* (2010) viewed SCI as the collaboration between different actors participating in the supply chain and conceptualise supply chain collaboration according to seven interconnecting elements: (i) information sharing, (ii) goal congruence, (iii) decision synchronisation, (iv) incentive alignment, (v) resource sharing, (vi) collaborative communication, and (vii) joint knowledge creation. Although these elements (or dimensions) are defined in the study, it should be realised that clear differentiation between them may be difficult to achieve; for example, between information sharing and collaborative communication.

It may be seen through reviews of SCI measurement (Alfalla-luque, Medina-Lopez and Dey, 2013; Jorge and Jerónimo, 2017) and the studies reviewed in Table 2.1 that many differences exist between these studies in terms of SCI definitions and measurement criteria. A possible reason for this is that SCI is much more complicated than these studies assume it to be; the current study therefore argues that SCI measurement should be individually characterised and contextualised for each specific sector of the supply chain. It is essential to develop an instrument to measure SCI for the maritime supply chain in any research relating to these issues within this sector.

The literature review also throws up a concern about the evaluators of SCI in previous studies. In most of the studies reviewed, the participants selected to evaluate SCI are manufacturers. In other words, in these studies, the researchers focused only on the focal firms of the supply chain. The lack of supplier and customer voices make the evaluation of SCI in these studies unilateral as it is self-reported rather than evidenced from triangulated data. The participation of different stakeholder groups as evaluators of SCI will enhance the quality of a study. For example, incorporating other players of the maritime supply chain, like shipping lines, freight forwarders and shippers, in assessing SCI between dry ports and seaports could strengthen research findings.

2.3. Supply chain integration in the maritime industry

As the maritime supply chain has a critical role in facilitating international trade and globalisation, thanks to its large volume shipments over long distances at low costs, research on the effective performance of the maritime supply chain in general, and the efficiency of shipping lines in particular, has been undertaken by scholars for decades past. As is well established, a container shipping firm has to maintain an abundance of good relationships with

both suppliers and customers to achieve good performance (Thai and Jie, 2018); integration is a central tenet of maritime logistics, particularly in transportation modes and between partners along the global supply chain (Panayides, 2006). In recent years, shipping companies have integrated both horizontally (through mergers, acquisitions and strategic alliances) and vertically (through operating dedicated terminals and by providing integrated logistics and intermodal services) (Panayides and Cullinane, 2002; Notteboom, 2004; Agarwal and Ergun, 2010; Gao and Yoshida, 2013; Divyaranjani, 2018).

Studies on the integration between ports, as nodes in the maritime supply chain, have been slower to attract interest and are still few in number, meaning that SCI in maritime logistics is similarly under-studied (Panayides and Song, 2009; Woo, Pettit and Beresford, 2013; Seo, Dinwoodie and Roe, 2015; Kurtuluş and Çetın, 2016). It is noticeable through reviewing the literature that, as in other sectors, SCI in the maritime sector has been constructed and measured in diverse ways, and a consensus on the parameters, items, components or criteria with which to measure integration between a port or terminal and other counterparts or port users is lacking.

For example, recognising that empirical work on the integration of ports or terminals in supply chains was limited, Panayides and Song (2009) proposed a model of SCI measurement including four parameters: (i) information and communication systems, (ii) value-added services, (iii) multimodal systems and operations, and (iv) SCI practices. In order to validate this model, they developed a questionnaire consisting of 19 indirect questions relating to these four parameters and distributed this questionnaire to 440 employees of container terminals in Europe and the Asia-Pacific region.

In a later study by Woo, Pettit and Beresford (2013), Panayides and Song's (2009) model was revised to include five components measuring port SCI: (i) information and communication systems, (ii) long-term relationships, (iii) value-added logistics services, (iv) intermodal transport services, and (v) SCI practices. Port SCI was then evaluated by the responses of ports, shipping companies and freight forwarders to a questionnaire relating to these five components. In a more recent study by Kurtuluş and Çetın (2016), the model of Panayides and Song (2009) was again developed, here into a model comprising four components to measure container terminal SCI: (i) relationship with terminal users, (ii) information and communication systems, (iii) value-added services, and (iv) multimodal systems and operations. The participants of this study were employees responsible for port and/or terminal operations at liner agencies,

shipping lines, freight forwarders, logistics service providers and other container terminal user companies.

Meanwhile, Seo, Dinwoodie and Roe (2015, p. 292) also found through their literature review that 'few valid and reliable instruments are available to measure accurately and objectively the multiple dimensions of supply chain collaboration in maritime logistics contexts'. With an assumption that supply chain collaboration more aptly captures joint relationships in the maritime industry than SCI, they constructed a supply chain collaboration model in container logistics including five components focusing on the relationship between ports and port users: (i) information sharing, (ii) knowledge creation, (iii) goal similarity, (iv) decision harmonisation, and (v) joint supply chain performance measurement. The participants in this study were not only terminal operators but also shipping lines, inland transport companies, freight forwarders, ship management companies and third-party logistics providers.

The lack of consistency in the literature can be illustrated through a number of studies from the last ten years relating to SCI in maritime logistics (summarised in Table 2.1).

Table 2.1- Supply chain integration measurement in the maritime industry (last ten years)

Dimensions of SCI	***Participants***	***Dimensions of performance***	***References***
Decision harmonisation	Container logistics	Value-added service, efficient operations, reliability.	Panayides and Song (2009); Heaver (2011); Seo, Dinwoodie and Roe (2015)
Goal similarity	Container logistics	Value-added service, efficient operations, reliability.	Carbone and Gouvernal (2007); Vitsounis and Pallis (2012); Seo, Dinwoodie and Roe (2015)
Information and communication systems	Shipping companies and freight forwarders; terminals; container terminals	Port performance: service quality; customer orientation; service price; terminal SCI	Song and Panayides (2008); Panayides and Song (2009; Wu, Choi and Rungtusanatham (2010); Heaver (2011); Seo, Dinwoodie and Roe (2015)
Intermodal transport services	Shipping companies and freight forwarders	Port performance: service quality; customer orientation; service price	Song and Panayides (2008); Wu, Choi and Rungtusanatham (2010)
Joint supply chain performance measurement	Container logistics	Value-added service, efficient operations, reliability.	Heaver (2011); Seo, Dinwoodie and Roe (2015)
Knowledge creation	Container logistics	Value-added service, efficient operations, reliability.	Song and Lee (2012); Panayides and Song (2013); Seo, Dinwoodie and Roe (2015)
Long-term relationships	Shipping companies and freight forwarders	Port performance: service quality; customer orientation; service price	Song and Panayides (2008); Wu, Choi and Rungtusanatham (2010)
Multimodal systems and operations	Container terminals	Costs and cost allocation, revenue generation, productivity, performance	Panayides and Song (2009)
SCI practices	Terminals	Terminal SCI	Song and Panayides (2008)
SCI practices	Shipping companies and freight forwarders	Port performance: service quality; customer orientation; service price	Song and Panayides (2008); Wu, Choi and Rungtusanatham (2010)
Value-added services	Shipping companies and freight forwarders; terminals	Port performance: service quality; customer orientation; service price; costs and cost allocation, revenue generation, productivity, performance Terminal SCI	Song and Panayides (2008); Panayides and Song (2009); Wu, Choi and Rungtusanatham (2010)

It is apparent through reviewing studies relating to port SCI in maritime logistics that, as in other sectors, research in this sector is currently somewhat divergent in terms of SCI model building and measurement, as well as participant groups. However, in comparison with other areas, the measurements of port SCI in maritime logistics are more specific, with participants (e.g. shipping companies, logistic companies and freight forwarders) who are not only port operators but also users of ports/container terminals.

2.4. Research into dry port - seaport integration

Following certain prior definitions of dry/inland ports, such as those by Jaržemskis and Vasiliauskas (2007); Roso, Woxenius and Lumsden (2009); Lättilä, Henttu and Hilmola (2013); Bask *et al.* (2014); Awad-Núñez *et al.* (2016); Roso, Russell and Rhoades (2019) and Varese, Marigo and Lombardi (2020), the term 'dry port' is understood in the current study as referring to an inland terminal where shippers can leave and/or collect standardised units (containers) and clear import in the current study export customs formalities for their shipments as at a seaport. A dry port may also provide various value-added services for cargo, such as stuffing/unstuffing, packaging and labelling.

In the context of the rapidly increasing volume of cargo transported through seaports, there is a growing need for dry ports to act as the extended gates of seaports (Roso, Woxenius and Lumsden, 2009; Veenstra, Zuidwijk and Van Asperen, 2012; Khaslavskaya and Roso, 2020) or as modern logistics centres, with customs declaration, inspection, quarantine and other port service functions, to reduce traffic congestion around city terminals, pollutant emissions and logistics costs (Wei and Sheng, 2017; Khaslavskaya and Roso, 2020). Some researchers go further to claim that what takes place inland will shape the future of containerised maritime transport (Notteboom and Rodrigue, 2009) or that 'seaports will revert back to being nodes for cargo handling and transhipment, and will lose their role as logistics nodes' (Veenstra, Zuidwijk and Van Asperen, 2012, p. 30). In this context, research into DPSP-I and its effects on seaport performance is necessary for the development of such dyads.

A review of the literature reveals that there is scant research into the integration or collaboration of dry ports and seaports. Using certain key words, i.e. 'supply chain integration', 'maritime logistics', 'seaport' and 'dry port' or 'inland terminal', most earlier studies have focused on container shipping integration and none relate to the integration of seaports and dry ports or inland terminals. In a study by Song and Panayides (2008), one of the parameters used to find

the relationship between the integration and competitiveness of a seaport was 'relationship with inland transport operators', with six questions answered by seaport operators. In another recent study, it was argued that that there is currently very little research on the model of the seaport–dry port dyad for the development of a dry port–seaport supply chain (Bask *et al.*, 2014; Jeevan and Roso, 2019). These researchers concluded that integration/collaboration could be driven from the inland terminal side, from the seaport side or from both and that mutual understanding and collaboration among the different actors involved in this supply chain will decide the level of development of a dry port–seaport dyad. However, they emphasised that measuring the collaboration between these ports and other actors involved in the relationship can be challenging.

There has been little research into DPSP-I or collaboration in the current context, and the literature is very divergent in terms of the definition and measurement of SCI. A conceptual model of DPSP-I is very necessary in order to examine the collaboration of these two nodes or players in the maritime logistics supply chain. Such a model may help to ease the difficulty in evaluating the integration of the dry port–seaport dyad and in studying the relationship between this integration and different factors of dry port and seaport performance.

2.5. Supply chain integration and port service quality

Although there is a growing body of evidence indicating that supply chain integration positively affects firm performance (Flynn, Huo and Zhao, 2010; Yuen and Thai, 2016), research on the direct impact of supply chain integration on quality is still scant. For example, several studies in the manufacturing sector investigated the impact between supply chain integration and quality; however, the findings do not agree. Rosenzweig, Roth and Dean (2003) found a significant and direct relationship between supply chain integration and product quality while the study by Koufteros, Vonderembse and Jayaram (2005) on the impact of customer integration, supplier product integration, and supplier process integration on quality showed a non-significant relationship. Prajogo and Olhager (2012) found a significant and direct relationship between supplier assessment as a component of SCI and quality performance, but a non-significant relationship between a strategic long-term relationship with suppliers and quality performance in their study. There is no previous research on the relationship carried in the service sector. This study; therefore, investigated the port service quality and the relationship between SCI and service quality in the context of maritime sector.

2.5.1. Port service quality

There has never been a universal definition of the concept of quality and its associated dimensions, either in a general context or in maritime transport (Thai, 2008); however, Table 2.2 shows that one of the most important aspects of evaluating a firm's performance is looking at its service quality in terms of how it meets customers' demands.

Numerous studies have been conducted to measure and improve service quality in business and thus to meet customer demand for higher service quality; however, such studies in the maritime industry sector are not only scant but also somewhat divergent (Yuen and Thai, 2016; Phan, Thai and Vu, 2020). For example, López and Poole (1998) used the three dimensions of 'efficiency', 'timeliness' and 'security' to measure port service quality, whereas Ha (2003) used seven dimensions to evaluate service quality factors at 15 major container ports: 'information availability of port-related activities', 'port location', 'port turnaround time', 'facilities available', 'port management', 'port costs' and 'customer convenience'. Authors including Ugboma, Ibe and Ogwude (2004) have stated that the SERVQUAL dimensions, developed by Parasuraman, Zeithaml and Berry (1985) for measuring service quality in general business, are suitable for measuring port service quality, while others, including Kim and Cho (2010), have developed tools for measuring port service quality using three dimensions: 'endogenous quality', 'exogenous quality' and 'relational quality'. The divergence in the research into measuring service quality suggests that such measurement should be developed and validated specifically for each individual sector.

In an attempt to specify a measurement of port service quality, Thai (2008) explored the concept of service quality in the maritime industry, developing and validating a resources–outcomes–process–management–image–social responsibility (ROPMIS) measurement model, which has been employed by a number of later studies, such as Yuen and Thai (2015) and Thai (2016). ROPMIS consists of six dimensions: 'resources', 'outcomes', 'processes', 'management', 'image' and 'social responsibility'. Phan, Thai and Vu (2020) propose a four-dimensional construct including outcomes-related PSQ, process-related PSQ, management-related PSQ and image-and-social-responsibility-related PSQ. These measurement models provide a holistic view of port service quality; however, in the area of meeting customer expectation, the most important dimension may be 'outcomes'. A description of the resources-related dimension as comprising equipment and facilities availability and condition, financial stability, shipment tracing capability and physical infrastructure focuses on the condition of the

port facility, with the assumption that this condition will, in all likelihood, shape port service quality. This argument leads to the question of whether port staff quality is another dimension of port service quality or whether it is a process(es)-related dimension equating to attitude, behaviour and customer understanding of staff (irrespective of staff professional knowledge and skills). Another issue of ROPMIS concerns the image and social responsibility dimensions – it is argued that the image and social responsibility of a port are cumulative as a result of the port's development over a very long period of time, and that image also depends much on social viewpoints and perceptions of quality. Therefore, if service quality is meeting or satisfying customers' requirements/expectations, the outcome dimension of ROPMIS should attract more focus than the other dimensions.

2.5.2. Supply chain integration and firm performance

In general, the relationship between SCI and firm performance has been found in the literature to be positive, with various theories existing, including the resource-based view (RBV), relational view (RV), knowledge-based view, social exchange theory, transaction cost economics (TCE), and information processing theory (Leuschner, Rogers and Charvet, 2013). For example, using TCE, some studies posit that SCI mechanisms such as investments in transaction-specific assets can lead to stable long-term relationships and high switching costs, which mitigate the threat of opportunism exhibited by supply chain partners (Won Lee, Kwon and Severance, 2007; Jorge and Jerónimo, 2017). The presence of transaction-specific assets, such as dedicated terminals, dedicated warehouses, joint ventures or any other pooled resources, ties supply chain partners in a long-term relationship that compels greater commitment and trust. This can subsequently reduce transaction costs associated with searching, negotiating and monitoring a product or service for every single transaction

The existing research also supports a positive relationship between external integration and firm performance (Ariadi *et al.*, 2020). A firm's performance in tasks such as research and development, marketing, procurement and logistics is influenced to a large extent by input from and collaboration with suppliers and customers. Information obtained from these external sources is essential for the coordination and performance of any given task (Lee, Padmanabhan and Wang, 1997). In the event of poor external integration, a focal firm is likely to receive inaccurate or distorted supply and demand information, which results in sub-optimal decisions and, eventually, poor firm performance (Lee, Padmanabhan and Whang, 2004; Ariadi *et al.*, 2020). In addition, external integration facilitates cooperation among supply chain partners and

the creation of cross-organisational problem-solving routines. These routines simplify business processes and resolve conflicting organisational goals, which improves firm performance. Finally, external integration allows supply chain partners to anticipate and coordinate their supply and demand, improving their flexibility, or responsiveness, to changing market conditions (Flynn, Huo and Zhao 2010). The ability to quickly adapt to changing market conditions improves both time-based and cost performances (Lee, Padmanabhan and Whang, 2004; Wong, Wong and Boon-itt, 2020). Yu *et al.* (2013) confirm by their data that supplier integration is significantly and positively related to firm financial performance.

In conclusion, the positive relationship of internal and external integration with firm performance has been addressed in the literature. Table 2.2 summarises the findings of a number of studies from the last ten years on the relationship between SCI and firm performance.

Table 2.2- The relationship between SCI and firm performance

Dimensions of SCI	***Participants***	***Dimensions of performance***	***Findings***	***References***
Black-box integration	Manufacturing firms	Product innovation (PI)	Black-box supplier integration → PI: non-significant relationship	Koufteros, Cheng and Lai (2007)
Collaborative communication (ClC)	Manufacturing firms	Collaborative advantage (CA), and firm performance (FiP)	SCI→CA; SCI→FiP: significant and direct relationships	Cao *et al.*(2010); Cao and Zhang (2011)
Corporate strategy integration (CSI)	Manufacturing firms	Competitive capabilities (CC) and business performance (BP)	CSI→CC: significant and direct relationship	Swink, Narasimhan and Wang (2007)
Cross-enterprise integration (CrI)	Manufacturing firms	Sourcing enterprise performance (SEP), buyer financial performance (BFP)	CrI→OP: significant and direct relationship	Handfield *et al.* (2009)
Customer integration (CI)	Manufacturing firms	Operational performance (OP), business performance (BP), financial performance (FP)	CI→OP; CI→BP; CI→FP: significant and direct relationships.	Flynn, Huo and Zhao (2010); Koufteros, Rawski and Rupak (2010); Danese and Romano (2011); Droge, Vickery and Jacobs (2012); Huo (2012); Huo *et al.* (2014); Zhao, Wang and Pal (2021)
External collaboration (EC)	Manufacturing firms	Business performance (BP), productivity (P), customer satisfaction (CS), operational performance (OP)	EC→P; EC→CS; EC→OP: significant and direct relationships	Allred *et al.* (2011) Danese, Romano and Formentini (2013)

Dimensions of SCI	*Participants*	*Dimensions of performance*	*Findings*	*References*
Firm-wide cross-functional integration (FWCI)	Manufacturing firms	Performance (Pf) – customer satisfaction, sales, competitive position, sales, net profit margin, return on assets.	FWCI→Pf: significant and direct relationship	Chen, Mattioda and Daugherty (2007)
SCI	Manufacturing firms	Firm performance (FiP); Collaborative advantage (CA) and firm performance (FiP)	SCI→FiP, SCI→CA; SCI→FiP: significant and direct relationship	Cao *et al.*(2010) Cao and Zhang (2011)
Grey-box integration	Manufacturing firms	Product innovation (PI)	Gray-box supplier integration → PI: significant and direct relationship	Koufteros, Cheng and Lai (2007)
Incentive alignment (IA)	Manufacturing firms	Collaborative advantage (CA) and firm performance (FiP)	SCI→CA; SCI→FiP: significant and direct relationships	Cao *et al.*(2010); Cao and Zhang (2011)
Information sharing (IS)	Manufacturing firms	Operational performance (OP); product performance (PP) and product modularity (PM); firm performance (FiP); collaborative advantage (CA)	SCI→OP; IS→PM; SCI→FiP; SCI→CA; SCI→FiP: significant and direct relationship	Villena, Gomez-Mejia and Revilla (2009); Cao *et al.*(2010); Lau, Yam and Tang (2010); Cao and Zhang (2011)
Information technology (IT)	Manufacturing firms	Operational performance (OP)	IT→OP: significant and direct relationship	Olhager and Prajogo (2012)
Joint knowledge creation (JKC)	Manufacturing firms	Collaborative advantage (CA) and firm performance (FiP)	SCI→FiP; SCI→FiP: significant and direct relationships	Cao *et al.*(2010); Cao and Zhang (2011)
Logistics integration (LI)	Manufacturing firms	Operational performance (OP); Quality (QP), delivery (DP), flexibility (FlP), and cost (CP)	LI→OP; LI→DP; LI→FlP; LI→CP: significant and direct relationships	Olhager and Prajogo (2012); Prajogo *et al.* (2012)

Dimensions of SCI	*Participants*	*Dimensions of performance*	*Findings*	*References*
Operational coordination (OC)	Manufacturing firms	Operational performance (OP) and strategic performance (SP); product-based service (PbS), customer action-based service (CaS), firm performance (FiP) product performance (PP), product modularity (PM)	OC→OP; OI→PbS; OI→CaS; OI→FiP; OC→PP: significant and direct relationship	Sanders (2008) He and Lai (2012)Lau, Yam and Tang (2010)
Product co-development (PD)	Manufacturing firms	Product performance (PP), product modularity (PM)	PD→PM: significant and direct relationships	Lau, Yam and Tang (2010)
Product-process technology integration (PPTI)	Manufacturing firms	Competitive capabilities (CC), business performance (BP)	PPTI → CC:significant and direct relationship	Swink, Narasimhan and Wang (2007)
Resource sharing (RS)	Manufacturing firms	Operational performance (OP), firm performance (FiP), collaborative advantage (CA),	SCI→OP; SCI→FiP; SC→OP; SC→SP: significant and direct relationships	Villena, Gomez-Mejia and Revilla (2009); Cao *et al.*(2010); Cao and Zhang (2011)
Strategic integration (SI)	Manufacturing firms	Operational performance (OP), strategic performance (StrP), product-based service (PbS), customer action-based service (CaS), firm performance (FiP)	SI→OP; SI→StrP; SI→PbS; SI→CaS; SI→FiP: significant and direct relationships	Sanders (2008); He and Lai (2012)
Strategic supplier integration (SSI)	Manufacturing firms	Quality (QP), delivery (DP), flexibility (FlP), cost (CP)	SA→QP: significant and direct relationship	Prajogo *et al.* (2012)
Supplier assessment (SA)	Manufacturing firms	Quality (QP), delivery (DP), flexibility (FiP), cost (CP)	SA→QP: significant and direct relationships	Prajogo *et al.* (2012)

Dimensions of SCI	*Participants*	*Dimensions of performance*	*Findings*	*References*
Supplier integration (SI)	Manufacturing firms and service firms Manufacturing plants	Sourcing enterprise performance (SEP), buyer financial performance (BFP), operational performance (OP), business performance (BP), efficiency, delivery performance (DP), support performance (SP), financial performance (FP)	SI→OP; SI→DP; SI→SP; SI→FP: significant and direct relationship	Devaraj et al. (2007); Handfield *et al.* (2009); Flynn, Huo and Zhao (2010); Danese and Romano (2011); Droge, Vickery and Jacobs (2012); Huo (2012); Huo *et al.* (2014)
Supplier process integration (SPsI)	Product development projects	Glitches, on-time execution, and market success	SPsI→on-time execution: significant and direct relationships	Koufteros, Rawski and Rupak (2010)
Supplier product integration (SPtI)	Product development projects	Glitches, on-time execution, and market success	SPtI→glitch: significant and direct relationship	Koufteros, Rawski and Rupak (2010)
Supply chain integration (SCI)	Manufacturing firms	Firm performance (FiP)	SCI→FiP: significant and direct relationship	Kim (2009)
Synchronisation	Manufacturing firms	Firm performance (FiP), collaborative advantage (CA), firm performance (FiP)	SCI→FiP; SCI→CA; SCI→FiP: significant and direct relationships	Cao *et al.*(2010); Cao and Zhang (2011)

2.5.3. Supply chain integration and port service quality

Although research into the relationship between SCI and firm performance is extensive, such research in the sector of maritime logistics remains scant. In a study relating to this issue, Cheng and Choy (2013) found a positive relationship between quality management practice and organisational performance in the shipping industry. In another study, Yuen and Thai (2017a) found in the literature that integration with ports and freight forwarders brings shipping firms closer to their customers and improves the overall quality of logistics services. Although there has been little research into the special relationship between SCI and port service quality, the findings in other sectors suggest a certain relationship between DPSP-I and the performance of each port.

2.6. Supply chain integration and customer satisfaction

In the literature, relationship between SCI and firm performance in terms of customer satisfaction are referred in few studies. For example, the studies of Allred *et al.* (2011) and Yu *et al.* (2013) which argue that customer integration allows the customer to contribute to the mutual knowledge created by the shared information and therefore, it enhances supply chain ability to satisfy customer expectations because information shared along the supply chain increases the probability of a common understanding among the parties. Hence, a customer's expectations are kept consistent with the supply chain's ability to meet the customer's need; met expectations being correlated with satisfied customers. However, research on the relationship between SCI and customer satisfaction is scant; particularly, in the context of maritime sector. The relationship in this study, therefore, is investigated based on the findings in other sectors.

2.6.1. Customer Satisfaction

Customer satisfaction is the result of customers' perception of the value received in a transaction or a relationship, and it can be seen as the customer response pertaining to a particular focus or at a particular time (Jahanshani *et al.*, 2014). According to Olsen and Johnson (2003, p. 3) there are two types of customer satisfaction: (i) transaction-specific satisfaction, defined 'as a customer's evaluation of his or her experience with and reactions to a particular product transaction, episode, or service encounter', and (ii) cumulative satisfaction, defined 'as a customer's overall evaluation of a product or service provider to date'. In

alignment with many studies in the literature, herein we use cumulative satisfaction because this definition is a more fundamental conceptualisation of the past, current and future performance of a supply chain (Yu *et al.*, 2013). The customer is the main driving force and the king of the market, and, therefore, a high level of customer satisfaction is regarded as a key element for the success of a business (Gupta and Singh, 2015). This is the reason why customer satisfaction has been intensively studied in the literature.

2.6.2. Supply chain integration and customer satisfaction in the port sector

In the transport industry, a number of studies have focused on finding the relationship between customer satisfaction and other factors pertaining to supply chains. For example, timeliness, charges, cargo safety and security, complaints, information, order acceptance, cargo taken and cargo delivery were used as criteria to evaluate customer satisfaction in a door-to-door rail transport service (Tang and Sun, 2015).

In another study, in order to find the relationship between port service quality and customer satisfaction, Thai (2016) used five measurement items to evaluate cumulative customer satisfaction with port services: infrastructure, management and employees, service quality, continuation of service use and recommendation of service to other partners. Meanwhile, Yu *et al.* (2013) found that customer integration in manufacturing firms has a positive effect on customer satisfaction; however, this study is not in the port industry sector. In that study, three items were used to investigate manufacturers' self-evaluation of their customers' satisfaction: (i) overall customer satisfaction levels increased, (ii) after-sales service satisfaction levels increased, and (iii) customers stated expectations were exceeded. Because the survey data were collected only from manufacturers, the study called for further research to validate the results and broaden related knowledge by collecting data from a variety of other supply chain partners.

Although customer satisfaction has been intensively studied and is well defined and measured in the literature, research on factors in the relationship between customer satisfaction and the supply chain is still limited, especially on those factors between SCI and customer satisfaction in the dry port–seaport maritime supply chain.

Since customer satisfaction is one of the most crucial factors deciding the existence of any business, the studies of Allred *et al.* (2011) and Yu *et al.* (2013) argue that customer integration allows the customer to contribute to the mutual knowledge created by shared information and, therefore, enhances the ability of the supply chain to satisfy customer expectations. However,

there are few studies investigating the relationship between SCI and firm performance in the maritime sector. The lack of understanding of the link between dry port–seaport SCI and customer satisfaction may result in a lack of effort and commitment in enhancing integration in this supply chain. Research exploring this link and the participation in it of voices from different partners in this type of supply chain may provide greater understanding.

2.6.3. Service quality and customer satisfaction

Research has found that customer satisfaction is positively related to the quality of products or services provided to the customer – that is, the level of customer satisfaction increases along with the level of positive product (or service quality) experience the customer has. Many prior studies have examined the relationship between service quality and customer satisfaction in many service sectors and have confirmed this positive relationship (see, for example, Santouridis and Trivellas, 2010; Liao, 2012). In the transport sector, a small number of studies have researched the relationship between service quality and customer satisfaction in aviation (Anderson, Baggett and Widener, 2009) and high-speed trains (Cao and Chen, 2011); these have found that the relationship is positive and significant. Other researchers have expanded the discussion of service quality and customer satisfaction to include other marketing variables. Chen and Hu (2013) found that service quality has positive effects on relational benefit and customer loyalty in the airline industry; while relational benefit influences customer loyalty directly, service quality also affects customer loyalty through customer relational benefits. Most recently, in the hotel and hospitality sector, Nunkoo *et al.* (2020) and Ali *et al.* (2021), have also found that service quality significantly influences customer satisfaction. These results are in line with the study conducted on travel agencies by Setó-Pamies (2012), which revealed that loyalty depends on the customer's degree of satisfaction and trust, and that satisfaction is, in turn, influenced by service quality. Elsewhere, satisfaction can be either a factor mediating the indirect relatedness of service quality to customers' behavioural intentions (Rajic and Dado, 2013) or an outcome of service quality via relationship quality (Chang *et al*., 2012).

Due to the limited availability of studies in the port industry, more recently Thai (2016) and Chang and Thai (2016) used the ROPMIS model for measuring port service quality. They used four criteria – satisfaction with port facilities, management and employees; satisfaction with port service quality; intention to recommend port services; and intention to continue using port services – to measure customer satisfaction. Both studies found that port service quality has a direct and positive impact on both customer satisfaction and customer loyalty.

2.7. Supply chain integration and financial performance

There has been a growing interest concerning the strategic importance of integrating suppliers, manufacturers, and customers. In the consideration of relationship between SCI and pure financial performance, there are few studies carried out, for example, Yu *et al*. (2013), Beheshti *et al*. (2014) found that the integration between supply chain members significantly affected financial performance. Further, other researchers have found that customer and supplier integration improve service performance (Droge, Vickery and Jacobs, 2012); Van Der Vaart and Van Donk, 2008), responsiveness (Droge, Jayaram and Vickery, 2004); Flynn, Huo and Zhao, 2010) flexibility (Wong, Lai and Cheng, 2014), sales and market growth (Droge, Jayaram and Vickery, 2004; Kim, 2009), and cost (Van Der Vaart and Van Donk (2008). However, not all studies find a direct performance relationship. For example, Vickery *et al.* (2003), Yu *et al*. (2013) found that customer service fully mediates the relationship. between integration and financial performance. Additionally, many studies use a mix of market and financial performance as the dependent variable and label it business performance or something similar (e.g. Flynn, Huo and Zhao, 2010). This study investigates the overview of port financial performance and the impact of SCI on financial performance in the maritime context.

2.7.1. Port financial performance

Due to its crucial role in administration, firm performance has been studied extensively in the literature, as reviewed by Taouab and Issor (2019). According to these authors, firm performance can be viewed from many different perspectives across a range of disciplines, and that has caused a proliferation of approaches to the development of firm performance measures. Different groups of managers (e.g. from accounting, marketing, human resource and corporate strategy divisions) are likely to develop different sets of firm performance measures; these can be divided mainly into financial performance and non-financial performance measures. While profit-based measures are widely used to provide financial data and advice to a company in the areas of management and administration, non-profit-based measures are extremely useful in strategic decision-making for long-term goals (Chenhall and Langfield-Smith, 2007). In other studies, non-financial performance can be divided into a variety of subcategories; for example, non-financial performance has been divided into operational and strategic performance (Fabbe-Costes and Jahre, 2008) and into operational, relational and strategic performance (Chang *et al.*, 2016).

Although non-financial performance is very important, firm financial performance indicators are the bottom-line concern for all firms (Chang *et al.*, 2016). Taking this point of view, Chang *et al.* (2016. p. 284) define financial performance as 'the improvement of economic goals based on revenue minus cost-based measures such as profitability, return-on-investment, and return-on-sales'. Studying the relationship between SCI and financial performance, they found that SCI enhances firm financial performance, and they encourage firm managers to evaluate and invest in SCI improvement more confidently.

Similarly, in the context of maritime transport, different perspectives lead to different port performance indicators. In reviewing the literature on port performance taking the perspectives of different port stakeholders, Ha, Yang and Lam (2019) found that to reconcile the conflicts of internal and external port stakeholders is difficult. The presence of three groups of port stakeholders – port operators, port users and port administrators – with hundreds of port performance indicators, insufficiently developed from some perspectives, (Ha *et al.*, 2017; Rezaei *et al.*, 2019) make port performance even more complicated.

A port can be seen as a part, or node, of a variety of transport chains, and to evaluate a port's performance by all indicators from all perspectives is an unrealistic ambition. To take the view of container terminal operators, this study focuses on financial performance: measures related to cost efficiency in container terminals are of fundamental significance to terminal operators (Ha, Yang and Lam, 2019). As suggested by Chang *et al.* (2016), the three performance indicators of revenue, service cost and profit are used by this study to evaluate the financial performance of seaports.

2.7.2. Supply chain integration and port financial performance

In the maritime sector, there have not been found a study illustrating the relationship between supply chain integration on financial performance; hence, this relationship will be investigated based on the findings from other sectors. As foresaid in section 2.7, there are conflicting results in the literature, ranging from industry to industry, with much of the research on this relationship conducted in the manufacturing area. In particular, while Rosenzweig, Roth and Dean (2003) found that SCI has significant direct effects on revenue, sales growth and ROA, Vickery *et al.* (2003) found a non-significant relationship between SCI and financial performance. Later, Droge, Jayaram and Vickery (2004) found that internal integration and the interaction of internal and external integration have a significant direct impact on financial

performance. Prajogo and Olhager (2012) found a significant relationship between logistics integration and cost performance. Similar findings are seen in the studies of Huo (2012) and Beheshti *et al.* (2014), which show that internal integration and SCI have a significant direct impact on financial performance. In contrast, in the same study, Huo (2012) concluded that customer integration had a non-significant relationship with financial performance. Yu *et al.* (2013) show that the relationship is fully mediated by customer satisfaction. Vickery *et al.* (2003) found that customer service fully mediates the relationship between integration and financial performance.

2.7.3. Customer satisfaction and port financial performance

A number of studies have found a positive relationship between customer satisfaction and financial performance (Yu *et al.*, 2013; Hairuzzaman, 2019). This study argues that customer satisfaction, as the proof that customers' wants and needs have been understood, increases customer loyalty, which, in turn, helps a firm to ensure a steady stream of future customers and cash flow. Conducting research into this relationship in the manufacturing sector in China, Yu *et al.* (2013) used a survey questionnaire in which customer satisfaction was evaluated by overall customer satisfaction, after-sales service satisfaction and customer expectation, and financial satisfaction was evaluated by growth in sales, growth in profit, growth in market share and return on investment. The study found a mediating effect of customer satisfaction on the relationship between customer integration and financial performance. Although there has not been much research into this relationship in the sector of maritime logistics, the findings of Yu *et al.* (2013) and Hairuzzaman (2019) suggest that the same relationship may exist between port user satisfaction and port financial performance.

2.8. Theoretical underpinning and conceptual model development

The diversity in the literature reviewed reflects the multifaceted nature of SCI (Barringer and Harrison, 2000), including that of integration between a dry port and a seaport. This study examines SCI from the lenses of two theories: transaction cost economics and relational view. These theories provide insights into the nature, forms, and contents of SCI. Supply chain integration can also be examined in the light of the transaction cost economics (TCE) theory, which explains that hierarchies and markets are two ways to organise firms' activities (Williamson, 1975). The decision of whether to use vertical integration/hierarchies or market mechanisms depends on the monitoring costs that arise from bounded rationality and from

uncertainties due to partners' self-interest and opportunism (Kaufman, Wood and Theyel, 2000). Through process integration and mutual trust, SCI helps firms reduce the costs of opportunism and monitoring that are inherent in market transactions, thus increasing the probability that partners behave in the best interest of the partnership (Kaufman, Wood and Theyel, 2000). It also helps firms avoid internalising an activity that may not be aligned with their competencies (Harrigan, 1988).

While TCE helps partners in a supply chain efficiently monitor the costs arising from their mutual transactions, RV theory can be used to understand a relationship between two or more supply chain partners. The relational view theory was first articulated by Dyer and Singh (1998) to suggest that idiosyncratic inter-organisational linkages can result in sustained competitive advantage. The relational view provides insight into how a firm develops value-creating linkages with other firms to achieve high profit returns. The RV can be seen as a complement of the resource-based view (RBV). Thus, while the unit of analysis in RBV is focused on the resources or capabilities of a firm, in the RV, the unit of analysis is the relationship between firms. Supply chain integration can be considered as one of intangible resources of an organisation or firm. In that respect, RBV theory argues that variance in firm performance can be explained by strategic resources, such as core competence (Prahalad and Hamel, 1990), dynamic capability (Teece *et al.*, 1997), and absorptive capacity (Cohen and Levinthal, 1990). Firms that combine resources in a unique way may achieve an advantage over competing firms that are unable to do so (Dyer and Singh, 1998). The RBV claims that investing in relation-specific assets and combining complementary and scarce resources can create unique products and services (Knudsen, 2003). The embedded nature of the partnering firms' relational assets and the causal ambiguity makes it difficult for their competitors to imitate their successes (Jap, 2001). Therefore, it can be hypothesised that SCI may have an impact on firm performance including operational and customer performance. It allows firms to focus on what they do best and contribute to the value-adding process of the supply chain (Park, Mezias and Song, 2004). Applied to SCI, the RV suggests that collaborative relationships between manufacturing firm and its suppliers and customers can generate relational rents through relation-specific assets, knowledge-sharing routines, complementary resource endowments and 'effective governance'. These four elements create an idiosyncratic relationship that is difficult for competitors to imitate. Moreover, when the relational rents generated through effective inter-firm collaboration are causal ambiguity and time compression diseconomies (Barney, 1991),

collaborative relationships could create differential advantage and confer supernormal rents to well-executed supply chain strategies.

2.9. The proposed conceptual model

The relationship between dry ports and seaports is particular in term of integration and collaboration because this is a bidirectional logistics relationship. A dry port or a seaport can be simultaneously a supplier and customer of the other, with cargo continuously flowing outwards and inwards through these nodes of the supply chain. Therefore, measuring the integration of this bidirectional logistics system differs from measuring SCI in other areas, where the measurement focuses only on the core node, i.e. a manufacturer, port or container terminal.

Based on the literature reviewed and the underpinning theories, a conceptual model is proposed in Figure 2.1 to measure the integration of dry ports and seaports and its effects on seaport performance.

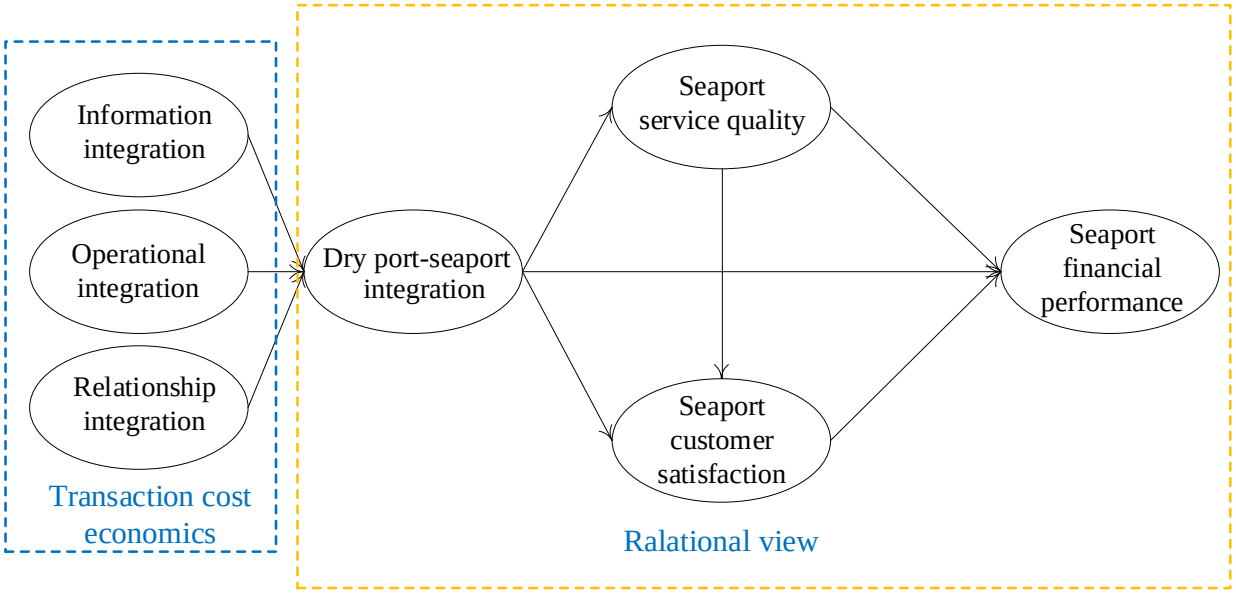


Figure 2.1- Conceptual model.

Based on the reviewed literature and the proposed conceptual model, a measurement framework for the evaluation of DPSP-I, seaport service quality, customer satisfaction, and seaport financial performance is described in Table 2.3. In this framework, customer satisfaction is equated with customer performance, with the intention that customer satisfaction will be reflected in the knowledge and experience of seaport operators.

Table 2.3- Measurement framework description

Construct	***Dimensions***	***Definition***	***Measurement***	***Adopted literature***
Dry port–seaport integration	Information integration	Information integration refers to the information that is shared, how it is shared and how issues in sharing information are addressed.	Information is shared regarding containers transported in the hinterland between seaports and dry ports.	Fawcett, Magnan and McCarter (2008); Song and Panayides (2008); Woo, Pettit and Beresford (2013); Seo, Dinwoodie and Roe (2015)
			The shared information of containers transported in the hinterland between seaports and dry ports can be integrated into the information system without manual input.	
			Seaports and dry ports work together to address issues in sharing information related to containers transported in the hinterland between the ports as soon as they arise.	
	Operational integration	Operational integration refers to any joint plan, operational activities and operational emergencies, and the improvement of the plan and operational ability and capability to enhance the efficiency of cargo flow in the hinterland between dry ports and seaports to meet customer requirements.	Seaports and dry ports exchange operational plans relating to containers transported in the hinterland between the ports.	Tongzon, Chang and Lee (2009); Cao *et al.* (2010); Flynn, Huo and Zhao (2010)
			Seaports and dry ports coordinate operational activities relating to containers transported in the hinterland between the ports.	
			Seaports and dry ports jointly respond to operational emergencies relating to containers transported in the hinterland between the ports	
			Seaports periodically discusses with dry ports ways to improve operational plans relating to containers transported in the hinterland between the ports to meet mutual customer requirements	

Construct	*Dimensions*	*Definition*	*Measurement*	*Adopted literature*
			Seaports periodically discuss with the dry ports ways to improve the operational ability and capability to meet mutual customer requirements.	
	Relationship integration	Port service quality refers to the speed and the competitive price that a seaport provides to customers; the safety and security, consistency, availability and improvement of port services; and the efficiency of port operation and management.	Seaports value the contribution of dry ports in providing services that suit mutual customers' requirements.	
			Seaports value long-term collaborative service contracts with dry ports.	Vijayasarathy (2010)
			The level of seaport investment in specific equipment, capacity, and personnel to meet the requirements of mutual customers with the dry port is extensive.	Boon-itt and Pongpanarat (2011)
			Seaports hold periodic discussions with dry ports for the assessment and improvement of the collaborative relationship.	
Seaport service quality	Seaport service quality	Resources refer to port equipment, facilities, infrastructure condition and availability, financial stability, and shipment tracing capability.	The speed of seaport service delivery for customers including those of dry ports.	Thai (2008)
			The level of competitiveness of seaports' price of service.	
			The level of safety and security of shipments in seaports, including those of dry ports.	
			The level of error in issuing invoices and documents in seaports.	

Construct	*Dimensions*	*Definition*	*Measurement*	*Adopted literature*
			The level of consistency of seaports' service provision for customers, including those of dry ports.	
			The level of availability of seaports' services for customers including those of dry ports.	
			The level of improvement of seaports' services through feedback from customers including those dry ports.	
			The overall level of efficiency of seaport's operation and management.	
Seaport customer satisfaction	Cost	Cost satisfaction	The level of satisfaction with the cost of seaports' service from your customers including those of dry ports.	Anderson, Baggett and Widener (2009); Pantouvakis (2010); Cao and Chen (2011); Tang and Sun (2015); Yeo, Thai and Roh (2015)
	Timeliness	Timeliness satisfaction	The level of satisfaction with seaports' service timeliness from customers including those of dry ports.	
	Goods safety and security	Goods safety and security satisfaction	The level of satisfaction with the safety and security of containers through seaports from customers including those of dry ports.	
	Information	Information satisfaction	The level of satisfaction with the information about containers through a seaport from the seaports' customers including those of dry ports.	
	Management	Management satisfaction	The overall level of satisfaction with the operations and management of seaports from customers including those of dry ports.	

Construct	***Dimensions***	***Definition***	***Measurement***	***Adopted literature***
Seaport financial performance	Revenue	Overall financial performance related to revenue	Revenue is increasing	Chang *et al.* (2016)
	Cost	Overall financial performance related to cost	The extent of cost efficiency	
	Profit	Overall financial performance related to profit	Profit is increasing	

The first dimension of the DPSP-I construct, information integration, refers to the sharing of strategic information, such as demand, for the purpose of forecasting and planning (Rai, Patnayakuni and Seth, 2006). It also includes systems collaboration to ensure the compatibility of inter-firm supply chain communications and technologies, for example, electronic data interchange, automatic replenishment systems and warehouse management systems (Frohlich, 2002; Seo, Dinwoodie and Roe, 2015). Information and knowledge should be shared between dry port and seaport operators. The purpose of this sharing is to pursue the synergy that helps each actor participating in the supply chain gain more in terms of operational and/or business performance and remove barriers or mitigate any uncertainty that may affect their mutual benefit. Therefore, this sharing should happen at both the managerial and operational levels to meet the demands of the market. The second dimension, operational integration, refers to all joint activities, work processes and decisions that are collectively performed by a group of internal departments or firms in the supply chain (Devaraj *et al*., 2007). The third dimension, relationship integration, refers to the adoption of a strategic connection between firms in the supply chain by improving trust, commitment and long-term orientation (Dyer and Hatch, 2006).

Employing the ROPMIS validated by Thai (2008), seaport service quality is evaluated through five criteria: resources, outcomes, process, management, and image and social responsibility (as described in the framework). However, with limited time and resources, the current study focuses mainly on the outcome-related dimension, the most important criterion (as discussed in 2.4).

Customer satisfaction can be evaluated by the five criteria suggested by Tang and Sun (2015) for use in the transport sector: cost, timeliness, goods integrity, information and management; or by the two criteria used by Yeo, Thai and Roh (2015) in maritime logistics: quality and loyalty; or by both these sets of criteria. Customer satisfaction can be measured via customer feedback or according to firm operators' self-assessment: Lebas (1995) states that customer satisfaction is solely the result of the activities of a firm that singly and collectively influence its achievement. Lebas' approach sees customer satisfaction as a type of firm performance that should be defined only for the future and in a specific case. In other words, from the perspective of firm operators, customer satisfaction becomes customer performance. In the dry port–seaport relationship, the participants are port operators and other port customers. In this case, in examining the relationship between DPSP-I and customer satisfaction, the use of Lebas'

approach and a focus on the first five criteria, i.e. cost, timeliness, goods integrity, information and management, are most suitable for evaluating customer performance.

2.10. Research hypotheses

In general, the literature finds a positive relationship between SCI and firm performance; it includes a variety of theories, such as the RBV, the RV, the knowledge-based view, social exchange theory, TCE and information processing theory (Leuschner, Rogers and Charvet, 2013). In particular, using TCE, some studies posit that SCI mechanisms, such as investments in transaction-specific assets, can lead to stable long-term relationships and high switching costs, which mitigate the threat of opportunism exhibited by supply chain partners (Won Lee, Kwon and Severance, 2007; Jorge and Jerónimo, 2017). The presence of transaction-specific assets, such as dedicated terminals, dedicated warehouses, joint ventures or any other pooled resources, ties supply chain partners in a long-term relationship that compels greater commitment and trust. This may subsequently reduce the transaction costs that are associated with searching, negotiating and monitoring a product or service for every single transaction. In this study, the integration between dry ports and seaports, as members of the maritime supply chain, can be seen as an intermediated form of hybrid governance (Cao and Zhang, 2011) because relational integration implies the adoption of a strategic connection among supply chain members, characterised by trust, long-term commitment and goodwill, which can help to avoid opportunistic behaviour (Jorge and Jerónimo, 2016).

In addition to this, the RV is used to explain the inter-firm relationship. That is, critical interconnected resources resulting from the integration between dry ports and seaports may reach beyond port boundaries. Elements such as trust, frequency of interaction and commitment are characteristics that help in understanding these relationships. They mean that, through the combined contributions of integrated partners, ports can jointly attain above-average performance (Dyer and Singh, 1998; Lavie, 2006). Therefore, in the light of RV theory, DPSP-I can lead to above-average port service quality, customer satisfaction and financial performance.

First, although there is scant research in the literature investigating the impact of DPSP-I on port service quality, many studies (as noted above) show the positive relationship between SCI and firm performance. This is particularly true in the manufacturing area: for example, Prajogo and Olhager (2012) found that a strategic long-term relationship with suppliers enhances delivery performance, and Droge, Vickery and Jacobs' (2012) findings show that external integration facilitates delivery performance. As delivery performance is an aspect of service

quality, this study proposes a hypothesis on the relationship between DPSP-I and port service quality:

H1: Dry port – seaport integration has a direct effect on seaport service quality in the context of Vietnam.

Second, regarding the relationship between DPSP-I and customer satisfaction, the studies of Allred *et al.* (2011) and Yu *et al.* (2013) argue that customer integration allows the customer to contribute to the mutual knowledge created by shared information and, therefore, enhances the ability of the supply chain to satisfy customer expectations. This study proposes a hypothesis on the relationship between DPSP-I and port service quality:

H2: Dry port – seaport integration has a direct effect on seaport customer satisfaction in the context of Vietnam.

Moreover, Yu *et al.* (2013) also confirmed by their data that supplier integration is significantly and positively related to firm financial performance. Prajogo and Olhager (2012) found that logistics integration positively direct affect cost performance. Beheshti *et al.* (2014) also claimed that SCI has positive direct impact on financial performance. In contrast, Huo (2012) provided that findings showing that there is a non-significant relationship between customer integration and financial performance. Under the line of proposed theories and supporting literature, the third hypothesis is proposed:

H3: Dry port – seaport integration has a direct effect on seaport financial performance in the context of Vietnam.

Certain previous studies illustrate the positive relationship between service quality and customer satisfaction, service quality and financial performance, and customer satisfaction and financial performance. First, Yeo, Thai and Roh (2015); Thai (2016); and Phan, Thai and Vu (2020) all found that the port service quality factor has a significant positive impact on customer satisfaction. Numerous other studies in many service sectors (e.g. transportation, including aviation [Anderson, Baggett and Widener, 2009] and high-speed railways [Cao and Chen, 2011]) also reveal a positive relationship between service quality and customer satisfaction. In line with the literature supporting the relationship between DPSP-I and customer satisfaction, this hypothesis is offered:

H4: Dry port – seaport integration has an indirect effect on seaport customer satisfaction, mediated by port service quality, in the context of Vietnam.

Second, although the literature contains no studies recording a direct relationship between service quality and financial performance in the maritime sector, such studies do exist for other sectors. For example, in the banking sector, Sobhy and Megeid (2013) demonstrate a positive relationship between profitability (on the one hand) and operation levels and liquidity performance (on the other), at both conventional and Islamic banks. In line with the supporting literature and theories, a further hypothesis is offered:

H5: Dry port – seaport integration has an indirect effect on seaport financial performance, mediated by port service quality, in the context of Vietnam.

Furthermore, Vickery *et al.* (2003) found that customer service fully mediates the relationship between integration and financial performance. Yu *et al.* (2013) found a positive relationship between customer integration and financial performance, mediated by customer satisfaction. Additionally, many studies use a blend of market and financial performance as the dependent variable, labelling that variable 'business performance' or something similar (e.g. Flynn, Huo and Zhao, 2010). Hence, this study, in the light of the supporting literature and the RV, offers these final hypotheses:

H6: Dry port – seaport integration has an indirect effect on seaport financial performance, mediated by customer satisfaction, in the context of Vietnam.

H7: Dry port – seaport integration has an indirect effect on seaport financial performance, mediated by port service quality-customer satisfaction, in the context of Vietnam.

Taking into account the current understandings of DPSP-I, seaport service quality, seaport customer satisfaction and seaport financial performance, and the current context of maritime logistics in Vietnam, hypotheses are proposed about the linkages between the factors identified (Figure 2.2).

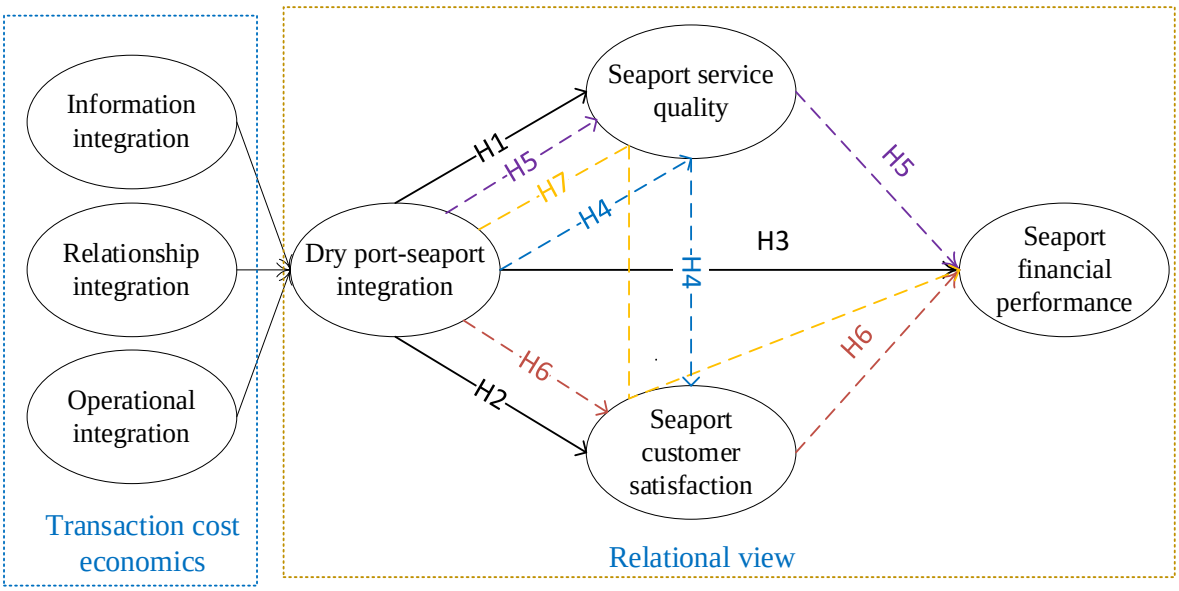


Figure 2.2- Conceptual model and hypotheses

This study, conducted in Vietnam to address these seven hypotheses, aims to validate the conceptual model by investigating, through the measurement framework described in Table 2.3, DPSP-I, seaport service quality, seaport customer satisfaction/performance and seaport financial performance. The research approach, construction of semi-structured interview questions and survey questionnaire, selection of participants and other related issues will be described in the next chapter.

2.11. Conclusion

This chapter provides comprehensive insights into SCI in general and in the maritime sector. It also includes a synthesis of current research issues published in reputable journals to identify the dimensions of DPSP-I and four constructs related to the relationship between SCI and firm performance in the context of the maritime sector – DPSP-I, port service quality, customer satisfaction and financial performance. Next, from among the theories popular in the SCI literature, the RV and TCE theory are discussed and adopted for this study. Based on the adopted theories and the literature review, a conceptual model and conceptual framework are proposed. These include four constructs (DPSP-I, port service quality, customer satisfaction and financial performance) and 28 items measuring those constructs, as presented in Table 2.3. Finally, the direct and indirect effects of DPSP-I on seaport performance in terms of port

service quality, customer satisfaction and financial performance based on underpinning theories and literature are proposed in the Figure 2.2.

Chapter 3. RESEARCH METHODOLOGY

3.1. Introduction

This chapter presents a discussion of the methodological approach and research design employed in this study. It commences with the introduction of the research paradigm (Section 3.2), followed by the research approach (Section 3.3). Section 3.4 explains the rationale for choosing the mixed methods (qualitative and quantitative) approach, and sampling and population are given in Section 3.5. Next, the units of analysis are presented in Section 3.6. A detailed description of the development of the research instrument is presented in Section 3.7, along with the preliminary interview questions and questionnaire design. The following three sections relate to the pilot study (Section 3.8) and administration of research instrument (Section 3.9) and data analysis (Section 3.10). The final section (Section 3.11) is the conclusion.

3.2. Research paradigm

The research paradigm is a set of basic and taken-for-granted assumptions that underwrite a researcher's frame of reference, mode of theorising and way of working (Saunders, Lewis and Thornhill, 2019). An appropriate research paradigm assists researchers in understanding their world and facilitates consistency in research implementation. The chosen research paradigm leads to the selection of a research approach (qualitative, quantitative or mixed methods), which subsequently influences the methods of data collection, analysis and interpretation and the research write-up, i.e. the gathering of information and the gaining of knowledge from it (Makombe, 2017). There are four major paradigms: post-positivism, constructivism, transformative and pragmatism (Creswell, 2013). Post-positivists hold a deterministic philosophy in which causes influence outcomes. A post-positivist researcher verifies theory by empirical observation and measurement. Constructivists believe that individuals seek understanding of the world in which they live and work. A constructivist researcher inductively generates a theory by focusing on specific contexts. Then, a transformative worldview holds that research needs to be intertwined with politics and a political change agenda to confront social oppression. Finally, pragmatists look to actions, situations and consequences. Instead of focusing on methods, pragmatic researchers emphasise the problem and use all available approaches to understand it.

The choice of research paradigm is dependent on the research problems and objectives and the personal experiences of the researcher (Creswell, 2009). As few studies have examined the integration of dry ports and seaports and its effects on seaport performance in Vietnam, further exploration is needed to enhance knowledge in this sector. Therefore, an inductive approach to theory building is suitable for exploring the research issues via a qualitative approach (Creswell and Poth, 2017). However, explanatory research is also required to examine the relationship between dry port–seaport integration (DPSP-I) and its effects on seaport performance, specifically in terms of service quality, customer satisfaction and financial performance. A pragmatism with a static design is appropriate deployed in this study to gain rich insights into this potential causal relationship, using quantitative analysis of causes and effects based on understanding, explanation and prediction. The validity and reliability of variables and models can be derived from a quantitative study (Dinasarapu *et al.*, 2011; Creswell, 2013). A second, deductive approach is therefore necessary to address the research questions of this study.

3.3. Research approach

Research approaches can be categorised as qualitative, quantitative or mixed methods. The research approach chosen provides a clear direction for establishing research procedures within a research design (Creswell, 2009). Therefore, choosing an appropriate research approach is an important step. Qualitative research is used in cases that: (1) lack a foundational theory or previous research, (2) are underpinned by inappropriate or incorrect theory or variables that have been used previously, (3) relate to phenomena description or theory where development is still required, or (4) relate to studies where quantitative measures are not applicable (Creswell, 2009). The various forms of qualitative study include ethnography, grounded theory, case studies, phenomenological research and narrative research (Creswell, 2009). Quantitative research is designed to study relatively large numbers of people, with the purpose of testing the relationships of variables in an existing theory (Creswell, 2009). Therefore, there are two types of quantitative projects: survey research, in which a sample is studied for generalisation to a population, and experimental research, which aims to determine the effects of a specific treatment on an outcome (Creswell, 2009). In the mixed methods approach, researchers collect and analyse both quantitative and qualitative data within the same study (Creswell, 2009). There are three types of strategy used to conduct mixed methods research: sequential mixed methods, concurrent mixed methods and transformative mixed methods. The

goal of adopting mixed methods is to understand the relationships among the variables in a situation and explore the topic in further depth (Creswell, 2009)..

This research aims to explore the current status of DPSP-I and its effects on seaport performance in Vietnam and thus is both exploratory and explanatory. Therefore, a sequential mix of qualitative and quantitative methods will be employed to collect data to answer the research questions and address the objectives.

Underpinned by the research philosophy of pragmatism and the combination of inductive and deductive approaches, this study employs a mixed methodology, combining qualitative and quantitative methods as the research strategy. A qualitative method provides understanding about the inner experience of participants, explores areas not yet thoroughly researched, discovers relevant variables that can be used in the quantitative method and offers a comprehensive approach to studying phenomena (Creswell, 2015). The qualitative approach helps to overcome limitations in the literature of DPSP-I in container seaport systems. Meanwhile, the quantitative approach validates results from the qualitative method and analyses the effects of DPSP-I integration on seaport performance.

3.4. The researcher's philosophical standing for this study

As stated in the analysis in Section 3.2, pragmatism and a sequential mixed methods approach procedure are applied to meet the objectives of this study. The sequential mixed methods research approach (Creswell *et al.*, 2011; Venkatesh, Brown and Bala, 2013) is recognised as an approach whereby the researcher strives to expand on the findings of one methodology with another. The primary objective of sequential mixed methods research is to increase the scope of the overall study by leveraging the findings from the first phase of the study to inform the subsequent phase (Venkatesh, Brown and Bala, 2013). In this context, the approach involves starting with a qualitative interview to meet exploratory objectives and, as a follow-up, administering a quantitative survey to a large sample. This enables the researcher to generalise the results to a large population (Creswell *et al.*, 2011; Venkatesh, Brown and Bala, 2013).

The qualitative phase of this study aims to explore in-depth new issues in the integration between dry ports and seaports via the thoughts and experience of managers who have been working in the maritime sector for over five years; in-depth interviews are therefore useful in this phase. For a number of reasons, the semi-structured interview was deployed for this study. First, the interview typically investigates appropriate questions to account for the phenomenon under study; hence, it provides the researcher with high levels of flexibility to question the participants strategically (Yin, 2009; Sekaran and Bougie, 2013). It also helps gain rich, in-depth answers and information from respondents based on its natural context (Bryman and Bell, 2015; Quinlan and Zikmund, 2015). This means that the semi-structured interview enables the interviewer to use defined dimensions and at the same time to investigate the interviewee about particular factors within the themes of the study (Sekaran and Bougie, 2013). Therefore, the employment of semi-structured interviews based on open-ended questions was selected as the main method to discover multiple truths among participants.

In the quantitative phase, survey research is applied to provide a quantitative or numeric description of the trends, attitudes or opinions of a population by studying a sample of that population (Creswell, 2009). A survey allows the collection of standardised data from a relatively large and geographically scattered population in a highly economical way (Quinlan and Zikmund, 2015). In this study, a questionnaire-based survey and a probability sampling method were hence employed to collect data. A more detailed research design for the survey applied is presented in the next section.

3.5. Sampling and population

Selecting elements from a topic-related population is a sampling strategy used to reach a reliable conclusion about the population and the research topic (Blumberg *et al.*, 2011). In general, the sampling strategy depends on the methods chosen and availability of resources (Kemper, Stringfield and Teddlie, 2003). In this mixed methods study, the qualitative phase employed convenience sampling, one of the non-probability sampling techniques in qualitative sampling (Teddlie and Yu, 2007). Convenience sampling is carried out by locating potential respondents who meet the required criteria and selecting them on a first-come-first-served basis until the sample size is achieved (Robinson, 2014).

The population targeted in this study consists of top management and/or operations managers working at dry ports and seaports and their customer firms, i.e. shipping lines, freight forwarders and shippers. According to Shen *et al.* (2020), top managers are understood as people who work in publicly listed companies as members of the top management team in designations such as Chief Executive Officers (CEOs), General Managers (GMs), Controllers, Senior Vice Presidents (SVPs), Vice Presidents (VP) etc. Such people are directly involved in key business decision-making other than being in the board of directors. The geographical boundary for these participants encompasses the container port groups in Hai Phong and Ho Chi Minh City, due to their importance and dominant cargo throughput contribution to the national total. The first interview participants were approached through introductions and recommendations made by the Secretariat of the Vietnam Seaports Association, and subsequent participants were snowballed following recommendations from the first ones. Based on the proposed conceptual model and the dimensions and measures described in Table 2.3, a set of semi-structured questions (Appendix 1) was designed and used to conduct 14 face-to-face interviews with participants in Vietnam. Due to the fact that all participants and the researcher were Vietnamese, with Vietnamese as their first language, all interviews were conducted in Vietnamese. The purpose of the interviews was to verify the dimensions and measurements of DPSP-I, seaport service quality, customer satisfaction and financial performance in the context of Vietnam. Subsequently, revised dimensions and measures were used as a framework to design the survey questionnaire of the current study.

Based on the revised dimensions and measures, a survey questionnaire (Appendix 2) was designed. The questionnaire includes three parts (A, B, C) and 31 questions; it was formulated to verify the integration between dry ports and seaports in Vietnam and the effects of this

integration on seaport performance. In order to classify participants' demographic information, a fourth part (D) including four questions was added to the questionnaire. The sampling frame for the survey was constructed from lists of container seaports composed by the Vietnam Maritime Administration and the Vietnam Seaports Association and cross-checked between those lists for repetition.

3.6. Units of analysis

The mixed methods research design includes a combination of quantitative and qualitative research data, techniques and methods within a single study. Categories of mixed methods research include triangulation, embedded, explanatory and exploratory sequential design (Creswell *et al.*, 2011). As this study aims to explore the integration of dry ports and seaports in Vietnam and examine its effects on seaport performance, the confirmatory sequential design is the best fit here, comprising, first, the exploration of factors shaping the integration between dry ports and seaports and, second, the collection of quantitative data to measure the effects of this integration on seaport performance.

With the above considerations, the unit of analysis in this research is members of the maritime supply chain. Specifically, since the first phase of this research aims to qualitatively validate the proposed conceptual model, the unit of analysis in this phase comprises seaport operators, dry port operators, shipping lines and logistics service providers. Then, the second phase of the study aims to examine the impact of DPSP-I on the operational and customer performance of seaports; therefore, the chosen unit of analysis in that phase is seaport operators.

3.7. Design of the research instrument

3.7.1. First phase: Interview

To gain insightful understandings of how DPSP-I, port service quality and customer satisfaction/performance can be comprehended and are constructed in the context of maritime logistics in Vietnam, a qualitative approach was adopted for the first phase of this study. Due to the complexity of DPSP-I and the fact that the interviewer is a novice researcher, all of the interviews were conducted face to face and were based on a set of topics and semi-structured questions (Appendix 1), which were divided into four sections. The semi-structured interview questions were constructed according to the measurement framework described in Table 2.4,

with the dual purpose of helping the researcher collect data systematically and maximising interactive opportunities between the interviewer and interviewees.

The questions in Section A seek an overview of the interviewee's career experience relating to port operation.

Section B focuses on DPSP-I, with eight questions relating to the relationship between the interviewee's port and its counterparts. The questions here concern information sharing; common goals, facilities, costs, risks and understandings of customers' needs; and collaboration in planning and operating.

Section C relates to the view of the participant on how seaport service quality is constructed and contains nine questions relating to criteria used to evaluate seaport service quality and the possible effects of DPSP-I on it.

Section D explores how seaport customer satisfaction/performance is perceived by the participant in the practices they have experienced in their work.

All of the interviews were transcribed and analysed using NVivo 11 software. The detailed analysis is presented in Section 3.10. Based on the findings from the interviews (analysed in the next chapter), the conceptual framework was revised, and the survey questionnaire was constructed accordingly.

3.7.2. Second phase: Survey

The findings from the interview data assisted the researcher to revise the proposed conceptual model and the conceptual measurement framework, and changes were made to both. For example, geographic integration (as a dimension of DPSP-I) was found to be relevant in the context of Vietnam and added to the conceptual model and measurement framework. The survey questionnaire for the second phase of the study was then constructed according to the revised conceptual model and framework.

This survey questionnaire was written in Vietnamese, the first language of the participants, and designed in six sections: research title, answering guidelines, questions on DPSP-I practices (Part A), questions on port service quality (Part B), questions on the participant's assessment of customer satisfaction and seaport financial performance (Part C), and additional information (Part D). The questionnaire included 31 questions answered on a Likert scale and six additional questions (as described in Appendix 2).

Practices relating to DPSP-I were evaluated through four groups of questions in Part A: information integration (three questions), operational integration (five questions), relationship integration (four questions) and geographic integration (three questions). The last group, geographic integration, which was not in the measurement framework described in Table 2.4, was identified through the interview data.

Port service quality was evaluated in Part B through eight Likert scale questions and one open question about particular improvements in operational performance within the participant's port. Part C covered the participant's assessment of customer satisfaction/performance and port financial performance based on their experience. The formation of these questions based on interview data will be analysed in the next chapter.

3.8. Pilot study

3.8.1. First phase: Interview

After obtaining ethics approval, three pilot interviews were undertaken with three colleagues conducting supply chain and logistics-related research at RMIT University and also working for universities in Vietnam, who therefore understood the interview content and were able to respond from a developing-countries perspective, which ensured validity for this study. The pilot interviews were undertaken as the final stage of preparation for data collection prior to the 14 study interviews in June and July 2019. The pilot interviews were performed using the English interview tool prior to its translation into Vietnamese. The pilot interviews helped the researcher to refine data collection plans and the content of the research questions, in line with Pu and Yin (2009). Consequently, some research questions were added, and minor changes were made to the order and wording of the questions to progress the interview satisfactorily. For example, the order of the second and third questions in Section B was reversed, and the wording in the (new) third question was changed from 'goals could be reached' to 'goals could be achieved'.

3.8.2. Second phase: Survey

Prior to the pilot survey, a pre-test was carried out to improve the layout of the survey questionnaire. This step examined spelling, wording, readability and answering time. Each question in the questionnaire had to be rigorously tested before the questionnaire was finally administered. The pre-test was sent to the volunteer participants for revision. Eight people,

including postgraduate students and professionals studying and working at RMIT University, participated in the pre-test; to match the purpose of the pre-test, each had knowledge in supply chain management. Each participant received instructions from the researcher on a one-to-one basis before responding to the questionnaire in a hard copy. As the participant was completing the pre-test, the researcher observed their expressions to identify confusion or problems in following the survey's instructions. On completion of the pre-test, each participant provided feedback on the general survey. Each session ended with an informal conversation between the researcher and participant in which other concerns were considered. The pre-test study uncovered some wording issues that had not been identified before. These discoveries were used to correct and improve the instrument. The participants reviewed the modified questionnaire and reported a significant improvement in the clarity of the instructions; they also reported that the questions did not seem so repetitive.

After pre-testing, a pilot study was undertaken to test the reliability of the constructs and items included in the questionnaire, which was based on the proposed conceptual framework. The researcher sent an email to 15 seaports in Vietnam to gain pilot participation agreement. Interest in the pilot study was expressed by 13 managers working in container terminals (five in the North and eight in the South). It was explained to these prospective participants that the pilot survey would be undertaken in English and that the objective of this pilot study was to measure the clarity and user-friendliness of the questions prior to the main survey. All the participants understood the objective and agreed to undertake the pilot survey in English. Thus, the pilot study was undertaken with the 13 managers via email. Table 3.1 presents the position of each respondent and their experience in maritime logistics.

Table 3.1- Respondents' designation and experience in the maritime sector

Designation	***Number of respondents***
Director	2
Vice director	5
Chief operations officer	6
Experience	***Number of respondents***
Fewer than 5 years	3
From 5 to 10 years	5
More than 10 years	5

It can be clearly seen that the positions of the participants were varied, ranging from vice director to chief operations office, and that their experience in the maritime sector ranged from less than five years to more than ten years. The pilot test was used to test the internal consistency of the items and the measuring constructs. The test results show that Cronbach's alpha (displayed in Table 3.2) ranged from 0.821 to 0.954 and that all items and constructs met the threshold suggested by Hair *et al.* (2014).

Table 3.2- Reliability of the questionnaire, tested using Cronbach's Alpha

Construct	***Number of items***	***Cronbach's alpha***
Information integration (II)	3	0.866
Operational integration (OI)	5	0.860
Relationship integration (RI)	4	0.895
Port service quality (PSQ)	8	0.954
Customer satisfaction (CS)	5	0.821
Financial performance (FP)	3	0.855

3.9. Administration of the research instrument

The research approach chosen depends on the nature of the research purpose (Creswell, 2015). Adopting a mixed methods approach, this study was conducted in two phases, the first phase involving qualitative in-depth interviews and the second employing a quantitative survey to collect relevant data.

In the first phase, based on the proposed conceptual model, face-to-face in-depth interviews were conducted with a number of port operators and their customers in the maritime supply chain (i.e. shipping lines, freight forwarders and shippers). In these interviews, participants were asked to elaborate on the current status of DPSP-I and how it has impacted/may impact seaport performance in the areas of service quality and CS. Findings from the interviews guided revision of the conceptual model and provided additional inputs to the design and development of the survey questionnaire to be administered in the second phase. Interviews were conducted face to face at the participants' workplaces and lasted for approximately 30 to 60 minutes. They were tape-recorded with the participants' prior consent. Upon completion, the interviews were transcribed and analysed using content and thematic analyses.

In the second phase, and after pre-testing and piloting, the survey questionnaire was translated into Vietnamese; then, the Vietnamese version was back-translated into English by a colleague of the researcher who has professional knowledge of port operations in Vietnam. The back-translated English version was then compared with the original English version for consistency, upon which the Vietnamese version of the questionnaire was confirmed (Quinlan and Zikmund, 2015). The questionnaire was then ready for distribution to different seaport operators in Vietnam.

The survey questionnaire was administered both online, using web platforms (such as Qualtrics), and by hard-copy mailings (collected by the VPA).

3.10. Data analysis

3.10.1. First phase: Interview

A variety of forms of analysis are available; the data analysis process needs to be appropriately constructed to represent the data as an identifiable reality obtained from the study participants (Creswell, 2009) and to enable interpretation of the meaning of the data (Neuman, 2011) to answer the research question. The process starts with data coding. According to Creswell (2009), coding is the process of labelling and organising qualitative data to identify different themes and the relationships between them. As fits the inductive approach applied for the qualitative analysis stage of this study, a three-stage process including open coding, axial coding and selective coding is proposed to code the data.

Open coding is the process of segmenting data into meaningful expressions and describing these in single words/short sequences of words (Blair, 2015). Relevant annotations and concepts are then attached to these expressions. This means that the transcript is not merely coded in isolation, but that the participant's voice is heard at the same time. Because coding is a subjective and interpretive process, it enhances the depth of interpretation of the participant's experiences (Blair, 2015). Open coding is an important step; it constitutes the first abstraction step.

Axial coding is another stage in identifying the core concepts in a study, involving regrouping the data or reanalysing the results of the open-coding process. From the revised codes, the identified themes (corresponding to the respondents' opinions) that emerge from the data are

linked to the conceptual framework derived from the literature, before being refined into the final codes and placed into the categories of the study's conceptual framework.

The final stage of data analysis is selective coding, which is completed after the core concepts emerging from the coded data categories and subcategories have been identified through open and/or axial coding. It relates to the chosen core concept around which the other categories from the axial-coding step are grouped for the purpose of explaining the observed phenomena. The categories are integrated and refined to facilitate their visible relationship within the conceptual framework, bringing the abstraction to a higher level. The process of coding in this study, with samples of the codes, is briefly presented in Table 3.3.

The analysis in this study not only involved categorisation but also compared the codes with those from the literature. By this comparison, the validity of the data analysis was enhanced. By using NVivo software, multiple clusters (or themes) were similarly developed to reach a holistic understanding of the integration of dry ports and seaports in Vietnam and its impact on seaport performance. All 14 interviews which had been audio recorded and saved in a secure storage server were first transcribed by the researcher for further text analysis using Nvivo 11. Each transcribed interview was saved in a separate file with an identifying label. Then, all files were imported into the software for data analysis. Next, the handling of qualitative data is an iterative process where the researcher explored, coded, reflected, took memos, coded some more, enquired and so on before interpreting and writing up.

Table 3.3- Developing codes: Code samples

Quotation	***Codes emerging from the data***	***Codes from the literature***	***Final codes***	***Categories***
[F]or a seaport, this is mainly information about operational plans (DP01)	Information sharing regarding operational plans	Information sharing	Operative information shared	Operational integration
[A]bout communication…emailing is a popular way (DP01)	Information sharing method	Information communication	Information sharing method	Information integration
Seaports and dry ports exchange [information] by email (DP02)	Information sharing method	Information communication	Information sharing method	Information integration
[We] inform ICDs and shipping lines directly … and the shipping lines also know their routes through data reporting systems. The port interacts with the carrier's system through the EDI data exchange system. (SP06)	Information regarding container transportation; information system	Information system	Information system	Information integration
There is no sharing now, ports only manage a container until it gets beyond the port gate. (SP02)	Level of information sharing	Level of information collaboration	Integrated information level	Information integration

3.10.2. Second phase: survey

3.10.2.1. Guidelines for data analysis

The data analysis in this study is a systematic procedure adapted from Hair *et al.* (2017) and includes six steps (as shown in Figure 3.1). After being collected and coded, the data underwent statistic processing using IBM SPSS 25.0 and SmartPLS 3.3. The detail of each step of the data analysis is discussed in the following sections.

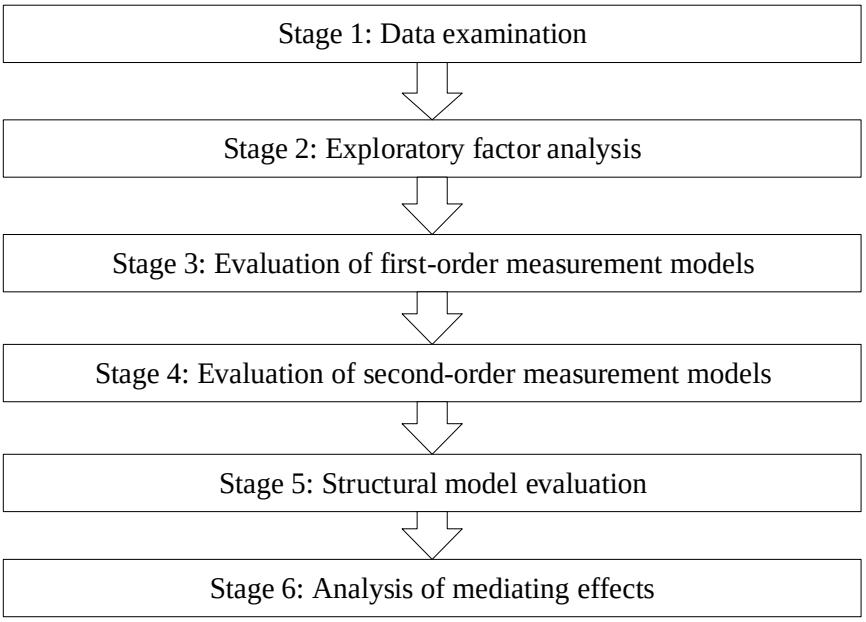


Figure 3.1- Data analysis procedure (Hair et al., 2017)

3.10.2.2. Data examination

The stage of data examination plays an important role in the application of PLS-SEM. Issues resulting from missing data, straight lining, outliers or non-normal data may result in bias or distorted results. It is therefore crucial for an honest analysis of the data that these issues are considered and dealt with before the analysis process.

Missing data

Missing data refers to a situation in which valid values for one or more variables are not available for analysis. This may result from errors in data collection and data entry or from an omission or a respondent's refusal to answer (Hair *et al.*, 2019). The negative effect of missing data may be data analysis failure due to the reduction of the sample size available for analysis,

or bias issues. Therefore, in order to minimise the problem of missing data in the first stages of data collection for this study, two particular methods of data collection were used: an online Qualtrics survey platform and a paper survey (a hard copy). On the Qualtrics platform, each survey question was set as a required question, marked by an asterisk (*). Respondents who failed to answer a particular question were not able to advance to the next page. As a result, participants had to answer all the questions before they could submit their responses. The paper survey questionnaires, with thorough instructions, were distributed to and collected from the senior managers of seaports via the VPA.

Straight lining

Straight lining happens 'when a respondent marks the same response for a high proportion of the questions' (Hair *et al.*, 2017, p. 58). It should therefore be investigated before the process of data analysis. In order to identify cases of straight lining, the standard deviation of all scores given by each case was calculated using Microsoft Excel. If this value was zero, the corresponding case was deleted from the data set (Field, 2013).

Outliers

Values in data displaying extreme differences are considered outliers (Kline, 2016). There are two forms of outlier: univariate and multivariate. A univariate outlier is a case with an extreme value on one variable, whereas a multivariate outlier has extreme scores on two or more variables (Tabachnick and Fidell, 2013; Kline, 2016). In order to detect univariate outliers, observable items were grouped under their corresponding single variables. Then, using the descriptive statistics function in SPSS, the values of each observation were converted to standardised scores (Z-scores), which were then examined based on the rules of thumb suggested by Hair *et al.* (2019). Outliers are defined as cases with Z-scores of ±2.5 or beyond for small samples (80 or fewer observations). For larger sample sizes, the Z-scores can be up to 4 and specifically ±3 or beyond (Hair *et al.*, 2019).

Multivariate outliers can be detected by a visual boxplots approach or Mahalanobis' D-square (D^2). A boxplot is a useful way to display data, with the median being at the centre of the plot. In a boxplot, the top and bottom are limits within which the middle 50% of observations fall; this is called the interquartile range (or IQR). In this study, any case over the upper quartile plus 3 times standard deviations or below the lower quartile minus 3 times standard deviations is labelled an outlier. Multivariate outliers can also be detected using Mahalanobis' D^2, which

measures the distance in standard deviation units of each observation between a set of scores for an individual case, and the sample means for all variables (Kline, 2016). Mahalanobis distance is a measure of multivariate distance that can be evaluated for each case using chi-square (χ^2) distribution (Tabachnick and Fidell, 2013). For calculation, the Mahalanobis D^2 is achieved by using the linear regression method in SPSS 25.0. After that, a function of SPSS 25.0, that is '1 − CDF.CHISQ(quant,df)' (quant = D^2 and df = 3), is computed to obtain the t-value of significance. In this study, a conservative statistical test of significance ($p < 0.001$) was used 'as the threshold value for designation as an outlier' (Hair *et al*., 2006, p. 75). Under a different method, observations having D^2/df values greater than 3 could be designated as possible outliers. However, where many observations are designated as outliers, researchers need to deliberately consider which cases should be retained and which eliminated based on different elements, such as outliers' characteristics and analyses' objectives.

Normality of data

Partial least squares SEM is a nonparametric statistical method that is different from covariance-based SEM (CB-SEM). While most statistical tests and estimation techniques used in CB-SEM assume 'each variable and all linear combinations of the variables are normally distributed' (Tabachnick and Fidell, 2013), PLS-SEM does not require normal data distribution (Hair *et al.*, 2017). However, it is important to verify how far the data are from normal because 'extremely non-normal data prove problematic in the assessment of the parameters' significances' (Hair *et al.*, 2017, p. 61).

According to Hair *et al.* (2017), non-normally distributed variables can have a substantial impact on the results in small samples of 50 or fewer observations, while their effects may be negligible for samples of 200 or more. In this study, with a sample size of 88, the normality of variables has been assessed in order to cancel out the detrimental effects.

Normality of variables is assessed by two components, such as skewness and kurtosis (Tabachnick and Fidell, 2013). In particular, indices of univariate skewness and univariate kurtosis are commonly reviewed. Skewness means that the distribution of data stretches towards either the right or left direction; if the number is greater than +1 or lower than −1, the data distribution is substantially skewed. Regarding kurtosis, Tabachnick and Fidell (2013) suggest that the distribution of responses is too peaked if kurtosis is greater than +1 and too flat if kurtosis is less than −1; therefore, data is likely to be normally distributed when the absolute

values of skewness and kurtosis are close to zero. By contrast, Kline (2016) recommends that 3 and 10 are the maximums for the absolute values of skewness and kurtosis, respectively, to achieve a normality assumption. Hair *et al.* (2019, p. 96) propose critical values of skewness and kurtosis that are ±2.58 (0.01 significance level) and ±1.96 (0.05 significance level), respectively.

Testing for non- response bias

Non-response bias refers to 'the mistake one expects to make in estimating a population characteristic based on a sample of survey data in which, due to non-response, certain types of survey respondents are under-represented' (Berg, 2005, p. 3). In general, a certain amount of non-response occurs in most surveys, since not every addressed participant returns the questionnaire. Therefore, non-response bias through mailed surveys has been recognised to be a serious concern (Dillman, Smyth and Christian, 2014). Rogelberg and Stanton (2007) argue that performing a non-response bias test is important to ensure the external validity of the survey and to identify whether or not the reported results reveal bias. One of the basic methods for testing non-response bias is to assume late respondents to be similar to non-respondents and compare (for differences) early responses and late responses for the means of all variables of the two samples. If no significant differences are identified between early and late responses, non-response bias is unlikely to have occurred (Berg, 2005; Rogelberg and Stanton, 2007; Gefen, Rigdon and Straub, 2011).

Testing for common method bias

Common method bias (also well recognised as common method variance) refers to 'a variance that is attributable to the measurement method rather than to the construct of interest' (Podsakoff *et al.*, 2003, p. 879). As one of the basic causes of measurement error, common method bias is a problem in surveys, because it often leads to invalid conclusions about the relationships between variables through the inflation or deflation of the findings (Podsakoff *et al.*, 2003). Hence, common method bias is one of the most frequently cited concerns among information system scholars (Straub, Boudreau and Gefen, 2004; Malhotra, Schaller and Patil, 2017). It is usually possible for researchers to employ practical remedies to minimise the potential impact of common method bias on the findings of their study. A number of authors (Straub, Boudreau and Gefen, 2004; Malhotra, Schaller and Patil, 2017) agree that Harman's single-factor test is the most commonly utilised statistical remedy for assessing and controlling

common method bias across all fields. In this single-factor test, all the items and variables in a study are under the control of exploratory factor analysis (EFA) (Malhotra, Schaller and Patil, 2017). Through examining the unrotated factor solution, the test determines the number of factors of importance in explaining the variance in the variables (Podsakoff *et al.*, 2003). Common method bias is assumed to occur 'if (a) a single factor will emerge from factor analysis or (b) one general factor will account for the majority of the covariance among the measure' (Podsakoff *et al.*, 2003, p. 889). Furthermore, this test is now becoming common in confirmatory factor analysis as an alternative to EFA to test the hypothesis that a single factor can explain all of the variance in the data (Podsakoff *et al.*, 2003; Malhotra, Schaller and Patil, 2017).

3.10.2.3. Exploratory factor analysis

The purpose of exploratory factor analysis (EFA) is to define the structure of potential underlying latent variables and reduce a data set with a large number of variables to a smaller and more manageable size. It is such a complex procedure that researchers need to consider the selection of the most efficient options, particularly for factor extraction and factor rotation (Costello and Osborne, 2005). First, factor extraction is the process of deciding how many factors to keep (Brown, 2006). The various methods of factor extraction include principal component analysis, principle factors, maximum likelihood factoring, image factoring, alpha factoring and unweighted and generalised weighted least squares factoring (Tabachnick and Fidell, 2013). From these, the principal component analysis method was chosen as an initial solution for the EFA in this study, as this is recommended as a method of extraction to identify the latent variables in the research (Brown, 2006; Hair *et al.*, 2019).

The output of the factor extraction process provides the eigenvalue associated with each factor, which indicates the substantive importance of the factor. Therefore, it is logical that the criterion for retaining a factor is a large eigenvalue. Kaiser (1974) suggests keeping all factors with eigenvalues greater than 1. However, Jolliffe (1986) claims that Kaiser's criterion is too strict and suggests the criterion of an eigenvalue of at least 0.7. In this study, the decision of whether to employ Kaiser's (1974) or Jolliffe's (1986) criterion depended on the number of extracted factors associated with each criterion. It was expected that the number of factors extracted would meet the required number of factors proposed in the theoretical model. Once factors were extracted, the factor rotation technique was utilised to discriminate between

factors. In SPSS, there are 'three methods of orthogonal rotation (varimax, quartimax and equamax) and two methods of oblique rotation (direct oblimin and promax)' (Field, 2013, p. 681). In this study, the varimax rotation method, as developed by Kaiser (1974), was chosen for the EFA procedure as it is the most common method of identifying major factors and is easiest to interpret (Field, 2013; Hair *et al.*, 2019).

Additional criteria to evaluate the adequacy of extracted components are factor loadings and item-total correlation. Field (2013) suggests retaining items with factor-loading values of 0.4 and above. Items should be deleted to avoid cross loadings if they are loaded on more than one factor (Hair *et al.*, 2019). The corrected item minus a total correlation value of 0.30 is considered the minimum requirement for the threshold value for correlations between each item and the total score from the questionnaire (Field, 2013).

Finally, it is important to conduct reliability analysis on each identified factor by computing a Cronbach's alpha value.

A value of 0.7 to 0.8 is considered an acceptable value for Cronbach's alpha (Kline, 2016).

However, when dealing with psychological constructs, a Cronbach's alpha value of below 0.7 can be acceptable because of the diversity of the measured constructs (Kline, 2016). The values of Cronbach's alpha if the item was deleted were also checked to consider whether the deletion of an item could improve the overall reliability value of its associated construct (Field, 2013).

3.10.2.4. The evaluation of the measurement models

3.10.2.4.1. First-order measurement model evaluation

There are two types of measurement model: reflective and formative. The difference between these two types is based on the relationship between a construct and its corresponding indicators. A measurement model is called reflective when the direction of the arrows is from the construct to the indicators. When, in contrast, the direction of the arrows is from the measured indicator variables to the constructs, the measurement model is described as formative (Hair *et al.*, 2014). In this study, all the first-order constructs were hypothesised as reflective constructs, and second-order constructs were hypothesised as formative constructs, therefore their evaluation was based on the procedure of two-stage approach.

The assessment of a reflective measurement model is based on internal consistency reliability and validity. The reliability indicates the consistency and stability of a measurement scale over

time (Straub, 1989), and the validity refers to the degree to which a set of measures can correctly represent the construct conceptualised in the study (Hair *et al.*, 2019). Three criteria need to be assessed in reflective measurement models, including internal consistency reliability, convergent validity and discriminant validity (Hair *et al.*, 2017).

Internal consistency reliability

Internal consistency reliability is the first criterion evaluated in a reflective measurement model. Traditionally, Cronbach's alpha is used to provide an estimate of the reliability based on the intercorrelations of indicators in the scale. However, the limitation of Cronbach's alpha is that it is 'sensitive to the number of items in the scale and generally tends to underestimate the internal consistency reliability' (Hair *et al.*, 2017, p. 111).

Therefore, in the PLS-SEM approach, the composite reliability, which is similarly interpreted to Cronbach's alpha, is used as a means to measure internal consistency. The values of composite reliability range between 0 and 1, with higher values indicating the higher reliability of the measure. Hair *et al.* (2019) report that satisfactory composite reliability is greater than or equal to 0.7, but that values of 0.6 to 0.7 can be accepted in exploratory research. Values below 0.6 are not desirable as they indicate a lack of internal consistency reliability or invalid measurement of the construct.

Convergent validity

Convergent validity refers to 'the extent to which a measure correlates positively with alternatively measures of the same construct' (Hair *et al.*, 2017, p. 112). Two criteria are used to assess convergent validity, including the outer loadings and the average variance extracted (AVE).

The first criterion is the outer loadings of the indicators, commonly called indicator reliability. It is a requirement that all indicators' outer loadings are statistically significant. The standard for the outer loadings should be greater than 0.7 (Hair *et al.*, 2017).

Indicators with very low outer loadings (below 0.4) should certainly be deleted from the scale (Hair, Sarstedt and Ringle, 2011). However, careful consideration should be given to indicators with outer loadings between 0.4 and 0.7. The decision of whether an indicator should be deleted depends on whether the removal of the indicator increases the measures of composite reliability and AVE. Where the removal of an indicator occurs, the measurement model is rerun.

The second common criterion to establish convergent validity is the AVE, which is equivalent to the communality of a variable. This is used as a measure of common variance in a construct (Fornell and Larcker, 1981). As a common rule of thumb, an acceptable AVE value is 0.5 or above (Hair *et al.*, 2017), indicating that a latent variable explains more than half of its indicators' variance. For each reflectively measured construct in the proposed model, AVE was assessed.

Discriminant validity

Discriminant validity refers to 'the extent to which a construct is truly distinct from other constructs by empirical standards' (Hair *et al.*, 2017, p. 115). Two methods of evaluating discriminant validity are to examine the cross loadings of the indicators and to compare the square root of the AVE values with the construct's correlations. In the first method, it is requirement for the outer loading of an indicator on the associated construct to be higher than all of its cross loadings with other constructs (Hair *et al.*, 2017). The second method is based on the idea that a construct shares more covariance with its associated indicators than with any other construct. The Fornell-Larcker criterion used in this second assessment is that the square root of the AVE for each latent variable should be greater than its highest correlation with any other variable.

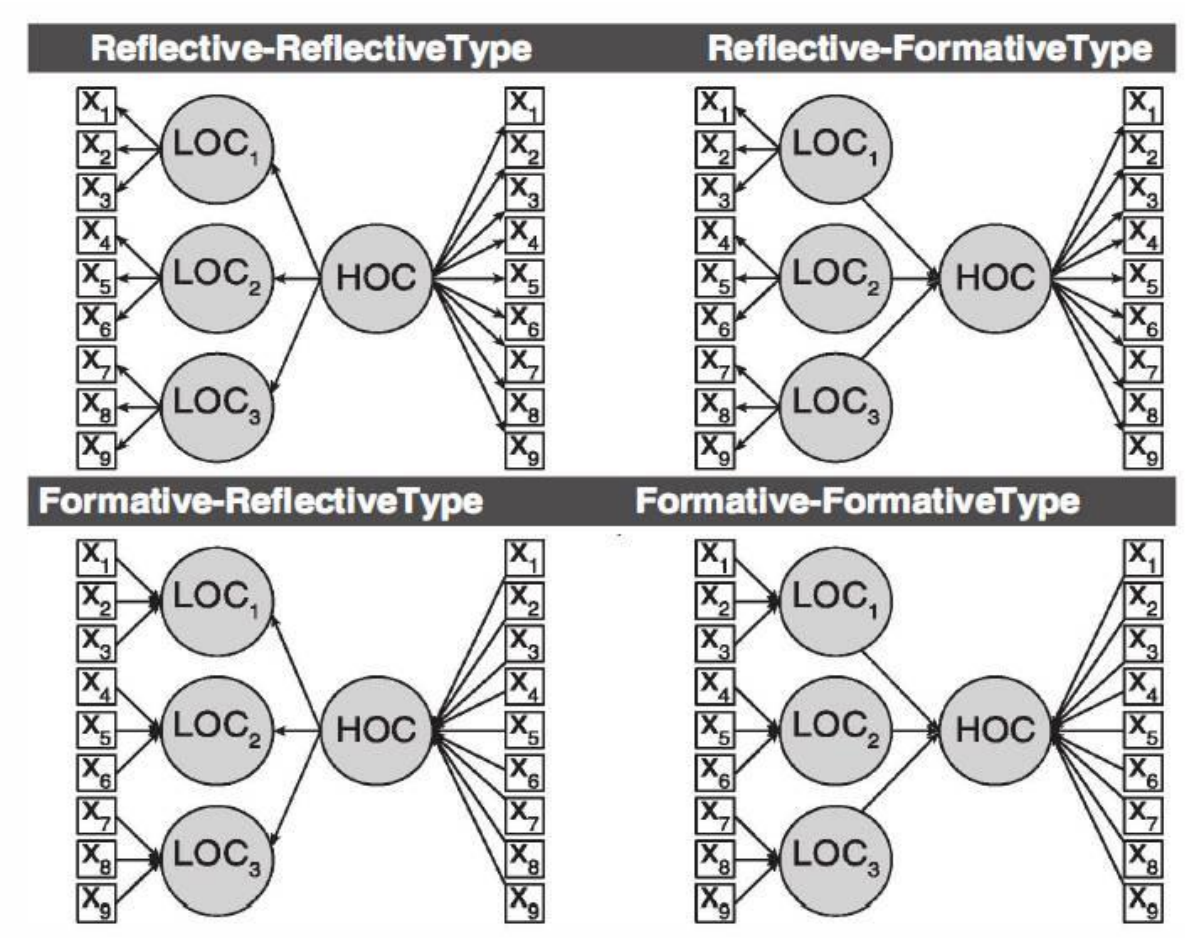
Table 3.4- Rules of thumb for the assessment of reflective measurement models

Criterion	***Value***	***Reference***
Internal consistency reliability (ICR)	>0.7	(Hair *et al.*, 2017)
Indicator' outer loadings	>0.7	
	> all cross loadings with other constructs	
Average variance extracted (AVE)	> 0.5	
Square root of AVE	> highest correlation with any other construct	

3.10.2.4.2 Second – order measurement model evaluation

The second-order measurement model is often a common type of higher-order model or hierarchical component model (HCM). As discussed in the literature, there are four main types of HCMs: reflective–reflective, reflective–formative, formative–reflective and formative–

formative (Jarvis, MacKenzie and Podsakoff, 2003; Wetzels, Odekerken-Schröder and van Oppen, 2009; Ringle, Sarstedt and Straub, 2012) (see Figure 3.2). These types of models include two elements: a higher-order component (HOC) and lower-order components (LOCs). The relationships between indicators and LOCs and between LOCs and the HOC are determinants for the type of HCM. For example, in the reflective–formative type of HCM, each LOC is measured by reflective indicators, whereas the relationship between the HOC and LOCs is formative.



Note: LOC = lower – order component; HOC = higher – order component

Figure 3.2- Types of hierarchical component models (Hair et al., 2017, p. 282)

Two approaches are available to estimate the higher-order measurement model: the repeated indicators approach and the two-step approach. Lohmöller (1989) proposed the repeated indicators approach, suggesting that all the manifest variables of LOCs are linked to a higher-order latent variable. Hair *et al.* (2017) claim that it is not difficult to apply this approach, but

that it is, however, important to pay attention to two conditions: (1) that the number of indicators of the LOCs should be equal, and (2) that the criteria applied for the HOC should be the same as for any other construct in the PLS path model. The repeated indicators approach is most suitable for the type of model where the relationship between LOCs and the HOC is reflective. In the case of a formative relationship between LOCs and the HOC, the repeated indicators approach supposes that 'almost all of the HOC variance is explained by its LOCs ($R2 \approx 1$)' (Hair *et al.*, 2017, p. 283); thus, the path relationship between the HOC and its predecessors is always insignificant. As a result, for formative–formative or reflective–formative higher-order models, the two-stage approach is more appropriate (Ringle, Sarstedt and Straub, 2012). The first stage is to obtain the scores of the LOCs, which are then used as indicators for measuring the HOC in the second stage. The latent variables can be considered the predecessors of the HOC to explain its variance, which may lead to significant path relationships. In summary, due to the differences between approaches, it is important to decide whether the repeated indicators approach or the two-stage approach is more suitable to estimate each type of the hierarchical latent variable model (Becker, Klein and Wetzels, 2012). In this study, the factor of DPSP-I was proposed as a reflective–formative second-order construct, and the two-stage approach was therefore applied to evaluate it. Becker, Klein and Wetzels (2012) recommend that the standards for reporting the evaluation results of reflective–formative constructs should be the same as the guidelines for formative constructs that are now discussed below.

In the review study of PLS-SEM in the field of marketing by Hair *et al.* (2012), many previous researchers commonly made a mistake of using the evaluation criteria of the reflective measurement model to assess formative measurement models. The examination of internal consistency reliability, convergent validity and discriminant validity is not appropriate and meaningful in formative measurement models because formative indicators are assumed to be error free (Edwards and Bagozzi, 2000). Instead, consideration is needed of the content validity of the methods of data analysis before the formatively measured constructs are assessed. The content validity of a construct is ensured when all its facets are fully explained by the formative indicators. In this study, in order to establish the formatively measured DPSP-I construct, a comprehensive literature review and an assessment of academic experts in the area of ports was helpful to properly set the domains of the construct (Diamantopoulos and Winklhofer, 2001).

The empirical evaluation of formative measurement models includes two steps. The purpose of the first step is to examine whether a specific indicator fits into the corresponding construct or not. Then, in the second step, the question of whether an indicator relatively and absolutely contributes to forming the formative construct is tested. Each step is now presented. The first step involves the assessment of the convergent validity of the formative measurement model to ensure that the selected indicators cover all relevant aspects of the formative construct. In this study, a multi-trait–multi-method (MTMM) analysis approach developed by Loch, Straub and Kamel (2003) was employed to validate formative measures. Accordingly, SmartPLS 3.3 was utilised to create a weighted score for each measured indicator, and a composite score for each formative construct was then computed. With all these values, a matrix of inter-item and inter-construct correlations was created by the bivariate correlations technique in IBM SPSSstatistics. The explanation for this matrix may be that individual measures should correlate not only with each other but also with their construct value at a significant level (Campbell and Fiske, 1959; Loch, Straub and Kamel, 2003). This is a persuasive explanation for the convergent validity of the formative instrument (Loch, Straub and Kamel, 2003).

The second step is to assess the significance and relevance of the formative indicators. An important criterion of this step is the significance of the outer weight, which is the outcome of multiple regression of the formative indicators and the latent variable in the roles of independent variables and dependent variable, respectively (Hair *et al.*, 2019). The outer weight values can first be compared with each other to determine the relative contribution of each indicator to the latent variable. Then, the absolute contribution is assessed by the outer loading of the formative indicator. Both outer weights (relative importance) and outer loadings (absolute importance) of the formative indicators can be examined by means of a bootstrapping procedure with 5,000 samples, as recommended by Hair *et al.* (2017). The empirical t-value is achieved after running the bootstrap routine. If this t-value is greater than the critical t-value 1.65, 1.96 or 2.57 at the significance level of 0.1, 0.05 or 0.01, respectively, the weight is significantly different from zero (Hair *et al.*, 2017); in this case, the formative indicator is definitely retained. In contrast, if the weight of the formative indicator is not significant, the question of whether the indicator is retained or not depends on its corresponding item loading. Accordingly, the indicator should be retained if the loading value is higher than 0.5, disregarding the outer weight value. However, if both outer weight and outer loading values

are insignificant, the indicators should be omitted from the model as there is no empirical support to retain them (Hair *et al.*, 2017).

3.10.4.2.5 Evaluation of the structural model

After the assessment of first–order and second–order measurement models, the next stage is to determine how well empirical data support the proposed theory or concept of the path model. This involves the examination of the predictive capabilities of the proposed model as well as the relationships between the constructs involved in the model (Hair *et al.*, 2017). A six-step procedure is applied to assess the structural model as shown in Figure 3.3.

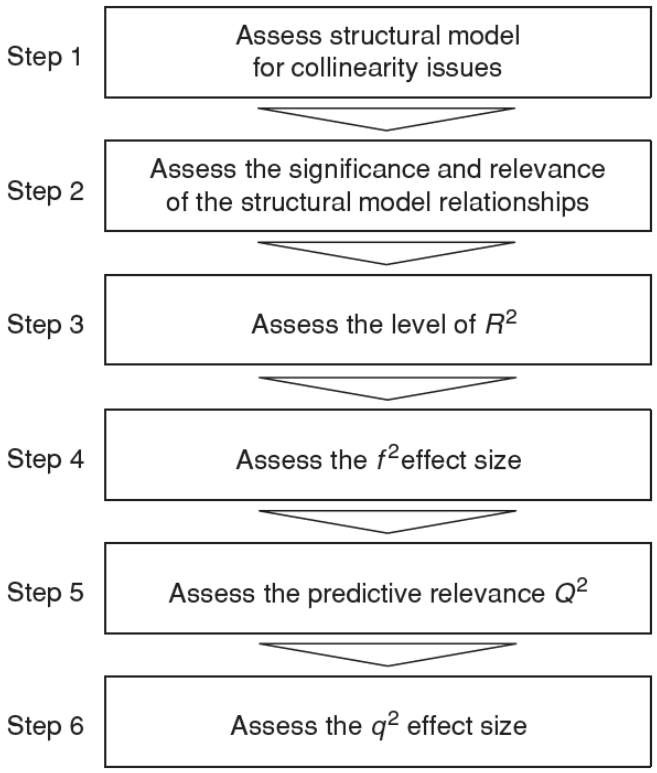


Figure 3.3- Structural model evaluation procedure (Hair et al., 2017, p. 191)

It may be understood that the estimation of path coefficients in the structural model is based on the regressions of each endogenous variable and its corresponding exogenous constructs.

Step 1: Collinearity assessment

It is necessary to examine the structural model for collinearity as high levels of collinearity among predictor constructs might cause an inaccurate estimation of path coefficients (Kline,

2016). The collinearity can be evaluated though the calculation of a variance inflation factor (VIF) for each of the latent variables (Hair *et al.*, 2019). Petter, Straub and Rai (2007) suggest that a predictor variable VIF greater than the threshold value of 3.3 indicates the existence of collinearity.

Step 2: Evaluation of structural model path coefficients

The second stage is to assess the significance of the structural model relationships, which represent the hypothesised relationships among the constructs. The path coefficients are examined with values between −1 and +1, with values close to +1 indicating strong positive relationships and values close to −1 indicating strong negative relationships. The relationships are weaker if the path coefficients are closer to 0. Bootstrapping is utilised to assess the path coefficients.

The generally recommended number of bootstrap samples is 5,000, or higher than the number of valid observations in the original sample (Hair *et al.*, 2017). The bootstrap standard errors allow the empirical t-value to be determined. If the empirical t-value is greater than the critical t-value, the path coefficient is considered significantly different from zero at a selected significance level (α). Hair *et al.* (2017, p. 195) suggest that 'Commonly used critical values for two-tailed tests are 1.65 (significance level = 10%), 1.96 (significance level = 5%), and 2.57 (significance level = 1%)'. In this study, a critical t-value with a significance level of 1% is used. After the examination of the significance of the structural model relationships, the relevance of significant relationships should be assessed because this is crucial for the results analysis and conclusion. Simply, if one path coefficient is greater than another, it can be concluded that its effect on the endogenous latent variable is larger.

Step 3: Coefficient of determination (R^2 value)

The next primary criterion for structural model evaluation is the coefficient of determination (R^2 value), which is 'a measure of the model's predictive power' (Hair *et al.*, 2017, p. 198). This coefficient represents the amount of explained variance of each endogenous latent variable. Due to the complexity of each model, it is impossible to formulate a general rule for an acceptable R^2, as recommended by Henseler, Ringle and Sinkovics (2009). Chin (1998) specifies R^2 values of 0.67, 0.33 and 0.19 reporting substantial, moderate and weak levels of predictive accuracy, respectively. A higher value of R^2 indicates higher levels of predictive accuracy.

Step 4: Evaluation of effect size f^2

Following the evaluation of the R^2 value, the next measure is the effect size (f^2). This examines whether there is a substantive influence on the endogenous variable in the structural model in the case of a selected exogenous variable being omitted. Cohen (1992) provides guidelines for f^2 assessment. Specifically, values of 0.02, 0.15 and 0.35 indicate small, medium and large effects, respectively, of the exogenous construct on an endogenous construct.

Step 5: Evaluation of predictive relevance (Q^2 and q^2 effect size)

The last evaluation of the structural model measures the model's predictive relevance, which is tested by Stone-Geiser's Q^2 value (Hair *et al.*, 2017). Chin (1998, p. 318) points to Q^2 as 'a measure of how well-observed values are reconstructed by the model and its parameter estimates'. Obtained by the blindfolding procedure in SmartPLS, Q^2 shows predictive relevance for an endogenous construct at values above zero. By contrast, values of zero and below are indicative of a lack of predictive relevance. Finally, like the f^2 assessment mentioned above, the impact of a model's predictive relevance is examined by the q^2 effect size. The values of q^2 at 0.02, 0.15 and 0.35 imply small, medium and large effect levels of predictive relevance, respectively, for a given endogenous construct (Hair *et al.*, 2017).

3.10.4.2.6 Mediator analysis

A mediator, which is a construct between the independent and dependent constructs in the causal chain, has an effect on the direct relationship between those constructs (Hair *et al.*, 2017). *Figure 3.4* presents the theoretically established path relationships of exogenous variable *(Y1)*, mediator *(Y2)* and endogenous variable *(Y3)*. Accordingly, the indirect relationship via the *Y2 mediator (i.e., p12* x *p23)* influences the direct relationship between *Y1* and *Y3* (*p13*).

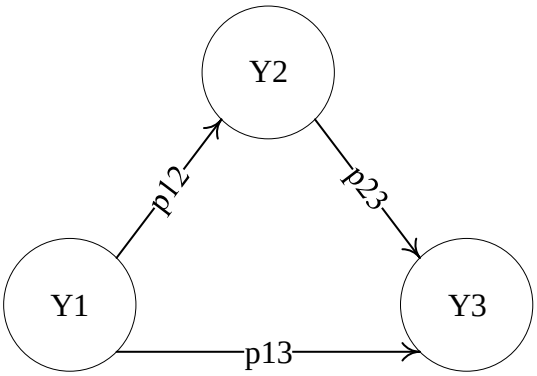


Figure 3.4- General mediator model (Hair et al., 2017, p. 229)

Zhao, Lynch and Chen (2010) classify three types of mediations and two types of non-mediations as following:

- Complementary mediation: Both indirect relationship (p12 x p23) and direct relationship (p13) are significant and have the same directions.
- Competitive mediation: Both indirect relationship (p12 x p23) and direct relationship (p13) are significant, but they have the opposite directions.
- Indirect–only mediation: Only the indirect relationship (p12 x p23) is significant while direct relationship (p13) is insignificant
- Direct–only non-mediation: Only the direct relationship (p13) is significant, but the indirect relationship (p12 x p23) is insignificant.
- No–effect non-mediation: Neither the indirect relationship (p12 x p23) nor the direct relationship (p13) significant.

Two common approaches to test mediation effects are the Sobel z-test (recommended by Baron and Kenny, 1986) and the bootstrapping test (suggested by Preacher, Rucker and Hayes, 2007). Between these, bootstrapping is increasingly the most commonly used method (Preacher, Rucker and Hayes, 2007) because it is user-friendly (Zhao, Lynch and Chen, 2010). In particular, bootstrapping aims at increasing the level of statistical power above that of Sobel's test (Preacher, Rucker and Hayes, 2007). Moreover, bootstrapping is a nonparametric method that is most suitable for PLS-SEM as it makes no assumptions about data distribution and can be applied to small sample sizes (Hair *et al.*, 2017). A bootstrap test of the indirect effect p12 x p23 was therefore chosen in this study, following a procedure suggested by Zhao, Lynch and Chen (2010).

3.11. Conclusion

This chapter justifies the research methodology designed for this study. It presents how the underlying philosophy of pragmatism guides the study. It also describes the mixed methods approach that was employed to examine and validate the proposed conceptual framework. It discusses the use of a convenience sampling technique to select an appropriate sample and the strategy of using interviews and a survey as the best methods of data collection. The chapter also justifies the application of NVivo and PLS-SEM for data analysis to answer the research questions of this study: NVivo 11 was used for qualitative data analysis; IBM SPSS 25.0 were used for the analysis techniques such as descriptive statistics analysis and EFA. Techniques for PLS – SEM were dealt with using the SmartPLS 3.3 software package. A procedure including six steps provided detailed guidelines for analysing and reporting data. Based on these six steps, the research results and findings are presented in Chapter 5.

Chapter 4. FINDINGS FROM INTERVIEW DATA

4.1. Introduction

This chapter comprises a discussion of the findings from the qualitative study on dry port–seaport integration (DPSP-I) and its impact on seaport performance in terms of port service quality, customer satisfaction and financial performance. Data were collected via semi-structured interviews. The findings discussed are based on the thematic analysis of 14 interviews.

The interview tool (see Appendix 1) consisted of five sections: (1) a profile of the interviewee, (2) the dimensions of DPSP-I, (3) the relationship between DPSP-I and port service quality, (4) the relationship between DPSP-I and financial performance, and (5) open questions. Section 4.3 presents the results of 14 interviews on the dimensions of the DPSP-I construct. Section 4.4 shows the results concerning the impact of DPSP-I on seaport performance. Following an analysis, Section 4.5 describes how the proposed research model was revisited based on the interview results; from that, the construction of the survey questionnaire is proposed in Section 4.6. The conclusion of this chapter is in Section 4.7.

4.2. Profile of the interview participants

In this research, the snowballing sampling method was used. The population targeted in the current study is top management and/or operations managers working at dry ports and seaports and their customer firms, i.e. shipping lines, freight forwarders and logistics service providers. The geographical boundary for the participants encompasses the container port groups in Hai Phong and Ho Chi Minh City, due to their importance and dominant cargo throughput contribution to the national total. Table 4.1 shows the profile of the 14 interview participants.

Table 4.1- Profile of the interview participants

Number	***Organisation***	***Location of organisation***	***Respondent's designation***	***Years of current designation***	***Years of experience***	***Durations of interview***
DP01	Dry port	South	Director	6	26	45'
DP02	Dry Port	South	Vice director	6	18	50'
LC01	Logistics company	South	Vice director	4	14	60'
LC02	Logistics company	North	Head of operations department	8	14	35'
LC03	Logistics company	North	Director	8	20	60'
SP01	Seaport	South	Operations director	5	18	60'
SP02	Seaport	North	Director	4	15	40'
SP03	Seaport	North	Director	5	18	45'
SP04	Seaport	South	Director	5	14	60'
SP05	Seaport	South	Vice manager	4	18	30'
SP06	Seaport	South	Vice director	4	19	45'
SP07	Seaport	North	Director	1	18	30'
SC01	Shipping line	South	Vice director	10	20	45'
SC02	Shipping line	North	Director	9	18	30'

4.3. Dry port – seaport integration

4.3.1. Information integration

Information sharing was apparent in almost all of the interviews; however, there was a difference between the dry port–seaport dyads with low levels of integration and those with higher levels. In those with low-level integration, information sharing was seen as unnecessary because the seaport assumed that its responsibility ended when a cargo left its port. This was seen in the statement of a seaport operator about his seaport's responsibility:

There is no sharing now. Ports only manage a container until it gets beyond the port gate. (SP02)

The statement of another seaport operator was similar; he said the port did not care about who would be in charge of making the containers flow smoothly from dry port to seaport and vice versa:

Actually, we do not care about [cargo flows]; we also do not inform the [inland clearing depot (ICD)] about the content … Normally, when the cargoes arrive at the port … the customer can hire any vehicle from a transportation company at any given time … It is up to the customer. (SP03)

It was different for the ports that saw themselves as the nodes of a supply chain; there, the sharing of information between participants in the supply chain was seen as a necessary task for each participant. This viewpoint was emphasised in an interview with another seaport operator:

The port plans to receive ships and notify ICDs via the email system … [We] inform the ICDs about the ships' times of arrival and departure so that the ICDs can be proactive in receiving export cargo and setting the closing time of the cargo. (SP06)

The information shared could be about goods or customers' needs and requirements and would include any information that could be helpful for supply chain partners.

[A]ll the information about the customer, about the schedule, about the operational plans of the two parties and the needs of the customers. (SP01)

The level of information sharing can be seen through the means of sharing, for example, emails, phone calls, direct meetings or shared software. This was evidenced in interviews with both dry port and seaport operators.

As in other businesses, information is exchanged [between ICDs and seaports] mainly via emails and the phone. (DP02)

[We] inform ICDs and shipping lines directly … and the shipping lines also know their routes through data reporting systems. The port interacts with the carrier's system through the Electronic Data Interchange EDI system. (SP06)

The need to improve ways of sharing information was mentioned in an interview with a dry port operator, who explained the reason for parties to cooperate with each other:

> *In order to serve the shipping lines well, these two parties [the dry port and the seaport] must discuss how to do it [improve information sharing], and this is mandatory.* (DP01)

It was found from the interview data that there are different levels of DPSP-I. This can be seen in the type of information shared and the ways of sharing it between the partners in the supply chain. For a port that does not see itself as a node or a player in a supply chain, it is likely that the responsibility of each port is defined by its physical border. Furthermore, there is a higher level of information integration practice in the South than in the North according to the information from Table 4.1. In the main, dry ports in the North are small and have lower accessibility. However, it is likely that the type of information shared and the way it is shared between a dry port and a seaport will be enhanced as the level of DPSP-I increases. Information sharing is necessary to the collaboration of a dry port–seaport dyad.

4.3.2. Operational integration

Cooperation between dry ports and seaports in supply chains, i.e. working together to enhance the collaboration between them, was found in the participants' working practices; however, the levels of collaboration varied. There was little collaboration between a dry port and a seaport when the seaport operator (e.g. SP02) thought that it was unnecessary. Another seaport operator saw such collaboration as a one-way connection in which the seaport assumed itself to be the decision-making centre and dry ports were seen merely as followers:

> *No, we made a request; they followed because they don't know the peculiarities of port work, so how can they give an opinion?* (SP04)

It was different with a dry port that highly appreciated the relationship with its counterpart in the supply chain. This collaboration in daily operational activities was described by the dry port operator:

> *First, the plan of the schedule is sent …, then the schedule of departure time and arrival time is sent once the barge is running, and, when the ship is close to arrival in port, we again make contact to report that we will arrive soon and are waiting for permission, as in the contract.* (DP01)

A seaport operator had the same viewpoint on the collaboration between dry ports and seaports. The cooperation between the two was apparent in every stage of cargo transportation:

> *The sharing of detailed information on operational activities will take place every day, every hour. Sometimes we have a specialised department to connect with ICDs, to supervise the barges' schedules and inform the vendors … and make cargo contracts in which there are statements of how many days the cargo will be stored at ICDs.* (SP01)

With regard to the shared responsibilities and risks in their supply chain, one seaport operator stated that these depended on the rights and responsibilities specified for each party in the cooperation contract; however, collaboration in sharing risks was necessary:

> *In terms of each party's responsibilities related to incurring risk, the port and ICD will state the rights and responsibilities that each party has to share … If there is a dispute, we discuss it together to find a solution.* (SP06)

It is apparent that the levels of dry port–seaport collaboration in supply chains vary, ranging from almost no collaboration to highly collaborative operating practices. In a highly integrated dry port–seaport dyad, cooperation between these nodes to meet their common customers' needs happens daily and involves many collaborative activities at every stage of cargo transportation. As with information integration, the level of operational integration is higher in the South than in the North (see Table 4.1).

4.3.3. Relationship integration

As with both information integration and operational integration in the dry-port–seaport dyad, relationship integration was found to exist at different levels in practice. Those who viewed dry ports and seaports as entirely independent business players saw collaboration and support from the other partner as unnecessary. As a seaport operator, SP07 made such an assumption, referring to dry ports as merely places to store containers.

> *There is no need to contact [the dry port operator] because that guy does not share his profits with us.* (SP07)

It was quite different for operators who realised the benefit to be gained from collaboration between a dry port and a seaport in a supply chain. The nurturing of the dry port–seaport

relationship and an appreciation of daily cooperation to improve it was described by one dry port operator:

> *The coordination is supposed to be supportive … [It is] very important. If the two parties rigidly lack reciprocal support, this cooperation will collapse immediately because the practice of transporting, loading and unloading depends on many objective factors, such as the weather, rain and wind, … machinery and … everything, so it cannot be inflexible.* (DP01)

To ensure a sustainable relationship, some of the dry ports and seaports participating in this study highly appreciated the cooperation established with their counterparts through long-term contracts. Talking about these contracts, DP01 stated that his dry port had collaboration contracts with many seaports and in turn, a seaport has collaborative contracts with many dry ports, while DP02 emphasised that the target of dry port–seaport cooperation was to meet their common customers' requirements.

> *Basically, the nature of the job is to support customers in exporting and importing cargo as smoothly, quickly … and safely as possible, … without any loss or damage.* (DP02)

The symbiotic nature of the relationship between dry ports and seaports was mentioned many times in the interviews with DP02, SP02 and SP06. The 'symbiotic' could be understood as 'mutually beneficial'.

> *The relationship between ICDs and seaports … is a relationship of resonance and symbiosis.* (SP06)

Through their practical experiences, these dry port and seaport operators realised that such symbiosis in the relationship had brought remarkable benefits and advantages to both seaports and dry ports.

> *Symbiosis exists here … The ICDs are located close to manufacturers, so a large number of cargoes can be gathered in the ICDs before being transferred to seaports.* (SP04)

> *It is clear that the cooperation between seaports and ICDs will bring many mutual profits and mutual benefits.* (SP05)

The dry ports and seaports in well-integrated supply chains all highly appreciated the contribution of their counterparts in cooperation and found that their collaboration led to an increase in their annual revenue. Arguing on this issue, one seaport operator said:

> *The collaboration between ICDs and seaports will enhance the competitiveness capacity of the seaports …, increase the number of customers using the seaport's services, increase the cargo throughput of the seaport and mean there is an increase in revenue resulting from the port's operational activities.* (SP01)

The interview data shows that seaports and dry ports that believe in the symbiotic relationship of the dry port–seaport dyad often want to build long-term collaboration. This desire is presented not only in their cooperation contracts but also in their daily activities, including planning, operating, performance evaluating, risk sharing and making improvements.

> *Operational information is mainly exchanged via email [and] phone. After a contract is signed, information, including goods delivery notes [and] inventory … is exchanged daily via phone.* (SP06)

It was also recognised that the level of relationship integration is greater in the South than in the North according to the information from Table 4.1.

4.3.4. Geographic integration

The connection between dry ports and seaports in terms of geographic location was identified through the interview data as a factor that could reveal the level of DPSP-I. One seaport operator who saw no reason to collaborate with dry ports saw the location of a dry port merely as a reactive action to a problem at a certain time:

> *There is a lot of congestion in the port, and … a two-hectare construction next to the port will be constructed to accommodate the goods …, and it is called an ICD … but I just call it …, well, a container yard.* (SP07)

However, it was different for the operators who appreciated the collaboration between dry ports and seaports; they believed that the reason that customers selected a particular dry port as the cargo dropping point (e.g. due to cost savings) provided a way to encourage their customers to stick with them. This was seen in the explanation of one dry port operator about the advantage of the dry port's geographical location:

> *Customers also do not want to go straight to the Cai Mep area because it is far, leading to high transportation costs … People want to unload at ICDs here to have cost savings … For example, a container transported [by road] from Binh Duong to Cai Mep would cost VND 7 million to 8 million and a lot of extra arising costs. But if waterways [from the ICD] are used, it would be much cheaper; customers recognise that it is cost-saving, that's important and time-saving as well.* (DP01)

The selected locations of some participating dry ports in this study – for example, in the centre of an industrial processing zone or next to a river transport network – had brought these dry port–seaport dyads certain competitive advantages.

> *The location of the port … is very convenient; first, it is in Ho Chi Minh City with the regional customs office No. 4, and it is located at the eastern gateway of the city, connecting with some neighbouring provinces where many industrial parks [and] manufacturing areas are located.* (DP02)

> *ICDs in the city are also in appropriate positions, i.e. near the manufacturers, and they are located to take advantage of transportation from the waterway system.* (SP01)

It is apparent that the selection of locations for setting up these dry ports was strategically considered and assessed in advance in order to obtain competitive advantages. The consideration of this factor during the construction of a dry port can decisively contribute to its long-term integration later.

The interview data show that the geographical location of a dry port or seaport may enhance or inhibit the collaboration between it and another port. In other words, the integration tendency of each dry port–seaport dyad can be addressed by looking at the relationship between the nodes in the supply chain in terms of geographical location. The level of geographical integration was found to be greater in the South than in the North (see Table 4.1).

4.3.1. Other findings

From the interview data, it was observed that, in the context of Vietnam, customs procedures significantly influenced the collaboration between dry ports and seaports. It is likely that seaports and dry ports that want to collaborate have straightforward customs procedures because these ports can get more customers than the others. This was explained by one dry port operator:

> *And any ports where there are simple and convenient customs procedures, open government agencies, it is very important; in Ho Chi Minh City, there are many ports, but why is this port … always full of customers while there are other ports that customers would not call at? It is also due to … more convenient locations and transportation customs procedures*. (DP01)

With the same experience as DP01, both DP02 and SP02 stated that their customers tended to select dry port–seaport dyads with '*good customs*', which provide '*simple and neat customs procedures, … and customs sub-departments are … flexible in supporting customers*' (DP02).

However, in the context of Vietnam, it is realised that the influence of customs procedures is a result of the interaction of a dry port and a seaport with a customs system that acts as a third party or an outsider to the dry port–seaport dyad. Therefore, it is argued in this study that customs procedures should not be taken as one of the criteria by which to measure DPSP-I.

4.4. The impact of dry port-seaport integration on seaport performance.

4.4.1. The impact of dry port-seaport integration on port service quality.

4.4.1.1. Price

In almost all the interviews, the seaport and dry port operators emphasised service price as an important criterion by which to evaluate seaport service quality, because their experience was that a competitive price was an advantage that often brought more customers.

> *The port with good prices [and] good service will attract customers day by day*. (SP01)

> *The price factor is the biggest consideration; although the port does well, if the price is not good, it is impossible to attract customers*. (DP02)

The other participants, i.e. logistics and shipping companies, agreed; for example, both LC01 and SC01 stated that service price was important among the many criteria for evaluating seaport service quality.

Therefore, many seaports pay attention to their collaboration with dry ports as a means to make prices more competitive, either via the transporting of large tonnage by waterways (especially in the south) or by providing better service (i.e. convenience) to customers.

Normally, in the south, the cargo is gathered [at ICDs] and then transferred to the seaports by rivers … It saves costs … because a large volume of cargo can be transferred at one time … but in the north, there is no such thing. (SP04)

4.4.1.2. Speed and timeliness

Seaport integration with ICDs results from demand from port operatives and (mainly) from customers. Customers want to unload their goods at ICDs on their doorsteps to obtain time savings, cost savings and the avoidance of risk to their cargo. The high number of parties involved in operational activities leads to timeliness being a necessity, and to enhanced port service speed being a criterion of competitiveness improvement.

The ship's operating turnaround increases very quickly; the ship saves operating costs; the shipping lines increase the ship's operating turnaround, which is the profit they get. For logistics enterprises, logistics enterprises benefit in terms of time. In the past, an average customer vehicle entering the port could stay in the port for 90 minutes; now it is only about 45 to 46 minutes, and the waiting fees are less, the delivery time is shorter, more accurate, there is no error. That difference benefits logistics enterprises, but for ports, the benefits are also relatively large. (SP06)

Another problem is that river transport [from ICDs to seaports] might take longer but be a more accurate time. (DP02)

The people [at seaports] just want ships to go quickly so they can receive others … and ICDs help them in this case. (DP01)

It is apparent that integration with ICDs not only provides seaport customers with competitive prices, but also enhances port service quality in terms of the speed and timeliness of port service.

4.4.1.3. Safety and security

Another criterion emphasised in the interviews was the safety and security of the cargoes transported through dry port–seaport dyads. Both dry port and seaport operators in this study stated that their customers required assurance of safety and security to prove the good quality of their service.

The first quality of a seaport is operations: safe, fast and scheduled operations. Safety includes the integrity of goods and ships [and] a correct schedules guarantee. (DP02)

> *The next one is security of goods in the port. Although we commit to our customers that we guarantee 100% of goods quality, ensuring that the customers' goods are not stolen or damaged, how can we control that? We must have good security … a good security system. The [next] one is safety: we must have good equipment and skilled workers.* (SP01)

It was found through the interview data that, in maritime logistics as in other sectors, safety and security are seen as an important criterion by which to measure service quality; DPSP-I enhances the safety and security of cargo during its transport to seaports.

4.4.1.4. Management

The participants of this study saw management quality from different perspectives relating to different seaport activities. This could be observed in what they said about management as a criterion for evaluating seaport service quality, especially in the collaborative dry port–seaport relationship.

> *[Having a] warm welcoming attitude to customers.* (DP01)

> *Talking about port service means primarily talking about technology.* (SP06)

> *When they [the customer] encounter a problem, and they can contact the port in an easy way to handle the issues, which easily happens in operating activities relating to many parties [dry ports, seaports, logistics companies] … that is a good point in the port's service … so every port has a troubleshooting centre to make sure customer issues can be handled 24/7. That is also a good point of port service.* (SP01)

How quickly a seaport responds to the requirements of its customers, including those from dry ports, the attitude of seaport administrative staff, how punctually a seaport provides necessary information to its customers, how a seaport reacts and solves an emerging problem, how a seaport supports its customers, the technology used in each port, and so on, were all factors equated with the management quality of seaports.

This finding from the interview data suggests that although management quality is positively impacted by DPSP-I, it is a complicated criterion by which to measure seaport service quality, and, therefore, a variety of questions should be used to investigate service quality in terms of management quality.

4.4.1.5. Other findings

In the interviews, some participants said that seaport reputation, environment and social responsibility resulted from the DPSP-I relationship when asked what the seaport had done in these areas.

However, none of these factors were cited as criteria for evaluating port service quality. These issues were seen mainly as separate social activities relating only to their communities.

Due to image and social responsibility having little connection to seaport service quality in the practical context of Vietnam, these were not taken in as criteria for measuring seaport service quality in this study.

4.4.1.6. Impact of dry port–seaport integration on port service quality

The interview data demonstrate that customers differ in their levels of satisfaction with seaport service quality.

> *With the shipping company, the shipping timetable is the most important, but for customers, they don't care about the shipping timetable, they care about how they can get the goods quickly, conveniently and at a reasonable price.* (DP01)

When asked about seaport service quality, some seaport customers, i.e. shipping companies, logistics companies and dry ports, went so far as to equate it with their customers' needs and requirements, and this led to the finding that the criteria by which to measure seaport service quality and those by which to measure customer performance are much the same.

4.4.2. Impact of dry port–seaport integration on customer satisfaction

4.4.2.1. Cost satisfaction

In line with the price criterion of service quality is the cost satisfaction criterion of customer performance. It is apparent that competitive pricing is an important factor in satisfying and attracting seaport customers. When asked about customer satisfaction, one dry port operator mentioned first 'a reasonable price':

> *For the assessment of satisfaction with the seaport, if it is a shipping company, will they care about, for example, whether this port has a reasonable price, good operation, professional staff and modern terminals, or not? As for import and export customers,*

they care about where I receive my goods, where I can save costs and clear procedures. (DP01)

It was the same with the shipping company of SC01; when asked to give his opinion about seaport service quality from the perspective of a customer, this participant stated that, for him, the price of the service was important:

For the sales department, what is important is the price that the port applies to the customer. (SC01)

A logistics company (LC02) had the same viewpoint as SC01; however, this participant emphasised the unofficial costs that are supplementary to the stated price provided by a seaport.

In fact, besides the official price written on paper, such as invoices, there are a lot of other costs, such as commission. That is the issue in the transportation industry in Vietnam. (LC02)

Therefore, in the context of Vietnam, both the price announced officially and the unofficial costs that customers have to pay in practice influence customer satisfaction.

4.4.2.2. Timeliness satisfaction

In maritime logistics, being on time has long been seen as the most important criterion for satisfaction, be it for ports or port users. A shipping company representative, asked about criteria relating to customer satisfaction, mentioned the words 'on time' first in relation to loading and unloading cargo:

Our goal to satisfy customers is to be on time. (SC02)

A logistics company representative went further, emphasising the target of increasing ship 'turnaround':

We measure the average berthing time; the speed of the ship's turnaround [is] the most important, that is, how the ship is turned around quickly, without delay. (LC01)

Having the same viewpoint, a dry port operator also emphasised the speed of container handling when asked about customer satisfaction:

[C]ontainer delivery must be done quickly and conveniently. (DP01)

Although the ways through which to benefit seaport customers (shipping companies, logistics companies, etc.) differ, seaports and their customers can save money together through the shared goal of reducing scheduled loading and unloading times.

4.4.2.3. Safety and security satisfaction

The need for cargo safety and security was apparent in all the interviews with shipping and logistics company representatives. This was a seaport operations director's first concern when asked about satisfaction with seaport service quality.

> *The most important thing is safety, punctuality and productivity … including the barge service, the arrangement of the port service so that it is efficient [and] the container diagrams for ensuring the time cargo spends in the port is minimised.* (SC01)

Both LC01 and DP01 assumed that it was the seaport's responsibility to provide a safe and secure service; this is one of the criteria for satisfying seaport customers.

> *Second, it is about safety and security.* (LC01)

> *Store [and] manage containers in a safe manner … avoiding any loss or damage to containers.* (DP01)

It is apparent that, in line with findings in other transport sectors, safety and security are common criteria used to evaluate customer satisfaction in the maritime sector, and that seaport service quality is not a special case. The safety and security of cargo transported between dry ports and seaports is enhanced when a seaport collaborates with a dry port close to its warehouse. A director of a seaport gave his opinion:

> *The customers are pleased because their cargo risk can be transferred from them to seaports at their doorstep-ICDs.* (SP04)

It is obvious that the safety and security of cargo is a focus for both ports and their customers, and that it is enhanced by the relationship between dry ports and seaports.

4.4.2.4. Management satisfaction

The interview data shows that customers were greatly concerned with seaport management and saw this as a criterion by which to evaluate seaport service quality. A shipping company representative mentioned the arrangements seaports make in order to service vessels:

> *[F]or example, when our ships arrive, whether the goods will be readily packed, and how many cranes you arrange to handle our vessels.* (SC01)

Another shipping company representative focused on the ways seaports cooperate with their customers to solve emerging problems as a criterion to determine level of satisfaction with seaport service quality.

> *The marketing department [of the seaport] has a meeting with us once a month. In the meeting, they can speak up about how they can support us to handle [the issues] immediately*. (SC02)

From the perspective of logistics companies, it was emphasised in interviews that the use of technology, especially information and communication technology, can facilitate information and data exchange between seaports and their customers. This, in turn, enhances seaports' understanding of their customers' requirements and expectations, which enables them to serve customers better, with the consequence of increasing customer satisfaction with seaport service quality. One interviewee elaborated on this as follows:

> *[With regards] to service quality, such as how to exchange information or how to support [customers] using software systems … third, in terms of procedure, we are becoming more and more modern. Online payment (provided by the seaport) is very convenient.* (LC01)

It is evidenced through the interview data that customer satisfaction with management quality contributes to overall satisfaction with a seaport's service quality. In addition, this satisfaction may accrue from a variety of aspects of seaport management (e.g. operational planning and implementation, help and support rendered to address customers' problems and the application of technology in customer service) within the management quality dimension of seaport service quality.

4.4.3. Impact of dry port–seaport integration on financial performance

The business goals of an enterprise are normally divided into financial and non-financial goals; both are important to enterprise competitiveness. Revenue, costs and profits are crucial indicators of financial goals. The factors affecting financial indicators always attract the attention of the managers and strategic planners of organisations. The interviewees gave a variety of opinions on the impact of DPSP-I on seaport financial performance and efficiency.

For example, the head of the operations department in a logistics company and a director of a shipping line (LC02 and SC01, respectively) expressed the view that collaboration with dry ports increases financial and time costs due to the duplication of cargo handling.

> *Costs rise because they have to load/unload cargo at both the dry port and the seaport … and therefore … the time is longer.* (LC02)

However, the director of a seaport said that although costs rise slightly, there is an increase in revenue and in the number of customers using the seaport service related to cargo handling; this leads to increased profits and financial efficiency.

> *That cooperation increases the cost every year … but, overall, … that cost increase means the revenue also increases thanks to the relationship with ICDs and ICDs bringing in a lot of cargo for [the seaport].* (SP04)

Participant LC02 is employed by a company working in the north of Vietnam, whereas SP04 works for a seaport in the south whose collaborative relationship with dry ports is well developed. It is obvious that a seaport having a relationship of competition with, or, indeed, independence from a dry port experiences the disadvantages of financial integration, while for a seaport having a well-integrated relationship with a dry port, the advantages of such integration can be recognised.

4.5. Revised conceptual model and measurement framework

Based on the findings from the interview data, the proposed conceptual model and conceptual measurement framework, including four proposed constructs (DPSP-I, port service quality, customer satisfaction and financial performance) and 28 initial items, were retained; however, a new dimension – geographical integration, measured by three items – was added to the model and to the framework, as shown in Figure 4.1 and Table 4.2. The dry port–seaport construct thus includes four dimensions: information integration (measured by three items), relationship integration (measured by four items), operational integration (measured by five items) and the new dimension, geographical integration (measured by three items). The port service quality construct comprises eight items, customer satisfaction comprises five items and financial performance comprises three items.

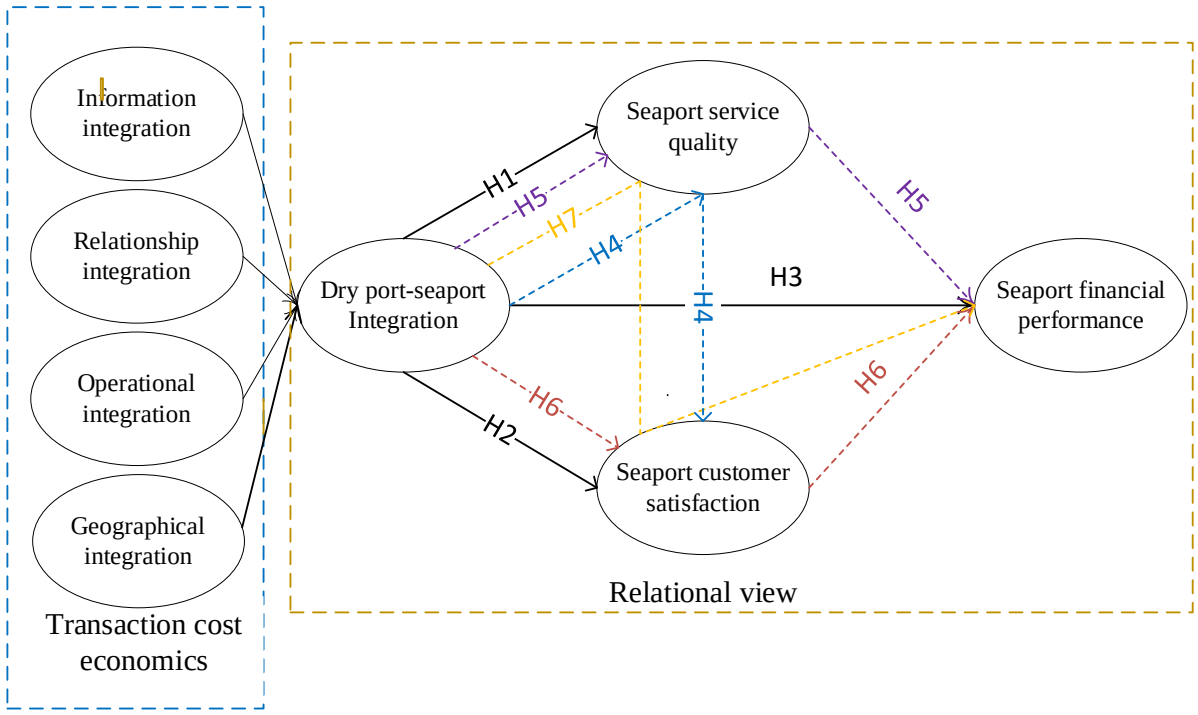


Figure 4.1- Revised conceptual model

Table 4.2- Conceptual measurement framework

Construct	***Dimensions***	***Definition***	***Proposed measurement***	***Adopted literature***	***Revised measurement***	***References***
Dry port–seaport integration	Information integration	Information integration refers to the sharing of information to ensure compatibility in dry port-seaport communication	Information is shared regarding containers transported in the hinterland between seaports and dry ports.	Fawcett, Magnan and McCarter (2008); Song and Panayides (2008); Woo, Pettit and Beresford (2013); Seo, Dinwoodie and Roe (2015)	Information is shared regarding containers transported in the hinterland between seaports and dry ports.	Fawcett, Magnan and McCarter (2008); Song and Panayides (2008); Woo, Pettit and Beresford (2013); Seo, Dinwoodie and Roe (2015) Findings from interviews
			The shared information of containers transported in the hinterland between seaports and dry ports can be integrated into the information system without manual input		The shared information of containers transported in the hinterland between seaports and dry ports can be integrated into the information system without manual input	
			Seaports and the dry ports work together to address issues in sharing information related to containers transported in the hinterland between the ports as soon as they arise.		Seaports and the dry ports work together to address issues in sharing information related to containers transported in the hinterland between the ports as soon as they arise.	
		Operational integration refers to the	Seaports and dry ports exchange operational plans relating to containers	Tongzon, Chang and Lee (2009); Cao *et al.* (2010);	Seaports and dry ports exchange operational plans relating to containers	Tongzon, Chang and Lee (2009); Cao *et al.* (2010); Flynn,

Construct	*Dimensions*	*Definition*	*Proposed measurement*	*Adopted literature*	*Revised measurement*	*References*
	Operational integration	integration-enhancing joint activities, work processes, decisions, etc. of dry ports and seaports in a supply chain.	transported in the hinterland between the ports.	Flynn, Huo and Zhao (2010)	transported in the hinterland between the ports.	Huo and Zhao (2010) Findings from interviews
			Seaports and dry ports coordinate operational activities relating to containers transported in the hinterland between the ports.		Seaports and dry ports coordinate operational activities relating to containers transported in the hinterland between the ports.	
			Seaports and dry ports jointly respond to operational emergencies relating to containers transported in the hinterland between the ports.		Seaports and dry ports jointly respond to operational emergencies relating to containers transported in the hinterland between the ports.	
			Seaports periodically discuss with dry ports ways to improve operational plans relating to containers transported in the hinterland between the ports to meet mutual customer requirements.		Seaports periodically discuss with dry ports ways to improve operational plans relating to containers transported in the hinterland between the ports to meet mutual customer requirements.	
			Seaports periodically discuss with dry ports ways		Seaports periodically discuss with dry ports ways	

Construct	*Dimensions*	*Definition*	*Proposed measurement*	*Adopted literature*	*Revised measurement*	*References*
			to improve operational ability and capability to meet mutual customer requirements.		to improve operational ability and capability to meet mutual customer requirements.	
	Relationship integration	Relationship integration refers to the strategic connection between dry ports and seaports.	Seaports value the contribution of dry ports in providing services that suit our and customers' requirements.	Vijayasarathy (2010) Boon-itt and Pongpanarat (2011)	Seaports value the contribution of dry ports in providing services that suit our and customers' requirements.	Vijayasarathy (2010) Boon-itt and Pongpanarat (2011) Findings from interviews
			Seaport value long-term collaborative service contracts with dry ports.		Seaport value long-term collaborative service contracts with tdry ports.	
			The level of seaport investment in specific equipment, capacity, and personnel to meet the requirements of mutual customers with the dry port is extensive.		The level of seaport investment in specific equipment, capacity, and personnel to meet the requirements of mutual customers with the dry port is extensive.	
			Seaport periodically discuss with the dry ports for assessment and improvement of the collaborative relationship.		Seaport periodically discuss with the dry ports for assessment and improvement of the collaborative relationship.	

Construct	*Dimensions*	*Definition*	*Proposed measurement*	*Adopted literature*	*Revised measurement*	*References*
	Geographical integration	Geographical integration refers to the strategic selection of a port location to enhance the integration of dry port – seaport dyads			The location of dry ports is strategically selected to attract more customers and cargo into the supply chain.	Findings from interviews
					The location of dry ports is strategically selected to reduce transport costs.	
					The location of dry ports is strategically selected to facilitate better cooperation with seaports.	
Seaport service quality	Seaport's service quality	Resources refers to port equipment, facilities, infrastructure condition and availability; financial stability, and shipment tracing capability.	The speed of seaport service delivery for customers including those of dry ports.	Thai (2008)	The speed of seaport service delivery for customers including those of dry port.	Thai (2008) Findings from interviews
			The level of competitiveness of seaports' price of service.		The level of competitiveness of seaports' price of service.	
			The level of safety and security of shipments in seaports, including those of dry ports.		The level of safety and security of shipments in seaports, including those of dry ports.	

Construct	*Dimensions*	*Definition*	*Proposed measurement*	*Adopted literature*	*Revised measurement*	*References*
			The level of error in issuing invoices and documents in seaports.		The level of error in issuing invoices and documents in seaports.	
			The level of consistency of seaports' service provision for customers, including those of dry ports.		The level of consistency of seaports' service provision for customers, including those of dry ports.	
			The level of availability of seaports' services for customers including those of dry ports.		The level of availability of seaports' services for customers including those of dry ports.	
			The level of improvement of seaports' services through feedback from customers including those of dry ports.		The level of improvement of seaports' services through feedback from customers including those of dry ports.	
			The overall level of efficiency of seaports' operation and management.		The overall level of efficiency of seaports' operation and management.	
Seaport customer satisfaction	Cost	Cost satisfaction	The level of satisfaction with the cost of seaports' service from your	Anderson, Baggett and Widener (2009); Pantouvakis	The level of satisfaction with the cost of seaports' service from your customers including those of dry ports.	Anderson, Baggett and Widener (2009); Pantouvakis (2010); Cao and Chen

Construct	*Dimensions*	*Definition*	*Proposed measurement*	*Adopted literature*	*Revised measurement*	*References*
			customers including those of dry ports.	(2010); Cao and Chen (2011); Tang and Sun, (2015); Yeo, Thai and Roh (2015)		(2011); Tang and Sun, (2015); Yeo, Thai and Roh (2015) Findings from interviews
	Timeliness	Timeliness satisfaction	The level of satisfaction with seaports' service timeliness from customers including those of dry ports.		The level of satisfaction with seaports' service timeliness from customers including those of dry ports.	
	Goods safety and security	Goods safety and security satisfaction	The level of satisfaction with the safety and security of containers through seaports from your customers including those of dry ports.		The level of satisfaction with the safety and security of containers through seaports from your customers including those of dry ports.	
	Information	Information satisfaction	The level of satisfaction with the information about containers through a seaport from the seaport's customers including those of dry ports.		The level of satisfaction with the information about containers through a seaport from the seaport's customers including those of dry ports.	
	Management	Management satisfaction	The overall level of satisfaction with the operations and management		The overall level of satisfaction with the operations and management	

Construct	*Dimensions*	*Definition*	*Proposed measurement*	*Adopted literature*	*Revised measurement*	*References*
			of seaport from seaport's customers including those of dry ports.		of seaport from seaport's customers including those of dry ports.	
Seaport financial performance	Revenue	Overall financial performance related to revenue	Revenue is increasing	Chang *et al.* (2016)	Revenue is increasing	Chang *et al.* (2016) Findings from interviews
	Cost	Overall financial performance related to cost	The extent of cost efficiency		The extent of cost efficiency	
	Profit	Overall financial performance related to profit	Profit is increasing		Profit is increasing	

4.6. Construction of the survey questionnaire

Based on the revised conceptual model and the revised conceptual measurement framework described in Figure 4.1 and Table 4.2, a survey questionnaire was constructed (Appendix 2). The four main parts of this survey questionnaire investigate DPSP-I, seaport service quality, seaport customer performance and seaport financial performance.

Dry port–seaport integration was investigated through four dimensions: information integration (three questions), operational integration (five questions), relationship integration (four questions) and geographic integration (three questions). Participants selected answers on a Likert scale with five levels from 'totally disagree' to 'totally agree'.

Seaport service quality was measured by four dimensions: level of competitiveness of seaports' price of service (one question), timeliness (one question), safety and security (one question) and management (five questions). Participants selected answers on a Likert scale with five levels from 'very low'/'very slowly' to 'very high'/'very quickly'.

As with seaport service quality, seaport customer performance was investigated through four dimensions: cost satisfaction (one question), timeliness satisfaction (one question), safety and security satisfaction (one question), and management satisfaction (two questions). Seaport financial performance was investigated through three dimensions: seaport revenue, cost and profit. Participants selected answers on a Likert scale with five levels from 'very low' to 'very high'.

The findings from the interview data helped the researcher to revise the conceptual model and the conceptual measurement framework to forms more suitable in the context of maritime logistics in Vietnam. This revision laid the foundations for the construction of an appropriate survey questionnaire to examine DPSP-I in Vietnam, as well as the relationship of this integration with seaport service quality and seaport customer satisfaction/performance. The results of the survey will be described in the next chapter.

4.7. Conclusion

This chapter focuses on the empirical results of 14 face-to-face interviews. The semi-structured interview tool, with its open-ended question format, was employed as the technique for the interviews. The interviews aimed to create a rich picture of the dimensions of DPSP-I in the

context of Vietnam's maritime sector. The results were found to support the initial research model presented in Chapter 2. Particular, DPSP-I comprises four dimensions including information integration measured, operational integration, relationship integration and geographic integration. These dimensions are measured by three, five, four and three items respectively. Further, the impact of DPSP-I on seaport performance in terms of port service quality, customer satisfaction and financial performance varies; this variation depends on the level of the integration between dry ports and seaports. The following chapter describes how a quantitative survey was conducted to validate the conceptual model and empirically test the study hypotheses.

Chapter 5. SURVEY FINDINGS

5.1. Introduction

Chapter 5 reports the results of data analysis (following the methods and steps described in Chapter 3) and findings from that analysis. After this introduction, the information of demographic profile of respondents are presented (Section 5.2). Following, the data examination is given (Section 5.3). Exploratory factor analysis (EFA) to purify the measurement scales is presented in Section 5.4. The evaluations of the first- and second-order measurement models are reported in Section 5.5 and Section 5.6, respectively. Next, the results of a structural model evaluation that includes five steps – collinearity assessment, structural model path coefficient, coefficient of determination, effect size (f^2) and predictive relevance (Q^2) – are demonstrated in Section 5.7. The analysis of the mediating effect is explored in Section 5.6. The last section (Section 5.8) summarises the results of the analysis.

To facilitate understanding of the analysis, Table 5.1 briefly describes the analysis methods and their corresponding rules of thumb.

Table 5.1- Overview of the data analysis techniques

Analysis	***Purpose***	***Technique***	***Rule of thumb***	***References***
DATA SCREENING				
Missing data and unengaged responses	To examine missing data.	Frequencies analysis	Missing = 0	Tabachnick and Fidell (2013)
	To examine unengaged responses.	Standard deviation of the scores of each case (STDEV.P)	STDEV.P > 0	Tabachnick and Fidell (2013)
Univariate outliers	To identify cases of extreme value on a single variable.	Standardised score (Z-scores)	−3.0 < value < +0.3	Hair *et al.* (2019)
Multivariate outliers	To identify cases of odd combinations of extreme values in two or more variables.	Mahalanobis' D^2	$D^2/df > 3$ or $p < 0.001$	Hair *et al.* (2019); Tabachnick and Fidell (2012)
Normality	To examine the data distribution of the scores of each item.	Skewness and kurtosis	−2.58 < value < +2.58	Hair *et al.* (2019)
EXPLORATORY FACTOR ANALYSIS				
Exploratory factor analysis	To identify latent variables.	Eigenvalues of factor	Eigenvalue > 0.7	Hair *et al.* (2019)
		Cronbach's alpha (α)	α > 0.5	
	To ensure that measures are free from error and, therefore, yield consistent results.	Item-to-total correlation	Value > 0.3	
		Communality	Value > 0.5	
		Kaiser-Mayer-Olkin (KMO)	Value > 0.5	
	To confirm that the scale selected for the present study is supported by the data.	Bartlett's test of sphericity	$p < 0.05$	
		Factor loadings	Value > 0.4	

Analysis	*Purpose*	*Technique*	*Rule of thumb*	*References*
FIRST-ORDER REFLECTIVE MEASUREMENT MODEL EVALUATION				
Reliability	To examine the consistency and stability of a measurement scale.	Composite reliability	Value > 0.7	Hair *et al.* (2019)
Convergent validity	To examine the extent to which a measure correlates positively with alternative measures of the same construct.	Indicator's outer loadings	Value > 0.7	Hair *et al.* (2019)
		Average variance extracted (AVE)	AVE > 0.5	Fornell and Larcker (1981)
Discriminant validity	To examine the distinction between two or more conceptually similar concepts.	Square root of AVE ($\sqrt{AVE}$)	$\sqrt{AVE}$ > the correlation with other variables of latent variable	Fornell and Larcker (1981)
		Indicator's outer loadings	Value > all cross loadings with other constructs	Hair *et al.* (2019)
SECOND-ORDER FORMATIVE MEASUREMENT MODEL EVALUATION A two-step approach was applied. The evaluation procedure was based on the same guidelines as the first-order reflective model evaluation.				
Convergent validity	To examine that the selected indicators cover all relevant aspects of the formative construct.	Inter-item correlations; inter-construct correlation	$p < 0.05$	Lowry and Gaskin (2014)
Significance of formative indicators	To test whether an indicator relatively and absolutely contributes to form the formative construct.	Indicator's outer weight	t-value > 1.96 at significance level 5%	Hair *et al.* (2017)
		Indicator's outer weight	Value > 0.5	Hair *et al.* (2017)
STRUCTURAL MODEL EVALUATION				
Collinearity assessment	To check the presence of collinearity issues.	Variance inflation factor (VIF)	VIF < 3.3	Petter *et al.* (2007)
Path coefficients (β value)	To examine the significance of structural model relationships.	t-value	t-value > 1.96 at significance level 5%	Hair *et al.* (2017)

Analysis	*Purpose*	*Technique*	*Rule of thumb*	*References*
Coefficient of determination (R^2 value)	To determine what percentage of an endogenous variable' s variance can be explained by exogenous variables.	R^2 value	Value of: 0.25 = weak; 0.5 = moderate; 0.75 = substantial	Hair *et al.* (2017)
Effect size (f^2)	To examine the substantive influence on the endogenous variables of omitting a selected exogenous variable.	f^2	Value of: 0.02 = small; 0.15 = medium; 0.35 = large	Cohen (1992)
		Stone-Geiser's Q^2 value	Q^2 value > 0	Hair *et al.* (2017)
Model's predictive relevance	To evaluate the magnitude of the R^2 value.	Effect size (q^2)	Value of: 0.02 = small; 0.15 = medium; 0.35 = large	Chin (1998)
ANALYSIS OF MEDIATING EFFECTS				
Significance of direct effect	To examine the path coefficient of direct relationship without a mediator variable.	Significance of β value	t-value > 1.96 at significance level 5%	Hair *et al.* (2017)
Significance of indirect effect	To examine the path coefficient of indirect relationship without a mediator variable.	Significance of β value	t-value > 1.96 at significance level 5%	
Variance accounted for (VAF)	To calculate how much of the direct effect is absorbed by the indirect effect.	VAF	VAF > 80% = full mediation; 20% < VAF < 80% = partial mediation; VAF < 20% = no mediation	

5.2. Demographic profile of respondents

The profiles of the survey respondents from each of the different 88 seaports which participated in the survey are shown in Table 5.2. The profiles comprise the respondents' designation and working experience in their position.

Table 5.2- Profile of respondents

Working experience in the port sector (year(s))	***Frequency***	
	Number	***%***
Less than 1	0	0.00
1 to 5	37	42.05
More than 5	51	57.95
Total	***88***	***100.00***
Designation		
Executive Vice President	1	1.14
Operations director	25	28.41
Deputy director of operations	28	31.82
Director of information technology	2	2.27
Operations manager	11	12.50
Deputy manager of operations	12	13.64
Sale manager	6	6.82
Operations team leader	3	3.41
Total	***88***	***100.00***

In terms of working experience, out of the 88 respondents that replied to the survey and passed the data examination and preparation test, 51 respondents (57.95%) and 37 respondents (42.05%) have more than 5 years and 1 – 5 years of working experience in in the port industry. Furthermore, the majority of respondents hold the position of senior manager (63.64%), followed by manager (32.95%) and other (3.41%).

5.3. Data examination

The stage of data examination plays an important role in the application of partial least squares structural equation modelling (PLS-SEM). Issues resulting from missing data, straight lining, outliers or non-normal data may result in bias or distorted results. It is therefore crucial for an honest analysis of the data to consider and deal with these issues before beginning the analysis process.

Missing data

Missing data refers to a situation in which valid values for one or more variables are not available for analysis. This may result from errors in data collection and data entry or from an omission or a respondent's refusal to answer (Hair *et al.*, 2019). The negative effect of missing data may be data analysis failure due to the reduction of the sample size available for analysis, or bias issues. Therefore, in order to minimise the problem of missing data in the first stages of data collection for this study, two particular methods of data collection were used: an online Qualtrics survey platform and a paper survey (a hard copy). On the Qualtrics platform, each survey question was set as a required question, marked by an asterisk (*). Respondents who failed to answer a particular question were not able to advance to the next page. As a result, participants had to answer all the questions before they could submit their responses. The paper survey questionnaires, with thorough instructions, were distributed to and collected from the senior managers of seaports via the VPA.

This design meant that only three missing values were recorded for the data set of 91 cases in this study (i.e. less than 10%).

According to a rule of thumb recommended by Hair *et al.* (2019, p. 62), 'missing data under 10 percent for an individual case or observation can generally be ignored'.

The data set consisted of only 91 cases, and the missing data comprised less than 10% of the total, this imputation should be applied. Following Enders (2010), the mean replacement method was conducted and the result imputed (Table 5.3).

Table 5.3- Result for missing data and imputed value

Case number	***Total number of variables***	***Total number of missing variables***	***% of missing***	***Comment***
7	31	1	3.2	Impute value
31	31	1	3.2	Impute value
58	31	1	3.2	Impute value

Straight lining

As per the guidelines in Chapter 3, the standard deviation of all scores within each case was counted; no value of zero was recorded. All 88 cases were therefore retained for further analysis at the end of this step.

Outliers

In this study, a survey using a Likert scales with 5 categories of response (from 1 to 5) was used. An outlier analysis using Scree Plot was conducted, and no outlier was detected.

Normality of data

The partial least squares path modelling (PLS-SEM) is a nonparametric statistical method that is different from covariance-based SEM (CB-SEM). While most statistical tests and estimation techniques used in CB-SEM assume 'each variable and all linear combinations of the variables are normally distributed' (Tabachnick and Fidell, 2013, p12), PLS-SEM does not require normal data distribution (Hair *et al.*, 2017). However, it is important to verify how far the data are from normal because 'extremely non-normal data prove problematic in the assessment of the parameters' significances' (Hair *et al.*, 2017, p. 61).

According to Hair *et al.* (2017), non-normally distributed variables can have a substantial impact on the results in small samples of 50 or fewer observations, while their effects may be negligible for samples of 200 or more. In this study, with a sample size of 88, the normality of variables has been assessed in order to cancel out the detrimental effects. Hair *et al.* (2019) propose critical values of skewness and kurtosis that are ±2.58 (0.01 significance level) and ±1.96 (0.05 significance level), respectively. In this study, multivariate normality was assumed not to be violated when all the variables were in the normal range for skewness and kurtosis, i.e. from −2.58 to +2.58 (Hair *et al.*, 2019). The results are shown in Table 5.4.

Table 5.4- Normality test results

Variables	*Skewness*	*Kurtosis*
II1	-0.794	0.808
II2	-0.481	0.842
II3	-0.858	1.366
OI1	-0.524	0.222
OI2	-0.500	-0.087
OI3	-0.773	1.317
OI4	-0.392	-0.079
OI5	-0.620	1.573
RI1	-0.922	1.070
RI2	-0.907	1.160
RI3	-0.774	1.121
RI4	-0.944	1.307
GI1	-0.283	0.802
GI2	-0.669	1.401
GI3	-0.389	0.646
PSQ1	-0.771	1.384
PSQ2	-0.400	0.461
PSQ3	-0.729	0.644
PSQ4	-0.583	0.824
PSQ5	-0.103	-0.843
PSQ6	-0.114	-0.503
PSQ7	-0.163	-0.498
PSQ8	-0.235	-0.408
CS1	-0.944	1.277
CS2	-0.732	1.409
CS3	-0.511	0.360
CS4	-0.316	0.954
CS5	-0.746	0.929
FP1	-0.143	-0.310
FP2	-0.079	-0.229
FP3	-0.337	0.713
N =88		

Table 5.4 shows both positive and negative values of skewness and kurtosis that are within the required value range for normal distribution. Specifically, the values of univariate standardised skewness ranged from −0.944 to −0.103, indicating that most of the variables were slightly skewed, and the values of kurtosis were from −0.843 to 1.573. Therefore, it is assumed that the data are normally distributed, and they were deemed satisfactory for further analysis.

Table 5.5- Descriptive statistics for variables of constructs in the proposed model

Items	*Minimum*	*Maximum*	*Mean*	*Standard deviation*
II1	1	5	3.59	0.955
II2	1	5	3.49	0.816
II3	1	5	3.69	0.889
OI1	1	5	3.51	0.897
OI2	1	5	3.55	0.883
OI3	1	5	3.64	0.819
OI4	1	5	3.52	0.871
OI5	1	5	3.57	0.770
RI1	1	5	3.67	0.867
RI2	1	5	3.72	0.870
RI3	1	5	3.74	0.864
RI4	1	5	3.81	0.882
GI1	1	5	3.72	0.757
GI2	1	5	3.66	0.725
GI3	1	5	3.61	0.780
PSQ1	1	5	3.72	0.757
PSQ2	1	5	3.75	0.820
PSQ3	1	5	3.93	0.868
PSQ4	1	5	3.82	0.810
PSQ5	2	5	3.86	0.833
PSQ6	2	5	3.73	0.813
PSQ7	2	5	3.72	0.830
PSQ8	2	5	3.74	0.823
CS1	1	5	3.52	0.788
CS2	1	5	3.48	0.758

Items	*Minimum*	*Maximum*	*Mean*	*Standard deviation*
CS3	2	5	3.74	0.719
CS4	1	5	3.61	0.734
CS5	1	5	3.60	0.766
FP1	2	5	3.74	0.766
FP2	2	5	3.78	0.702
FP3	1	5	3.70	0.775
Valid N (listwise) =88				

The descriptive statistics in Table 5.5 (maximum, minimum, mean and standard deviation) provide an overview of the variables after the procedure of data screening. They show that, while port service quality (PSQ) with regard to the level of safety and security of shipments in seaports, including those of the dry port, scored highest (mean = 3.93); customer satisfaction (CS) with timeliness obtained the lowest score (mean = 3.48). Respondents indicated high agreement with all levels of association between all aspects of dry port–seaport integration (DPSP-I) and port performance, with almost all mean scores being greater than 3.5.

Testing for non- response bias

As presented in Chapter 3, where no significant differences are identified between early and late respondents, non-response bias is unlikely to occur (Berg, 2005; Rogelberg and Stanton, 2007; Gefen, Rigdon and Straub, 2011). For testing non-response bias, the independent sample -test is used to compare the 'early' respondents against 'late' respondents. Early responses denote responses received in between the first delivery of the questionnaire by e-mail and post, and the first reminder. Late responses are considered to be rest of the returned usable questionnaires received after the first reminder. The received responses are then classified into two sub- samples to perform a two-sample independent t-test, including the first 30 responses (34%) as the first sub-sample and the last 30 responses (34%) as the second sub-sample. The result of the non-response bias test is presented in Appendix 3. Although the results show that there seems to be a statistical bias, non-response bias in this study does not seem to be a major issue for correcting the interpretation of the research results thank to two reasons. First, this research attracted responses from 88 out of 102 container terminal population in Vietnam, representing 86.3 percent response rate, which is much higher than the 70% threshold where a

non-response bias may occur (Tourangeau and Plewes, 2013). Secondly, a comparison of the characteristics of the respondents (Table 5.2) to known characteristics of the population as suggested by Tourangeau and Plewes (2013) also affirms that non-response bias is not an issue in this research. Specifically, about 63.64 percent of respondents hold senior management positions such as executive vice president, director and deputy director of operations, etc. while 57.95 percent and 42.05 percent of them also have more than 5 years and 1 – 5 years of working experience in the port sector. These aligned well with the targeted population who are senior executive in the port industry who are well-versed of strategic issues in not only port operations and management but also the interrelationship between their ports and other supply chain partners such as dry ports.

Testing for common method bias

Common method bias is assumed to occur 'if (a) a single factor will emerge from factor analysis or (b) one general factor will account for the majority of the covariance among the measure' (Podsakoff *et al.*, 2003, p. 889). Furthermore, The Harman single factor test is now becoming common in confirmatory factor analysis as an alternative to EFA to test the hypothesis that a single factor can explain all of the variance in the data (Podsakoff *et al.*, 2003; Malhotra, Schaller and Patil, 2017). Table 5.6 shows the results of EFA using the unrotated principle components analysis.

Table 5.6- The results of common bias test

Total variance explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	15.078	48.639	48.639	15.078	48.639	48.639
2	3.258	10.511	59.150			
3	1.743	5.624	64.774			
4	1.439	4.643	69.417			
5	1.256	4.050	73.467			
6	1.072	3.458	76.926			
7	1.003	3.234	80.160			
8	0.657	2.118	82.278			
9	0.578	1.866	84.144			
10	0.555	1.791	85.935			
11	0.496	1.601	87.536			
12	0.395	1.275	88.811			
13	0.358	1.155	89.966			
14	0.320	1.033	90.999			
15	0.292	0.943	91.942			
16	0.284	0.917	92.859			
17	0.264	0.851	93.710			
18	0.240	0.774	94.484			
19	0.223	0.719	95.203			
20	0.208	0.672	95.875			
21	0.184	0.594	96.470			
22	0.170	0.547	97.016			
23	0.149	0.479	97.496			
24	0.144	0.464	97.960			
25	0.132	0.424	98.384			
26	0.123	0.395	98.779			
27	0.111	0.357	99.136			
28	0.088	0.283	99.419			
29	0.072	0.232	99.651			
30	0.062	0.200	99.851			
31	0.046	0.149	100.000			
Extraction Method: Principal Component Analysis.						

The leading factor accounted for 48.64% of the variance in the measures. This means that no single factor occupied the largest portion of variance in the measures (more than 50%). Furthermore, no single factor emerged to signify the variance among all the measurement items. Thus, these results reveal that common method bias does not seem to be a major issue in this study requiring correction for the interpretation of the research results.

5.4. Exploratory factor analysis

In EFA, after determining how many factors should be extracted by the eigenvalues, it is necessary to re-estimate the communalities of the factors that represent the proportion of common variance. Field (2013, p. 677) states that 'if the values are 1 then all common variance is accounted for, and if the values are 0 then no common variance is accounted for'.

For a sample size of 88 (88 cases), the criterion of communality applied in this study is greater than 0.7 (as recommended by Kaiser [1974]). Next, examination of a KMO measure of sampling adequacy and Bartlett's test of sphericity are suggested.

A KMO value with a minimum of 0.5 shows that the sample size is adequate for factor analysis (Kaiser, 1974). The p-value from Bartlett's test of sphericity should be significant ($p < 0.001$) to indicate the absence of problems with the variables' structure (Field, 2013)..

Additional criteria by which to evaluate the adequacy of the extracted components are factor loadings and item-total correlation. Field (2013) suggests retaining items with factor-loading values of 0.4 and above. Items should be deleted to avoid cross loading if they are loaded on more than one factor (Hair *et al.*, 2019). The corrected item minus the total correlation value of 0.3 is considered the minimum threshold value for correlations between each item and the total score from the questionnaire (Field, 2013).

In this study, EFA was conducted on 31 measurement items using the extraction method of principal component analysis and the varimax rotation method; the results are presented in Table 5.7.

Table 5.7- Exploratory factor analysis results

Total Variance Explained									
Compo-nent	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	15.078	48.639	48.639	15.078	48.639	48.639	6.286	20.277	20.277
2	3.258	10.511	59.150	3.258	10.511	59.150	4.027	12.990	33.267
3	1.743	5.624	64.774	1.743	5.624	64.774	3.784	12.206	45.473
4	1.439	4.643	69.417	1.439	4.643	69.417	2.947	9.507	54.980
5	1.256	4.050	73.467	1.256	4.050	73.467	2.713	8.750	63.730
6	1.072	3.458	76.926	1.072	3.458	76.926	2.590	8.354	72.085
7	1.003	3.234	80.160	1.003	3.234	80.160	2.503	8.075	80.160
8	0.657	2.118	82.278						
9	0.578	1.866	84.144						
10	0.555	1.791	85.935						
11	0.496	1.601	87.536						
12	0.395	1.275	88.811						
13	0.358	1.155	89.966						
14	0.320	1.033	90.999						
15	0.292	0.943	91.942						
16	0.284	0.917	92.859						
17	0.264	0.851	93.710						
18	0.240	0.774	94.484						
19	0.223	0.719	95.203						
20	0.208	0.672	95.875						
21	0.184	0.594	96.470						
22	0.170	0.547	97.016						
23	0.149	0.479	97.496						
24	0.144	0.464	97.960						
25	0.132	0.424	98.384						
26	0.123	0.395	98.779						
27	0.111	0.357	99.136						
28	0.088	0.283	99.419						
29	0.072	0.232	99.651						

Total Variance Explained									
Compo-nent	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
30	0.062	0.200	99.851						
31	0.046	0.149	100.000						
Extraction Method: Principal Component Analysis.									
Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO)=0.904									
Bartlett's Test of Sphericity: Chi-Square=2511.416; df=465; p<0.001									
Total variance explained=80.160									

The results of EFA satisfied the requirements suggested by previous researchers. First, the KMO value was 0.904, which is well above the minimum of 0.6 suggested by Kaiser (1974) and in the 'meritorious' range (Field, 2013, p. 685). Hence, the sample size was believed to be adequate for factor analysis. The results of Bartlett's test of sphericity ($\chi 2 = 2511.416$, $p < 0.001$) satisfied the criteria suggested by Hair *et al.* (2019).

The results of EFA indicated that all of 31 measurement items in the conceptual model could be retained because their factor loadings were higher than the required minimum value of 0.4 suggested by Hair *et al.* (2019), ranging from 0.640 to 0.853 (Table 5.8). The items were extracted into seven components, which had eigenvalues greater than 1 and explained 80.160% of the total variance (Table 5.8).

Table 5.8- Rotated Component Matrix

Rotated Component Matrix[a]							
	Component						
	1	2	3	4	5	6	7
PSQ7	0.853						
PSQ5	0.824						
PSQ6	0.803						
PSQ3	0.750						
PSQ8	0.742						
PSQ1	0.727						
PSQ4	0.727		0.384				
PSQ2	0.691		0.321				
OI4		0.788					
OI1		0.787					
OI3		0.758					
OI2		0.746					
OI5		0.686		0.320			
CS4			0.777				
CS2	0.334		0.758				
CS5			0.734				
CS1	0.379		0.714				
CS3	0.399		0.640				
RI4				0.752			
RI3	0.304			0.743			
RI2				0.706			
RI1	0.358	0.337		0.661			
GI3					0.845		
GI2					0.819		
GI1		0.310			0.782		
II1		0.314				0.822	
II2						0.785	
II3						0.772	
FP3							0.806
FP2	0.360						0.771
FP1	0.390						0.736

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 8 iterations.

Finally, it is important to conduct reliability analysis on each identified factor by computing a Cronbach's alpha value.

A value of 0.7 to 0.8 is considered an acceptable value for Cronbach's alpha (Kline, 2016).

However, when dealing with psychological constructs, a Cronbach's alpha value of below 0.7 can be acceptable because of the diversity of the measured constructs (Kline, 2016). The values of Cronbach's alpha if the item was deleted were also checked to consider whether the deletion of an item could improve the overall reliability value of its associated construct (Field, 2013).

In this study, the Cronbach's alphas were computed to test the internal consistency. The results are shown in Table 5.9.

Table 5.9- Cronbach's alphas

***Component**/Item*	*Cronbach's alphas*
Customer satisfaction (CS1-CS5)	0.905
Financial performance (FP1-FP3)	0.880
Dry port-Sea port integration	0.940
Geographical integration (GI1-GI3)	0.879
Information integration (II1-II3)	0.876
Operational integration (OI1-OI5)	0.918
Relationship integration (RI1-RI4)	0.939
Port service quality (PSQ1-PSQ8)	0.959

Although a Cronbach's alpha of 0.7 or higher is suggested by Hair *et al.* (2019), in an exploratory study, a value of 0.6 is deemed to indicate acceptable reliability (Hair *et al.*, 2019). Socialisation and cultural experience have alpha values above the 0.7 standard, indicating that variables are consistently loaded on the same factor. All alpha values in the study range from 0.876 to 0.959, well over Kline's (2016) suggested value of 0.7. In addition, all the values of items' total correlation are above 0.5, which is the threshold suggested by Hair *et al.* (2019).

This demonstrates the apparent reliability of all proposed factors. Therefore, no items of the constructs were deleted, and the research instrument retained 31 items from four constructs after EFA.

In summary, EFA indicated that all four constructs were adequate, reliable and valid for further analysis. All 31 items were retained for the evaluation of the first- and second-order measurement models, in which DPSP-I was identified as a second-order construct, and the other three constructs (PSQ, CS and financial performance [FP]) were identified as first-order constructs.

5.5. The evaluation of the measurement models

5.5.1. First-order measurement model evaluation

In this study, all first-order constructs were hypothesised as reflective constructs, and second-order constructs were hypothesised as formative constructs (Figure 5.1 and Figure 5.2), therefore their evaluation was based on the two-stage approach.

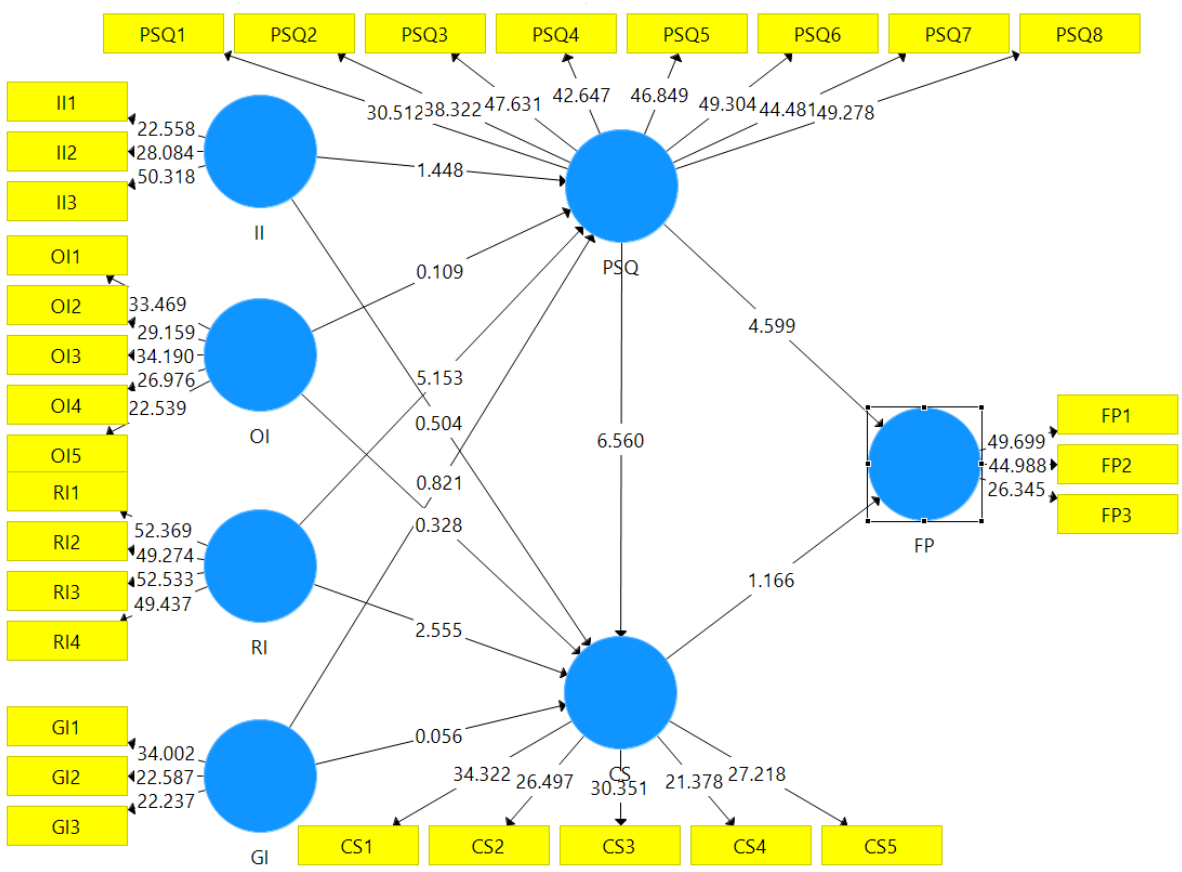


Figure 5.1- First-order measurement model

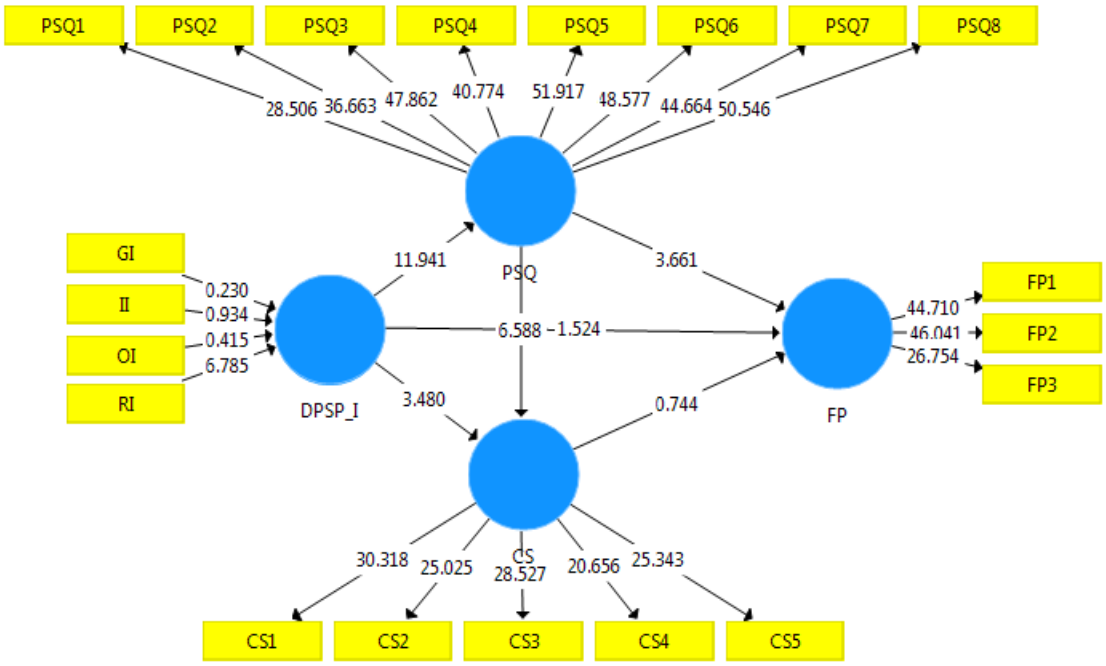


Figure 5.2- Second-order measurement model

The assessment of a reflective measurement model is based on internal consistency reliability and validity. While reliability indicates the consistency and stability of a measurement scale over time (Straub, 1989), validity refers to the degree to which a set of measures can correctly represent the construct that is conceptualised in the study (Hair *et al.*, 2019). Three criteria need to be assessed in reflective measurement models: internal consistency reliability, convergent validity and discriminant validity (Hair *et al.*, 2017).

In this study, the evaluation of first-order constructs presented in Table 5.10 is based on these three criteria.

Table 5.10- The results of first order measurement model evaluation

Reflective construct	***Indicator***	***Loading***	***Cronbach's Alpha***	***Composite Reliability (CR)***	***Average Variance Extracted (AVE)***
Information integration (II)	II1	**0.877**	0.878	0.925	0.803
	II2	**0.886**			
	II3	**0.925**			
Operational integration (OI)	OI1	**0.877**	0.919	0.939	0.755
	OI2	**0.866**			
	OI3	**0.896**			
	OI4	**0.853**			
	OI5	**0.851**			
Relationship integration (RI)	RI1	**0.923**	0.939	0.956	0.846
	RI2	**0.914**			
	RI3	**0.920**			
	RI4	**0.922**			
Geographical integration (GI)	GI1	**0.903**	0.880	0.926	0.806
	GI2	**0.897**			
	GI3	**0.894**			
Port service quality (PSQ)	PSQ1	**0.854**	0.959	0.966	0.779
	PSQ2	**0.870**			
	PSQ3	**0.902**			
	PSQ4	**0.888**			
	PSQ5	**0.887**			

Reflective construct	*Indicator*	*Loading*	*Cronbach's Alpha*	*Composite Reliability (CR)*	*Average Variance Extracted (AVE)*
	PSQ6	**0.884**			
	PSQ7	**0.883**			
	PSQ8	**0.890**			
Customer satisfaction (CS)	CS1	**0.878**	0.905	0.929	0.724
	CS2	**0.858**			
	CS3	**0.845**			
	CS4	**0.825**			
	CS5	**0.849**			
Financial performance (FP)	FP1	**0.916**	0.881	0.926	0.807
	FP2	**0.869**			
	FP3	**0.916**			

First, composite reliability was examined to show the internal consistency reliability of the latent construct. As can be seen from Table 5.10, the composite reliability value for each of the seven constructs – information integration (II), operational integration (OI), relationship integration (RI), geographical integration (GI), PSQ, CS and FP – was higher than the recommended value 0.7 (Hair *et al.*, 2017). It may therefore be assumed that all seven constructs were well measured by their assigned items.

Regarding the evaluation of discriminant validity, the square root of AVE using the Fornell-Larcker criteria and the cross loadings of all indicators were checked. The square root of AVE for each construct was found to be higher than its correlation values with other factors (see Table 5.11). In addition, the loading of each indicator on its corresponding factor was greater than all of its cross loadings with other constructs (see Table 5.12).

Table 5.11- Fornell-Larcker criterion

Construct	*CS*	*FP*	*GI*	*II*	*OI*	*PSQ*	*RI*
CS	0.851						
FP	0.554	0.898					
GI	0.380	0.244	0.898				
II	0.382	0.360	0.395	0.897			
OI	0.464	0.404	0.556	0.636	0.869		
PSQ	0.723	0.663	0.422	0.479	0.504	0.882	
RI	0.641	0.536	0.518	0.537	0.659	0.661	0.920

Table 5.12- Cross loading analysis

Indicator	*CS*	*FP*	*GI*	*II*	*OI*	*PSQ*	*RI*
CS1	0.879	0.502	0.362	0.346	0.481	0.672	0.570
CS2	0.858	0.484	0.375	0.269	0.320	0.622	0.510
CS3	0.845	0.527	0.277	0.381	0.380	0.657	0.568
CS4	0.824	0.388	0.380	0.306	0.378	0.541	0.525
CS5	0.848	0.437	0.223	0.316	0.411	0.567	0.551
FP1	0.543	0.914	0.220	0.305	0.315	0.631	0.499
FP2	0.524	0.917	0.289	0.386	0.395	0.622	0.495
FP3	0.407	0.863	0.131	0.269	0.391	0.519	0.446
GI1	0.356	0.222	0.900	0.396	0.544	0.421	0.475
GI2	0.305	0.244	0.904	0.332	0.494	0.346	0.445
GI3	0.361	0.191	0.890	0.332	0.455	0.366	0.477
II1	0.272	0.272	0.319	0.885	0.549	0.380	0.386
II2	0.353	0.301	0.371	0.883	0.553	0.428	0.483
II3	0.394	0.386	0.368	0.922	0.606	0.474	0.562
OI1	0.446	0.427	0.435	0.548	0.873	0.405	0.520
OI2	0.438	0.336	0.472	0.536	0.857	0.477	0.590
OI3	0.420	0.389	0.487	0.560	0.896	0.443	0.599
OI4	0.358	0.260	0.481	0.551	0.858	0.430	0.532
OI5	0.355	0.344	0.535	0.568	0.861	0.433	0.617
PSQ1	0.609	0.577	0.416	0.389	0.402	0.853	0.527
PSQ2	0.663	0.592	0.364	0.451	0.429	0.870	0.615
PSQ3	0.661	0.641	0.392	0.426	0.472	0.902	0.606

Indicator	*CS*	*FP*	*GI*	*II*	*OI*	*PSQ*	*RI*
PSQ4	0.721	0.550	0.412	0.391	0.424	0.889	0.633
PSQ5	0.557	0.598	0.352	0.374	0.433	0.885	0.560
PSQ6	0.626	0.560	0.270	0.446	0.430	0.885	0.571
PSQ7	0.604	0.554	0.341	0.349	0.384	0.883	0.503
PSQ8	0.643	0.603	0.419	0.535	0.564	0.891	0.630
RI1	0.633	0.532	0.488	0.444	0.622	0.658	0.918
RI2	0.585	0.544	0.447	0.566	0.622	0.601	0.917
RI3	0.575	0.481	0.455	0.508	0.578	0.616	0.918
RI4	0.565	0.413	0.518	0.455	0.602	0.557	0.926

In summary, the above discussion indicates that all the evaluation criteria for first-order measurement models were met, providing the supporting the reliability, convergent validity and discriminant validity of all measures.

5.5.2. Second – order measurement model evaluation

As discussed in Chapter 3, there are four major types of hierarchical component models (HCMs): reflective–reflective, reflective–formative, formative–reflective and formative–formative (Hair *et al.*, 2014). In this study, the higher-order construct DPSP-I was formed of four lower-order components (LOCs): information integration, operational integration, relationship integration and geographical integration. The conceptual meaning of DPSP-I could be changed if any LOC were to be deleted; therefore, DPSP-I was defined by the associated LOC dimensions. Following Coltman *et al.* (2008), DPSP-I was recognised as a formative (rather than reflective) model; the relationships between the LOCs and their indicators were found to be reflective following the first-order measurement models evaluation discussed in Section 5.4.1. As a result, DPSP-I was categorised as a reflective–formative second-order construct, as shown in Figure 5.3

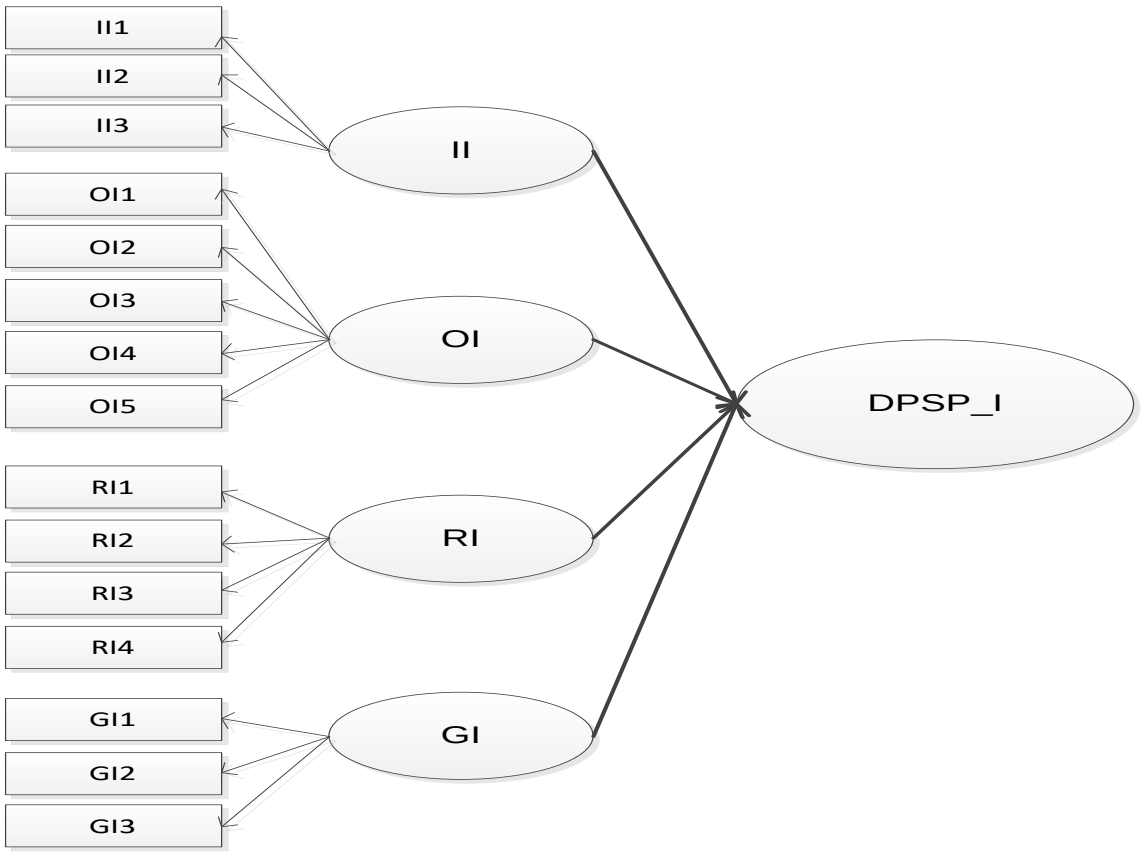


Figure 5.3- Reflective-formative measurement model of DPSP_I construct.

The evaluation procedure for the second-order formative constructs was based on the same guidelines as the first-order formative construct assessment. It included three steps with specific criteria, as discussed below.

In the first step, the multi-trait–multi-method (MTMM) matrix was created by a formulation suggested by Loch *et al.* (2003). A weighted score for each LOC was recorded using SmartPLS 3.3, and then a composite score for each formative construct was computed. Using these values, a matrix of correlations among first-order constructs (II, OI, RI and GI) and the second-order construct (DPSP-I) was created; this is presented in Table 5.13. It can be seen that all of the first-order constructs (II, OI, RI and GI) are highly correlated with each other and correlated with their second-order construct (DPSP-I), as initially proposed. Therefore, the results of the MTMM matrix led to the inference of convergent validity for the DPSP-I construct.

The next step was to analyse the significance of the outer weights of the first-order constructs (II, OI, RI and GI) to assess their relative contribution to the second-order construct, DPSP-I. The findings (shown in Table 5.14) reveal that all four dimensions, II, OI, RI and GI, have t-

values above the critical t-value of 2.57 at a significance level of 1%, indicating the significance of their path weights ($p < 0.01$). Therefore, the significance and relevance of the four first-order constructs, II, OI, RI and GI, represent their formative DPSP-I construct.

Table 5.13- Correlation among 1st and 2nd order construct of DPSP_I

Constructs	GI	II	OI	RI	DPSP_I
GI	1.000				
II	0.396**	1.000			
OI	0.554**	0.636**	1.000		
RI	0.519**	0.539**	0.658**	1.000	
DPSP_I	0.738**	0.782**	0.878**	0.855**	1.000

***. Correlation is significant at the 0.01 level (2-tailed).*

Table 5.14- Results of validity for formative second order model of construct of DPSP-I

Second-order construct	First-order construct	Outer weights	t-value	Significance level	P-value
DPSP_I	**GI**	0.265	10.993	***	0.000
	II	0.283	12.235	***	0.000
	OI	0.317	14.308	***	0.000
	RI	0.356	13.058	***	0.000

**p<0.1, **p<0.05, ***p<0.01*

5.6. Evaluation of structural model

As presented in Chapter 3, the assessment of the structural model includes the examination of the predictive capabilities of the proposed model as well as the examination of relationships between measurement constructs. The evaluation procedure for the structural model involved six steps, the results of which are discussed in the following sections.

Step 1: Collinearity assessment

It was necessary to examine the structural model for collinearity as high levels of collinearity among predictor constructs can cause an inaccurate estimation of path coefficients (Kline, 2016). Collinearity can be evaluated though the calculation of a VIF for each of the latent variables (Hair *et al.*, 2019). According to Petter, Straub and Rai (2007), if the VIF of a

predictor variable is greater than the threshold value of 3.3, this indicates the presence of collinearity.

The levels of collinearity should be examined separately for each set of predictor constructs associated with an endogenous variable of the structural model. In this study, DPSP-I was proposed as a predictor of PSQ, DPSP-I and PSQ were proposed as predictors of CS, DPSP-I and PSQ, and CS was proposed as a predictor of FP. Therefore, it was necessary to examine collinearity for three sets of predictor variables: DPSP-I and PSQ (set 1); DPSP-I, PSQ and CS (set 2) and DPSP-I, PSQ, CS and FP (set 3).

Table 5.15 shows the tolerance values (VIF) of the predictor constructs of the three sets. It can be seen that all the VIF values are below the threshold value of 3.3 suggested by Petter, Straub and Rai (2007). Therefore, multicollinearity among the predictor constructs is not a problem in the proposed structural model.

Table 5.15- Collinearity assessment.

First set (PSQ)		***Second set (CS)***		***Third set (FP)***	
Predictor construct(s)	VIF	Predictor construct(s)	VIF	Predictor construct(s)	VIF
DPSP_I	1.000	DPSP_I	1.853	CS	2.301
		PSQ	1.853	PSQ	2.495
				DPSP-I	2.045

Step 2: Evaluation of structural model path coefficients

Table 5.16 summarises results of the evaluation of path coefficients, and the corresponding t-values, significance levels and p-values. A path coefficient is considered significant if the empirical t-value is greater than the critical t-value of 1.65 at a significance level of 10%, 1.96 at a significance level of 5% and 2.57 at a significance level of 1% (Hair *et al.*, 2017).

Table 5.16- Result of the evaluation of path coefficients of structural model

Hypothesis	***Path relation***	***Path coefficient***	***t-value***	***Significance levels***	***p-values***
H1	DPSP-I → PSQ	0.678	11.941	***	0.000
H2	DPSP-I → CS	0.285	3.480	***	0.001
H3	DPSP-I →FP	0.144	1.524	ns	0.128

**p<0.1, **p<0.05, ***p<0.01, ns: not significant.*

The findings indicate that two hypotheses (H1 and H2) of direct relationships between constructs are statistically supported at t-values over the critical t-value 2.57 at significance level 1%. Specifically, DPSP-I positively influences PSQ (at a higher level) and CS (at a lower level): $P_{DPSP\text{-}I \rightarrow PSQ} = +0.644$, $t = 11.517$, $p < 0.01$ and $P_{DPSP\text{-}I \rightarrow CS} = +0.206$, $t = 3.480$, $p < 0.01$, respectively. The relationship between DPSP-I and FP was found to be not significant.

In summary, the direct causal links from DPSP-I to PSQ and CS were found to be significant, with $P_{DPSP\text{-}I \rightarrow PSQ}$ stronger than $P_{DPSP\text{-}I \rightarrow CS}$. It means that the effect of DPSP-I on PSQ stronger than that on CS. The direct causal link from DPSP-I to FP was found to be non-significant. There is no effect in the direct relationship between DPSP-I and FP.

Step 3: Coefficient of determination

The next primary criterion for the structural model evaluation is the coefficient of determination (R^2 value), which is 'a measure of the model's predictive power' (Hair *et al.*, 2017, p. 198). This coefficient represents the amount of explained variance of each endogenous latent variable. Due to the complexity of each model, it is impossible to formulate a rule of thumb for an acceptable R^2 as recommended by Henseler, Ringle and Sinkovics (2009). Chin (1998) specifies R^2 values of 0.67, 0.33 and 0.19 reporting substantial, moderate and weak levels of predictive accuracy, respectively. A higher value of R^2 indicates higher levels of predictive accuracy

Table 5.17 illustrates the R^2 value of the three endogenous latent variables (PSQ, CS and FP) in the proposed model.

Table 5.17- Coefficient of determination

Endogenous constructs	***R^2 value***
Port service quality	0.415
Customer satisfaction	0.548
Financial performance	0.451

The dependent variable DPSP-I accounts for 41.5% of the total variance associated with PSQ and 54.8% of the total variance associated with CS. The exogenous construct CS explains 45.1% of the dependent variable FP. Following the rule of thumb suggested by (Henseler, Ringle and Sinkovics, 2009), the R^2 values of all three variables indicate a moderate level of predictive accuracy (Byrne, 2016).

Step 4: Evaluation of effect f^2 size

Following the evaluation of the R^2 value, the next measure is the effect size (f^2). This examines whether there is a substantive influence on the endogenous variable in the structural model in the case of a selected exogenous variable being omitted. Cohen (1992) provides guidelines for f^2 assessment. Specifically, values of 0.02, 0.15 and 0.35 indicate small, medium and large effects, respectively, of the exogenous construct on an endogenous construct.

Table 5.18 presents the results of f^2 estimation, which measures the impact of the independent variables on the three dependent variables, PSQ, CS and FP, in the proposed model.

Table 5.18- Result of effect size analysis

Endogenous	***Exogenous***	***Effect size (f^2)***	***Inference***
Port service quality	Dry port-seaport integration	0.853	Large effect
Customer satisfaction	Dry port-seaport integration	0.101	Small effect
	Port service quality	0.347	Medium effect
Financial performance	Customer satisfaction	0.009	Nearly no effect
	Port service quality	0.175	Medium effect
	Dry port-seaport integration	0.019	Very small effect

The results show that DPSP-I has a small effect on CS, and the effect of CS on FP is nearly zero, with f^2 values of only 0.101 and 0.009, respectively, i.e. smaller than the medium effect value of 0.15 (Cohen, 1992). In contrast, the effect size of DPSP-I on PSQ is large, with an f^2 value of 0.853. Two medium effect sizes are seen in the impact of PSQ on CS and FP, with f^2 values of 0.347 and 0.175, respectively.

In summary, the results indicate that the endogenous latent variables are quite well explained by the exogenous variable in the proposed model.

Step 5: Evaluation of predictive relevance Q^2 and q^2 effect size

The last evaluation of the structural model measures the model's predictive relevance, which is tested by Stone-Geiser's Q^2 value (Hair *et al.*, 2017). Chin (1998, p. 318) points to Q^2 as 'a measure of how well-observed values are reconstructed by the model and its parameter estimates'. Obtained by the blindfolding procedure in SmartPLS, Q^2 shows predictive

relevance for an endogenous construct at values above zero. By contrast, values of zero and below are indicative of a lack of predictive relevance. Finally, like the f^2 assessment mentioned above, the impact of a model's predictive relevance is examined by the q^2 effect size. The values of q^2 at 0.02, 0.15 and 0.35 imply small, medium and large effect levels of predictive relevance, respectively, for a given endogenous construct (Hair *et al.*, 2017).

The results of Q^2 for the assessment of predictive relevance associated with the endogenous variables in the theoretical model, obtained using the blindfolding procedure in SmartPLS 3.3, are shown in Table 5.19.

Table 5.19- Results of predictive relevance evaluation (Q^2) and q^2 effect size

Dependent constructs	***Q^2***	***Inference***
CS	0.393	predictive relevance
PSQ	0.347	predictive relevance
FP	0.356	predictive relevance

The Q^2 value is greater than zero, indicating the model's predictive relevance (Hair *et al.*, 2017). The results show that the Q^2 values of CS (0.393), PSQ (0.347) and FP (0.356) are all greater than zero, demonstrating the sufficient predictive relevance of the proposed model.

5.7. Mediator analysis

At the beginning, the bootstrapping procedure with 88 cases and 5,000 samples was carried out to evaluate the significance of indirect effect p12 x p23. If the indirect effect is insignificant, it can be concluded that there are no mediating effects in the model. In contrast, if there is a significant indirect effect p12 x p23, the next step is to classify the type of mediation by estimating the coefficients p12, p23, and p13. Mediation can be classified partial or full mediation (Hair *et al.*, 2019). Accordingly, the strength of the relationship between Y1 and Y3 in the model that excludes the mediator was compared with the strength of the indirect relationship. If the path coefficient of the direct relationship between Y1 and Y3 is reduced, but still significant in the model without the mediator, the mediation could be presumed to be partial mediation. Full mediation occurs where the direct effect of Y1 on Y3 is no longer significant after the moderator is eliminated. In this study, the mediation test was conducted on the causal relationships between four constructs (DPSP-I, PSQ, CS and FP).

The mediation effect of the constructs was assessed by using a bootstrapping method suggested by Zhao, Lynch and Chen (2010). Accordingly, the first step was to examine the significance of indirect relationships which refer to the relationships between the independent variable DPSP-Iand a mediator (PSQ), and between a mediator (PSQ) and the dependent variables (CS and FP). The next step was to classify the type of mediation by examining the significance of direct effects for the relationships between the variable (DPSP-I) and variables (FP) and (CS) without a mediator (PSQ).

The results (shown in Table 5.20) indicate that the indirect effect of the relationship between DPSP-I and FP, mediated by PSQ, is significant, with t-value above 1.96, while the direct effect of the relationship between DPSP-I and FP is non-significant, with t-value below 1.96. Considering the levels of significance of both indirect and direct effects, the causal relationship between DPSP-I and FP was found to be one of full mediation. This supports the fourth hypothesis of this study (H4). Additionally, while the indirect effect of the relationship between DPSP-I and CS, mediated by PSQ, is significant, with t-value above 1.96, the direct effect of that relationship is also significant, with t-value above 1.96; consequently, the causal relationship of DPSP-I and CS was found to be one of partial mediation. This supports the fifth hypothesis (H5). The other relationships, DPSP-I and FP, mediated by CS, and PSQ and CS, were found to be non-significant in both indirect and direct relationship; this means that no relationships were found between them. Therefore, the remaining study hypotheses (H6 and H7) are not supported.

Table 5.20- Results of mediation analysis

Hypo-thesis	***Indirect effect model***					***Direct effect model***					***Total effect***	***Type of mediation***
	Path relation	***Path coeffic ient***	***t-value***	***Signifi cance levels***	***p-values***	***Path relation***	***Path coeffic ient***	***t-value***	***Signifi cance levels***	***p-values***		
H4	DPSP-I →PSQ → CS	0.357	5.346	***	0.000	DPSP-I→CS	0.285	3.480	***	0.001	0.642	Partially mediated relationship
H5	DPSP-I→PSQ→FP	0.329	3.474	***	0.001	DPSP-I→FP	0.144	1.524	ns	0.128	0.473	Fully mediated relationship
H6	DPSP-I→CS→FP	0.031	0.697	ns	0.486	DPSP-I→FP	0.144	1.524	ns	0.128	0.175	No relationship
H7	DPSP-I→PSQ→CS →FP	0.039	0.690	ns	0.490	DPSP-I→FP	0.144	1.524	ns	0.128	0.183	No relationship

**p<0.1, **p<0.05, ***p<0.01, ns: not significant.*

5.8. Conclusion

This chapter provides a comprehensive report of the results and findings following use of the data analysis techniques that were introduced in Chapter 3. In the first step of the analysis, statistical techniques such as missing data, outliers and normality were used to screen the data collected from the main survey. Out of 91 completed surveys, three cases were deleted due to outliers checking. The final data set of 88 cases was then concluded to be normally distributed at the univariate level.

After EFA was used to purify the measurement scales, an evaluation of the first- and second-order measurement models produced findings in response to the first objective of the study. Specifically, II, OI, RI and GI were identified as four dimensions of the DPSP-I construct. Turning to the second objective of the study, the results of structural model evaluation showed that DPSP-I has direct effects on PSQ and CS, and indirect effects on CS and FP, via a partial mediator and a full mediator (PSQ), respectively.

In conclusion, the results found in this chapter have produced responses to all the research questions proposed in this study. The following chapter provides a detailed discussion of the results and findings.

Chapter 6. DISCUSSION

6.1. Introduction

This chapter discusses the outcomes of this study. First, findings are presented in sequence in accordance with the study's objectives and research questions. The chapter commences with a discussion of the integration between dry ports and seaports and, within this discussion, Research Question 1 is answered. The results are linked with previous research found within the literature to highlight what factors are associated with the integration between dry ports and seaports (Section 6.2). In this section, the discussion of three proposed dimensions (information integration, operational integration and relational integration) and a new dimension found from interviews are addressed. Section 6.3 provides a discussion of the impact of dry port–seaport integration (DPSP-I) on seaport performance in terms of port service quality, customer satisfaction and financial performance. The direct and indirect relationships between them are also discussed to the extent of Research Question 2, particularly Sub-Research Questions 2.1, 2.2 and 2.3 and Hypotheses 1 to 7.

6.2. Dimensions of dry port-seaport integration

As noted in earlier chapters of this thesis, dry ports, as nodes in transport networks, have been developed, among other reasons, to support seaport operations and the sustainable development of international intermodal transport chains, or 'links' (Hanaoka and Regmi, 2011; Roso, 2013). A dyadic dry port–seaport relationship, therefore, is becoming more common, although it is still an emerging phenomenon and very little research has been done on its development models (Bask *et al.*, 2014). As a result, this study seeks to provide a comprehensive understanding of the integration between dry ports and seaports in a developing country as empirical evidence to enrich the knowledge of the integration of dry ports and seaports in various contexts. Transaction cost economics (TCE) theory suggests that a strategic connection between dry ports and seaports is characterised by trust, commitment, long-term orientation and goodwill that can help to avoid opportunistic behaviour. Based on this, DPSP-I helps firms reduce the costs of opportunism and monitoring that are inherent in market transactions through process integration and mutual trust, thus increasing the probability that partners behave in the best interests of the partnership (Kaufman *et al.*, 2000). Unlike many other relationships, in terms of integration or collaboration, DPSP-I is a bidirectional logistics relationship. Either the dry port or the seaport can be the supplier or the customer for each other at the same time, with the

cargo flowing inside out or outside in continuously through these nodes of the supply chain.

The findings from interviews and surveys present different levels of integration between dry ports and seaports, varied from component to component, and also highlighted the positive impact of the integration on seaports' performance. This aligns with the literature that the level of integration depends on different factors (Kannan and Tan, 2010; Flynn, Koufteros and Lu, 2016). In the previous chapter (Chapter 4), the analysis of the conceptual model indicates that DPSP-I is measured by four factors: three proposed factors from the conceptual model (information integration, operational integration and relational integration) and a new finding from interviews (geographical integration). There is alignment between findings from qualitative and quantitative methods. While results from interviews indicate that the four factors vary from a low level to high level of integration, the descriptive statistics witness the means of a five-point Likert scale ranging from 3.48 to 3.93 (see Chapter 5), with most mean scores above 3.5 and standard deviations (ranging from 0.702 to 0.955) lower than 1; this illustrates that the integration level between dry ports and seaports is not high in average, but it varies from a low to high level. These findings can be explained in the context of developing countries, such as the case of Vietnam, by the historical development of dry ports, some of which are quite limited or may be totally disconnected from seaport existence. Conversely, in a number of cases in Vietnam where dry ports maintain good collaboration with seaports or are even integrated into the seaport system, the logistics performance of the port–hinterland system, including seaports, is enhanced significantly (Nguyen *et al.*, 2020)..

Meanwhile, measurement model tests suggest that the reliability and validity of the four factors also show that they are adequate, reliable and valid. Their relative contributions to the DPSP-I construct show that relationship integration is the strongest associated factor (the outer weight is 0.356), followed by operational integration (0.317), while information integration (0.283) and geographical integration (0.263) are the factors contributing the least to the DPSP-I (see Figure 6.1). They are discussed individually in detail below. Furthermore, the mean values of DPSP-I aspects range from the highest of 3.74 (relationship integration), followed by geographical integration (3.66), and the smaller values are information integration (3.59) and operational integration (3.56). The mean values show the prevalence of aspects of DPSP-I in the context of the Vietnam maritime sector.

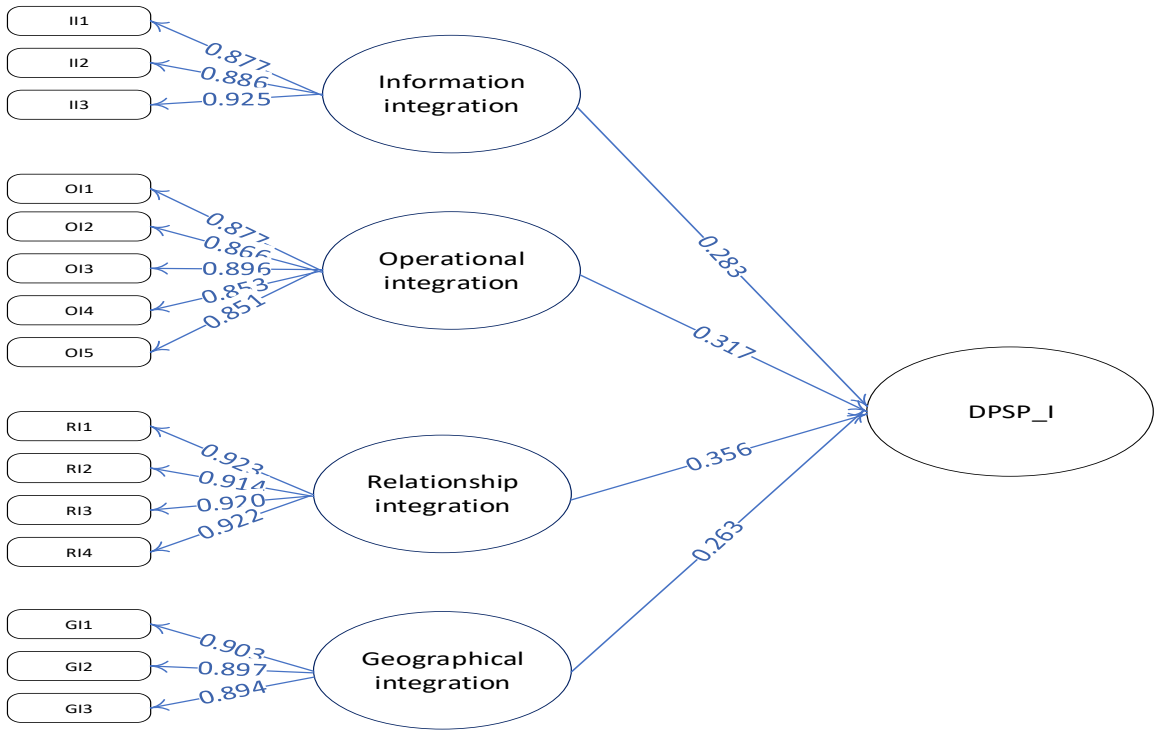


Figure 6.1- Reflective-formative measurement model of DPSP_I factor

6.2.1. Relationship integration

Relationship integration is based on the contention that developing relationships and fostering trust with supply chain partners are critical aspects in collaboration and coordination (Vijayasarathy, 2010). In this study, relationship integration refers to the mutual trust in building the relationship between dry ports and seaports; it is the factor most associated with DPSP-I characteristics and the most prevalent among the four factors in the context of DPSP-I in Vietnam, as discussed in Section 6.2. Furthermore, the result of Cronbach's alpha (0.939) demonstrates that relationship integration is reliable and valid. These findings show that the respondents who are working in the maritime sector value relationship integration in the integration between dry ports and seaports in the Vietnam maritime context. This can be explained by the literature and by practical aspects. In the literature, Yuen and Thai (2016a) ranked the importance of supply chain integration (SCI) components; among them, relationship integration was the most important. Furthermore, the importance of relationship integration was also studied and emphasised in numerous research papers (Kwon and Suh, 2004; Vijayasarathy, 2010). In practice, DPSP-I is a challenging process, as it chiefly involves the interactions of people; therefore, the absence of trust or commitment could affect interactions and, consequently, the successful implementation of DPSP-I. Nurturing mutual trust aims to

achieve motivation to engage in collaborative behaviours and attitudes, saving time and cost during the operational process. Another characteristic of the integration between dry ports and seaports is that the level of relationship varies from low to high. These results align with the findings from interviews with senior managers working in the maritime supply chain who said that integration varies from low to high, depending on specific contexts. For the northern seaport system in Vietnam, due to the short distance to manufacturing stores (around 100 km), the transportation mode chosen is mainly by road; according to a director of a logistics company (LC03) and a seaport manager (SP03), the saving of time and cost make it more advantageous to transport cargo directly to seaports, compared to transporting to dry ports (intermediate nodes) first. The relationship between dry ports and seaports, therefore, becomes loose or even competing. In contrast, the seaport system in the south of Vietnam shows the close collaboration or integration of dry port–seaport dyads because the collaboration/integration enhances their mutual benefit, thanks to convenient domestic transportation waterways connecting dry ports and seaports (SP04). This not only leads to lower costs but also the congestion tackled at seaports. The study of Nguyen *et al.* (2020) presented similar findings that, in the context of Vietnam, there existed a more complex relationship between dry ports and seaports, which could be competing, independent, collaborative or integrated due to different ownership (Nguyen *et al.*, 2020). Different ownership could lead to opportunism activities. Furthermore, dry ports and seaports play critical nodes in the supply chain, connected by multimodal transportation. Effective operation of the maritime supply chain could be reached by eliminating the 'bottleneck' effect in the supply chain. This means that the smooth cooperation of operational activities among parties relating to the supply chain should be enhanced. Thus, tight collaboration or relationship integration between parties becomes one of the critical factors associated with the construct of inter-organisational relationship integration, regardless of context or industry. This finding aligns with previous studies. For example, close relationship (and inter-firm trust) is the most influential factor in supply chain collaboration in the manufacturing sector in the United States (Cao and Zhang, 2013). Similarly, in the manufacturing and service sectors in Taiwan, a high level of trust among supply chain partners is the foundation of a long-term strategy of information sharing and collaboration (Wu, Chuang and Hsu, 2014). In the maritime sector, Yuen and Thai (2016a) argue that firm performances can be maximised by establishing closer relationships with supply chain partners.

The relationship integration is measured based on the seaport's value to the dry port's contribution, mutual long-term collaborative commitment between them, their extensive investment in specific resources (equipment, capacity and personnel) to meet the requirements of mutual customers, and continuing collaboration improvement between dry ports and seaports. Ranging from 0.914 to 0.923, the factor loadings of these indicators demonstrate that most of them are of similar weighting for relationship integration. This means that they strongly associate with the relationship integration factor. In the context of DPSP-I, the trust, respect, commitment and willingness to invest in specific resources to meet the needs of mutual customers that a seaport gives to their partner (the dry port) is important to foster their relationship integration. Furthermore, it is necessary to continue improving integration to upgrade and maintain this relationship because there is evidence of concern relating to barriers in SCI (Yuen and Thai, 2016b). Dry ports and seaports are members of the maritime supply chain; however, they are independent organisations. That is one reason why the mean value of relationship integration is not high (3.74), which means that the prevalence of this factor is moderate. This is in line with a study from Ketkar *et al.* (2012), who argue that dysfunctional behaviour in organisations, such as lack of trust, opportunism (or individualism) and resistance to change, was claimed to be the main reason for SCI failures. It would therefore be logical to suggest that, without the right attitude and commitment of these individuals, any investments on SCI will be futile. The indicators which measure the relationship integration factor will be discussed in detail below.

Valuing the contribution of partners (dry ports) is the highest factor-loading indicator (0.923) among the indicators. This indicator refers to the valuation that a seaport gives to its partner (the dry port), thanks to the dry port's contribution in providing services that suit the seaport's (and customers') requirements. The result indicates that developing relationships and fostering trust between partners comes from appreciating the counterpart's contribution to the supply chain activities. In other words, a seaport will gain trust from its business partners (the dry port)s and vice versa. The relationship between them will also be enhanced if the seaport gives recognition to its counterparts (dry ports) for their contributions in providing joint services related to transporting the cargo between dry ports and seaports; the enhanced trust then leads to mutual benefits and win-win progress. For example, according to a manager of a small seaport in the South of Vietnam (SP04), two-thirds of the cargo throughput of their seaport is based on integration with dry ports. And they show their appreciation to dry ports by supporting

them in transporting cargo between dry ports and seaports at low costs. However, the means of a five-point Likert scale from the descriptive statistics is 3.67 (see Chapter 5) and the standard deviation is 0.867, showing that the seaports' valuation to the dry ports' contribution is less prevalent among indicators constituted by relationship integration and is at an average level. The lower implementation of this indicator could be a result of the historical development of dry ports in Vietnam. The low level is present in the dry port–seaport dyads whose relationship is competing or independent, where there is no appreciating partner's contribution. The reason for the disconnected relationship between dry ports and seaports, according to Nguyen *et al.* (2020), is the spontaneous and unplanned development of dry ports, which exists in developing countries like Vietnam. This is unlikely to be found in developed countries. Meanwhile, the findings from descriptive statistics and interviews also illustrate the other aspect of the valuing level to supply chain partners' contributions: that the seaports who are in the well-integrated supply chain (mostly in the south of Vietnam) all highly appreciate their counterparts' (dry ports') advantage (close to manufacturers, far from cities) and their contribution in cooperation (port services), according to a manager of a seaport (SP06), while their key partners (dry ports) also put 'daily cooperation' with seaports 'to improve DPSP relationship' in priority from a seaport manager's perspective (SP05). The SP06 also claimed that they all see cooperation as a 'symbolic relationship' that will 'bring many mutual profits, bringing benefits' (SP05). These findings are also in line with previous researchers who claim that trust is at the heart of relationship integration (Ryu, So and Koo, 2009), and it is a belief that a partner will not act opportunistically (Tsanos and Zografos, 2016).

The second highest associated indicator (factor loading of 0.922) is continuing collaboration improvement. This indicator refers to a periodic discussion that a seaport carries on with its partner (the dry port) to assess and improve their collaborative relationship. The improvement of this relationship also occurs through mutual daily support in operational activities. Furthermore, the mean of a five-point Likert scale from the descriptive statistics is the largest – 3.81 (see Chapter 5) – and standard deviation is 0.882, showing that relationship integration is mainly implemented by improving collaboration. This indicator is representative of relationship integration not only because of its characteristics but also due to its prevalence, although the prevalence is not very high. Furthermore, similar to the first indicator, the differences depend on the integration level of dry ports and seaports in the context of the Vietnamese maritime supply chain. While collaborative improvement is not well

acknowledged in the dry port–seaport dyads whose interrelations are competing or independent, the improvement of continuing collaboration will be highlighted in the dyads' collaboration, which is supposed to be 'symbiotic'. According to a seaport director (SP02), the collaboration is not entering into the contract signed by both parties, but it happens daily, enhancing the operational activities; it is also reviewed in the periodic meetings to ensure that cargo flow transports smoothly and efficiently. This is in line with the Kaizen theory of continuous improvement, in which Imai claims that Kaizen is process-oriented, i.e. before results can be improved, processes must be improved, as opposed to result–orientation, where outcomes are all that count (Imai, cited in Suárez-Barraza, Ramis-Pujol and Kerbache, 2011). Dry ports and seaports are in a committed relationship that engages in relational governance, including investment in transaction-specific assets and a high level of organisational trust (Zhao *et al.*, 2008). Thus, the motive for exchange relationships departs from purely economics in a social context that carries strong expectations of trust and the absence of opportunism (Zaheer and Venkatraman, 1995; Jeong and Oh, 2017). Relationship integration is a special assets-intangible relationship that results from mutual trust and loyalty; therefore, continuing collaborative improvement is a crucial indicator to retain a sustainable and close relationship.

The third highest factor-loading indicator is long-term collaborative commitment. In this study, commitment is not only carried out by a service contract signed by a seaport and its partner (the dry port), but also happens in the daily operation activities whereby seaports support dry ports in transporting cargo within their hinterland. In the contract, the parties' obligations and benefits related to transporting cargo between dry ports and seaports are stated. The contract is revised and re-signed yearly, according to a director of a dry port (DP01). In daily operations, they work together to transport cargo and to serve mutual customers (DP02). This indicator (with a factor loading of 0.914) shows the attitude of supply chain partners about the development and maintenance of a stable, long-lasting, mutual relationship (Wu, Chuang and Hsu, 2014). The prevalence of the long-term collaborative commitment was found to be average, reflected through the mean (3.72) of the five-point Likert scale and standard deviations (0.87) from the descriptive statistics (see Chapter 5). Although no commitment existed in the previously discussed specific dry port–seaport dyads whose relationship is competing or independent, the long-term collaborative commitment in dyads' relationships is agreed upon by respondents from both interviews and surveys. Furthermore, in this relationship, dry ports are considered as seaports' extended gates, where all the port services could be provided while

‘seaports will revert back to being nodes for cargo handling and trans-shipment, and will lose their role as logistics nodes’ (Veenstra, Zuidwijk and Van Asperen, 2012, p. 30), Their long-term dyadic relationship, therefore, plays an important role in enhancing their mutual benefits. The study investigated by Nguyen *et al.* (2020) also presented that around two-thirds of a seaport’s throughput comes from Vietnamese inland clearance depots (ICDs), which are in long-term collaborative relationship contracts with the seaports. The relationship commitment between dry ports and seaports, from the perspective of TCE theory, can be viewed as an investment in transaction-specific assets, which are difficult or impossible to redeploy when a relationship is terminated. The assets enhance the competitiveness of the parties involved in the integration and boost their mutual benefit.

With a factor loading of 0.920, the willingness of a party to invest in specific resources (equipment, capacity and personnel) to meet the requirements of mutual customers is the fourth indicator reflecting relationship integration. It shows that the level of a seaport’s investment in specific equipment, capacity and personnel to meet the requirements of the seaport’s mutual customers with the dry port is high. In the context of the Vietnam maritime supply chain, seaports invest in the resources that enhance port capacity to meet port development, including customer demand resulting from integration with dry ports. A senior manager of a dry port (DP01) claimed in his interview that both ICDs and seaports are required to invest in facilities to enhance their capacity to transport cargo efficiently between them to serve mutual customers. The five-point Likert scale mean (3.72) and standard deviation (0.87) of this indicator from the descriptive statistics (see Chapter 5) illustrate that the level of investment, in which integration is taken into account, is of average prevalence based on the specific dry port–seaport dyads’ pattern. Furthermore, DPSP-I could be seen as relationship-based resources, which are unique and enhance dry port and seaport competitive advantage. The special resources, based on mutual trust and the long-term collaborative commitment between dry ports and seaports, are difficult or impossible for competitors to imitate. The dry ports in this context truly become seaports’ extended gates, where all the port services, such as packing and customs clearance, can proceed. These findings are in line with previous studies that note that relationship-specific investments can create relationship-based resources (e.g. stakeholders are resource integrators) that are unique and non-dissociable, which are more valuable than the individual resources. The parties involved co-create value, which differentiates them in isolation and creates a competitive advantage (Cova and Salle, 2008; Paswan and Panda, 2020).

6.2.2. Operational integration

Operational integration refers to any joint activities, work processes and decisions that are collectively performed by a group of internal departments or firms in the supply chain (Devaraj, Krajewski and Wei, 2007). From a similar point of view, Bichou and Gray (2005) argue that port operational integration involves the extent to which the port plans and organises activities, processes and procedures beyond its boundaries in such activities. In the context of DPSP-I, operational integration refers to any joint plan, operational activities and operational emergencies, as well as the improvement of the plan and operational ability and capability, in order to enhance the efficiency of cargo flow transported in the hinterland between dry ports and seaports to meet customer requirements. Operational integration, therefore, can be measured by a joint plan, joint operational activities, joint operational emergency response and the improvement of operational plans and capability together. The result of descriptive statistics (see Chapter 5) shows the means of a five-point Likert scale and standard deviations of these indicators ranging from 3.51 to 3.64 and 0.77 to 0.897, respectively, illustrating that the commonness of this factor is average, reflecting the specific context of DPSP-I in Vietnam. As analysis in Chapter 4, except for opinions from interviews that operational collaboration is not necessary (SP02) or one-way connective (SP04), many managers argue that cooperation between seaports and dry ports should be observed in every stage of cargo transportation (SP01, SP06). However, the results of the measurement model evaluation demonstrate that operational integration was reliable and valid, and it was also a strongly associated factor in the DPSP-I construct (the Cronbach's alpha was 0.919 and outer weight was 0.317). All the indicators have high factor loadings, ranging from 0.851 to 0.896, demonstrating that these indicators strongly measure the operational integration between dry ports and seaports. This includes the extent to which seaport managements collaborate with dry ports in the maritime supply chain in order to join plans, operational activities, work processes and emergency responses, which will enhance solutions for the cargo passing through the system. However, as previously mentioned, the prevalence of operational integration is not high. It is due to the barriers arising from the interaction between different organisations. This could be seen to align with arguments from Yuen and Thai (2016b); they argue that difference in strategic management constrains integration. For example, in competing or independent dry port–seaport dyads, seaports might lose the income from cargo storage if the cargo is unloaded at dry ports.

Joint planning, joint operational activities and joint work processes are used to align

collaborative partners in determining the most efficient and effective way to use firms' resources to achieve a specific set of objectives (Cao and Zhang, 2011). From the findings of interviews with senior managers working in the maritime sector, in the DPSP-I context, after an operational plan is discussed and confirmed among involved parties, the carried operational activities and operational processes are observed and managed by both parties to ensure efficiency of costs and time. Whenever any emergency issue arises, dry ports and seaports quickly get together to assess the risk level of cargo transported and each party's responsibility, costs and mutual support as well before responding. This could be the reason why the indicators of emergency response and joint planning are most associated with the factor of operational integration. Furthermore, the validity and reliability of the indicator-operational ability and capability improvement are meaningful to operational integration. Meanwhile, the findings of this study demonstrate that the level of operational relationship between dry ports and seaports in the Vietnamese maritime context varies from low to high. The different levels of integration can be witnessed in the study of Bask *et al.* (2014) on two cases of dry port-seaport dyads from Northern Europe, which found that there are different forms and levels of collaboration in these dyad systems. Nevertheless, dry ports, through various modes of transportation, help to manage the container flow to and from seaports effectively. As a result, this leads to higher service frequency and lower freight costs through a modal split, which results in schedule integrity at the seaport (Notteboom and Rodrigue, 2009; Beresford *et al.*, 2012).

6.2.3. Information integration

Information integration is characterised by electronic linkages and integrated information sharing within and beyond organisational boundaries to facilitate cross-functional coordination in the supply chain (Kulp, Lee and Ofek, 2004). According to Lai, Wong and Cheng (2010) and Zhou *et al.* (2007), inter-organisational information integration involves standardising and digitising information exchange that spans cross-organisational business activities. Such integration makes information available for timely dissemination to relevant supply chain partners for responsive decision-making and market actions (Wong, Lai and Cheng, 2014). In this study, information integration refers to inter-firm information flows and systems that are invested and integrated to ensure compatibility of the software. This enhances the accessibility, accuracy and timeliness of the information during the operational process in order to ensure the flow of cargo operates smoothly. The results of the measurement model evaluation demonstrate that information integration (the Cronbach's alpha was 0.876, outer weight was

0.27) is a factor measuring and the third strongest factor associated with the DPSP-I construct. This finding is supported by the opinions of senior managers working in the maritime sector; they see themselves as representative of nodes (dry ports, seaports) or links (logistic companies) in the supply chain. The information shared, from their point of view, could be cargo, customers' needs and requirements, or any information related to the cargo flow transported between dry ports and seaports. The ways of sharing, according to them, are also various, from phone calls and emails to compatible information systems. The frequency of shared information could be periodic or immediate, depending on schedules or emergencies. However, without macro planning and spontaneous development of dry ports in the context of Vietnam maritime, the dry port–seaport relationship could be competing, independent or a seaport's extended gate (Nguyen *et al.*, 2020). Therefore, the level of information sharing ranges from low (unnecessary; SP02) to high (integrated information; SP01). This DPSP-I is reflected through the mean value of information integration (3.59), the less prevailing factor among four factors comprising the dry port–seaport construct. The findings align with the literature; for example, Kumar and Pugazhendhi (2012) suggest that there are various degrees of integration sharing that range from no sharing to partial sharing to full sharing, and integration sharing depends on various factors.

Integration information is measured based on transported cargo flow information, an information interchanging system, and responses to emergencies based on dry ports and seaports working together to ensure smooth transportation cargo flow and supply chain efficiency. Ranging from 0.914 to 0.923, these indicators strongly measure information integration in the context of the seaport–dry port relationship.

6.2.4. Geographical integration

Geographical integration in this study refers to the relationship between seaports and dry ports located in areas that are convenient for cargo receipt and delivery to and from the cargo owner. It means that the locations of dry ports are either next to customers' doorsteps or the transportation links between the dry ports and seaports are easy to access. The result of descriptive statistics (see Chapter 5) shows the means of a five-point Likert scale and standard deviations of these indicators range from 3.61 to 3.72 and 0.725 to 0.78, respectively, illustrating that there are different levels of geographical integration depending on the integrative relationship pattern between dry ports and seaports. In the afore mentioned

descriptive analysis, the levels of the DPSP-I change from dyad to dyad. In some dyads, their connection is disconnected or loose, normally due to the competing or independent interrelation between them, while with the collaborative dry port–seaport dyads, the geographical location of the dry ports is a point that seaports take into consideration when deciding to integrate or collaborate. It also partly enhances the level of their mutual integration. In other words, looking at the relationship between dry ports and other nodes in a supply chain in terms of geographical location, the integration tendency of each dry port–seaport dyad could be addressed. For example, interviews with seniors working in the maritime industry show that the geographical location of a dry port or seaport may enhance or inhibit the collaboration between the dry port and seaport. An example of this situation is a small seaport in southern Vietnam that is located in a highly competitive seaport area. To secure their market share, this seaport has annual contracts with five dry ports (ICDs) that are connected to the seaport via inland waterway; around two-thirds of the seaport throughput is from such ICDs, which highlights the importance of this collaboration. Meanwhile, the validity and reliability of the geographical integration factor, confirmed via the measurement model evaluation, are significant (the Cronbach's alpha was 0.879, outer weight was 0.246). All the indicators have high factor loadings, ranging from 0.894 to 0.903, demonstrating that these indicators strongly measure geographical integration in the context of the seaport–dry port relationship. Although dry ports have been developed in Vietnam since 1995 to support cargo flow to seaports, they have been developed spontaneously without macro planning, ranging from small-scale terminals to highly integrated systems, leading to diversity in port–hinterland systems (Nguyen and Notteboom, 2016). Furthermore, conventional hinterland transport, which is based on numerous links by road and a few by low-capacity rail in the north and by road and river waterway in the south, leads to the geographic-selected integration between dry ports and seaports. For example, dry ports located next to seaports play the role of container yards to compete with seaports that are small-scale and limited in capacity in terms of container services or cargo storage due to low economies of scale. This is in line with arguments from the study of Nguyen *et al.* (2020) that, in the north of Vietnam, some ICDs and depots, which receive investment from shipping lines and logistics companies that are just a few kilometres away from small-scale maritime terminals in order to serve their own cargo, play the role of satellite terminals for the surrounding seaports to enhance the frequent high cargo flow between these nodes. In these cases, dry ports and seaports act as competitors that have no direct relationship. In contrast,

Roso, Woxenius and Lumsden claim in their study (2009) that, in developed countries, close dry ports generate no urban road transport or gate congestion from shippers at long or midrange distances. They therefore offer greater possibilities for buffering containers and even loading them on the rail shuttle in sequence to synchronise with the loading of a ship in the port, thanks to support from a very reliable rail service. This avoids the risk of increased dwell times for container vessels. It is clear that there is no geographical integration between dry ports and seaports in developed countries, where dry port development is based on the good plan, but this factor exists in the context of the spontaneous plans of dry port development, which are found mainly in developing countries.

The findings in this study also indicate that dry ports (ICDs) whose locations are convenient for connecting industrial zones or are next to the waterway transport network bring competitive advantages to dry port–seaport dyads. It is obvious; cargo owners prefer to integrate dry ports that are located in areas with easy and convenient access, from the seaports' point of view. In the literature, dry ports in advanced economies are positioned so as to reach the supply chain at the lowest cost; in other words, inland nodes are 'supply chain-oriented' (Ng and Cetin, 2012) and based on macro-planned, developed road–rail or rail–rail systems. This is presented through numerous studies; for example, Awad-Núñez, González-Cancelas and Soler-Flores (2016) argue that, from the seaports' perspective, dry port locations help to minimise the number of close logistics platforms (controlling competition) and maximise the number of distant logistics platforms (integrating the entire collaborative logistics system). Roso, Woxenius and Lumsden (2009) also indicate that the main reason for a seaport to engage with a dry port is that a wider hinterland can be secured by offering shippers low-cost and high-quality services. However, this differs from advanced economies; dry ports in developing countries might be 'cluster oriented' (Ng and Cetin, 2012), aiming to get more customers. The dry ports in this context, consequently, are likely to be situated close to production bases, or even inside economic zones; for example, studies by Ng and Gujar (2009) in India, UNESCAP (cited in Nguyen and Notteboom, 2016) in the Indochina region and Cronje, Krugell and Matthee (2009) in South Africa point out this characteristic. In Vietnam, although the dry ports have been developed spontaneously without macro planning, and the links between them and seaports are mainly by low-capacity roads, rails and natural river systems, they are mainly close/convenient to industrial areas. Therefore, the geographical locations of dry ports in developing countries become a critical factor that seaports consider before integrating; in other

words, there is a factor of geographical integration measuring DPSP-I, while the importance of dry port location in developed countries seems blurred, thanks to efficient link systems. According to Notteboom and Rodrigue (2009) and Ng and Cetin (2012), dry ports in developing countries distinguish themselves from those in developed ones through differences in geography, regional developmental pace and local practices. These authors emphasise that dry ports in developing economies are more cluster-oriented than supply chain-oriented. In other words, the development of these dry ports might not be to optimise the total logistics performance, but to gain more customers.

6.3. The impact of dry port-seaport integration on seaport's performance.

In light of relational view (RV) theory, inter-firm resources of supply chain collaboration are partnership-specific; critical resources that cannot be achieved in isolation and can only be created through the combined contributions of integrated partners to reach beyond firm boundaries could enhance the competitive advantage of the supply chain (Sukati *et al.*, 2012). Therefore, SCI is thought of as one of the managerial tools that has the potential to generate competitive advantages in organisations (Flynn, Huo and Zhao, 2010b; Vickery *et al.*, 2003), and the relationship between SCI and firm performance has been well investigated through the decades. Most SCI studies hold the same view: that the level of SCI has a positive influence on performance outcomes (Cao *et al.*, 2010; Cao and Zhang, 2011; He and Lai, 2012; Liu *et al.*, 2013). However, the research on DPSP-I and its relationship with ports' performance is scant. This study proposes a DPSP-I model to examine the influence of integration on seaports' performance with the hypothesis that the influence is positive. The findings from interviews and questionnaires show that the integration of dry ports and seaports has a significant positive impact on seaports' performance in terms of port service quality, customer satisfaction and financial performance. A detailed discussion of the impact of DPSP-I on seaports' performance is presented below.

6.3.1. The impact of dry port- seaport integration on seaport service quality

The results of the structural model evaluation (see Chapter 5) demonstrate that DPSP-I has a significant impact on port service quality ($R^2 = 0.415$, $p < 0.01$). Although there is a growing body of evidence indicating that SCI positively affects firm performance (Flynn, Huo and Zhao, 2010; Yuen and Thai, 2016), research on the direct impact of SCI on quality is still scant. For example, several studies in the manufacturing sector investigated the impact between SCI

and quality; however, the findings do not agree. Rosenzweig, Roth and Dean (2003) found a significant and direct relationship between SCI and product quality, while the study by Koufteros, Vonderembse and Jayaram (2005) on the impact of customer integration, supplier product integration and supplier process integration on quality showed a non-significant relationship. Prajogo and Olhager (2012) found a significant and direct relationship between supplier assessment as a component of SCI and quality performance, but a non-significant relationship between a strategic long-term relationship with suppliers and quality performance in their study. There is no previous research on this relationship in the service area. The findings of this study on maritime service show that the relationship between DPSP-I and port service quality is significant and direct; moreover, the variance of port service quality (41.5%) can be explained by the variance of the integration between dry ports and seaports; a higher level of DPSP-I may lead to better port service quality in terms of service delivery speed, price competitiveness, the safety and security of shipments, the amount of paperwork errors, service consistency, service availability, service improvement and level of operation and management efficiency. Elaboration on these influences in the context of DPSP-I in Vietnam is presented below.

Speed of service is a component of service quality. Among the inherent characteristics of a service supply chain, which include perishability, intangibility and simultaneity in production and consumption (Yuen and Thai, 2015b), efficiency must be associated with a more responsive reaction. Contrary to product supply chains, where inventories can be procured, manufactured, inspected and stored in advance at various nodes of the supply chain, a service cannot start until the supply-requiring information or orders from customers are received. Indeed, most planning and preparation for a service cannot be performed in advance (Stavrulaki & Davis, cited in Yuen and Thai, 2017). In this context, a streamline of information flow – an interconnection between dry ports and seaports in operational activities – becomes essential because, through information integration, cargo information from dry ports can be made available to seaports well in advance and can be integrated into their operational systems, and the seaports can be well prepared with the equipment, facilities and manpower to handle cargo as soon as it arrives. The speed of service is therefore enhanced.

Meanwhile, the integration of information on cargo, customers' needs and requirements, or any information related to the cargo flow transported between dry ports and seaports enhances inter-firm information flows and the compatibility of the integrated software systems, which ensures

the accessibility, accuracy and timeliness of information during the operational process. Information related to cargo transported to/from dry ports, therefore, is available in advance on the seaport information system, and there are no errors, thanks to the elimination of manual input operations. This integrated information allows the operated cargo flow to run smoothly. Improving the measured indicators of port service quality during integration between dry ports and seaports is acknowledged by senior managers in interviews. In the context of the maritime supply chain in Vietnam, information sharing via electronic platforms between the parties involved in transporting cargo enhances the consistency of service and avoids paperwork errors, according to a seaport manager (SP04).

Next, a joint plan, according to a dry port manager's opinion, is mutually discussed and exchanged between dry ports and seaports in order to organise resources, facilities and personnel in a timely manner to load/unload cargo on/from ships. The availability of service is therefore enhanced via operational integration. Some interviewees claim that following joint operational plans in daily activities, work processes and decisions to support emergencies improve the consistency of service and increase the speed of releasing ships – this is port service quality criteria that port customers and shipping lines pay much attention to. These findings are in line with literature focusing on the manufacturing area; for example, Prajogo and Olhager (2012) state that strategic, long-term relationships with suppliers enhance delivery performance, while findings from a study by Droge, Vickery and Jacobs (2012) show that external integration facilitates delivery performance. Furthermore, according to a manager of a seaport, when parties involved in DPSP-I trust and respect their counterparts' contributions, and thus the cooperative relationship, this will bring about mutual benefits. When supply chain partners are committed to each other, they will provide all the necessary resources to show their loyalty to the relationship (Cann, 1998). Time and cost in transactions occurring between partners within the supply chain, therefore, could be minimised, thanks to trust and commitment. In maritime supply chain practice, the collaborative relationships between dry ports and seaports result in saving time and costs in operative activities; providing service to customers then facilitates improvements in service speed and costs. Consequently, this increases the number of customers using seaports' services and the volume of cargo throughput of the seaports in operation. An example of this effect can be seen in a seaport in the south of Vietnam that has two-thirds of container throughput, thanks to collaboration with dry ports (ICDs).

Lastly, geographical integration is a factor of the DPSP-I construct that is caused by the historical development of ports that are spontaneous and without long-term strategy in developing countries. This includes Vietnam (Nguyen and Notteboom, 2016), where geographical integration has had a positive influence on seaport service quality. In the context of Vietnam, this integration exists in dry port–seaport dyads where seaports are looking for collaboration in order to ensure their market share. This pattern usually appears with small-scale terminals that are located in a highly competitive areas and that have a unimodal connection to access; therefore, they tend to collaborate with dry ports that are close to manufacturing areas or are convenient for transportation to gain the most customers. A successive collaboration brings a seaport two-thirds of container throughput, bringing better revenue and ensuring port operation. In this case, seaports are willing to share transportation costs with customers to obtain higher revenue through an increased number of customers. According to a port manager (SP06), the port's customer benefit is the relatively competitive price (the price is reasonable thanks to the seaport's cost-sharing initiative). This means that the price customers pay for seaport service may be less, similar or a little bit higher than the average, but customers can get much better service in return: the convenience and safety of the cargo are assured because it is transferred from the shippers to the port at the dry ports, which is close to their manufacturers. Furthermore, when a seaport is integrated with a dry port that is located close to industrial zones, this can help reduce delivery/pickup times to/from the customer's premise. In other words, the port service quality of seaports can be enhanced at the dry ports. The early transfer of responsibility for the cargo from customers to seaports on the customers' doorsteps (dry ports) facilitates cargo safety and security, thanks to specialised cargo-handling equipment, transporting vehicles and skilled personnel at dry ports. This subsequently minimises risks because it enhances cargo safety and security in the handling process and the transportation between dry ports and seaports.

In summary, although many existing studies support a positive relationship between external integration and operation performance (Yuen and Thai, 2016), the investigation into the impact of DPSP-I on port service quality is scant. As evidence, this study presents the significant positive influence of integration on port service quality. However, it is noticeable that DPSP-I has a different influence on port service quality in developed and developing countries, which exists despite the fact that integrated dry port–seaport dyads benefit parties involved in the maritime supply chain. The difference results from competing or independent dyads due to

spontaneous and unplanned dry port development, which leads to loose or disconnected relationships between dry ports and seaports (Nguyen *et al.*, 2020). This argument is in line with the idea proposed by Roso, Woxenius and Lumsden (2009) that dry ports are used much more consciously than conventional inland terminals (the pattern of DPSP-I in Vietnam), which aims to improve the situation that results from increased container flows and focuses on security and control through the use of information and communication systems. Therefore, creating effective seaport inland access – that is, smooth transport flow with one interface (in the form of the dry port concept) instead of two, with one at the seaport and the other at the inland destination (Roso, Woxenius and Lumsden, 2009) – requires coordination between all the actors involved (Van Der Horst and De Langen, 2008).

6.3.2. The impact of dry port- seaport integration and port service quality on customer satisfaction.

The results of the structural model evaluation (see Chapter 5) demonstrate that DPSP-I that is associated with port service quality has a significant impact on customer satisfaction, with $R^2 = 0.548$ and $p < 0.05$ and $p < 0.01$, respectively. This means that the variance of customer satisfaction (54.8%) can be explained by the variance of integration between dry ports and seaports and the variance of port service quality. In the context of DPSP-I's inherent characteristics of a service supply chain, in which production and consumption occur at the same time, customers feel satisfied when they experience service that fulfils or surpasses their expectations. Satisfaction is also one of the most important elements to explain any type of relationship among participants that relies on the customer's experience being fulfilled or surpassing their expectations (Yeo, Thai and Roh, 2015). Discussion of this relationship is presented in detail below.

In terms of the relationship between DPSP-I and customer satisfaction, the former has a significant impact on the latter. Relational view theory helps explain why integration should be related to customer satisfaction. First, the customer requires availability, accuracy of information related to cargo that is transported between dry ports and seaports, and ports' responsive reactions through information integration that is shared along the supply chain, which increases the probability of a common understanding among the parties. Therefore, a customer's expectations of timeliness and cargo information are kept consistent with the supply chain's ability to meet the customer's need, and met expectations correlate with satisfied

customers. This aligns with the studies of Allred *et al.* (2011) and Yu *et al.* (2013), which argue that customer integration allows the customer to contribute to the mutual knowledge that is created by shared information, and this subsequently enhances the supply chain's ability to satisfy the customer's expectations. Second, trust and commitment between dry ports and seaports, which is gained through relationship integration, lead to cost and time savings related to cargo transportation within hinterlands. This meets the customer's expectations in terms of costs and cargo operation and management, as well. Next, joint planning and joint operational activities, through operational integration, help to eliminate many of the delays that arise in the cargo transportation process, ensuring the customer's requirements for time and management are met. Last, geographical integration satisfies the customer's desire for competitive cost. Furthermore, this provides convenience in terms of choosing where the customer wants to drop off their cargo, and the security and safety of the transported cargo are assured, thanks to the alternative of dropping the cargo on their doorstep and transferring the cargo responsibility to seaports there.

In the context of the integration between dry ports and seaports in Vietnam, from the perspective of senior managers (SP04, DP01) who have been working for over ten years in the maritime sector, customer satisfaction has been achieved through more convenient alternative options that seaports give their customers, thanks to integration. Instead of cargo being transported directly to seaports, customers can leave their cargo in dry ports (ICDs) close to their warehouses and be sure that their cargo will be transported to the seaports safely and at a reasonable cost. In so doing, the responsibility of cargo transportation is transferred from the shippers to the dry ports. In this case, dry ports become the seaports' extended gates, providing support to enlarge the seaports' market share and tackle congestion at ports. Better customer service, thanks to integration between dry ports and seaports, is the most important advantage that customers in this supply chain experience in various contexts. However, these experiences differ in developed countries compared to developing countries. Although there are some similarities, such as more value-added services at the customer's doorstep, faster customs clearance, simplified documentation and lower storage rates, some differences can be observed between the two contexts. While customers in developed countries are satisfied with lower transport costs, more value-added services at the customer's doorstep and faster transport of units to/from the seaports (Roso, Woxenius and Lumsden, 2009) – thanks to the efficient intermodal transportation network (mainly by rail) connecting dry ports and seaports under the

planned macro strategy – those in the Vietnam maritime context are willing to pay slightly higher prices or wait longer for units to be transported to/from seaports as this, in turn, provides convenience for cargo owners and ensures the safety and security of cargo by dropping/picking up the cargo on their doorstep. Another difference between developed countries and developing countries (including the Vietnam maritime context) is the intermodal transportation network between dry ports and seaports; the efficiency of networks in developed countries is based on rail and dry ports, which are developed based on a well-planned macro strategy, while the efficiency in Vietnam is due to the utilisation of naturally dense waterways (especially in the south of Vietnam) for transporting goods by barge.

Meanwhile, the findings show that port service quality has a significant impact on customer satisfaction. Generally, customer satisfaction is known as an outcome of service quality, which means that it is related to the quality of the products or services that are provided to the customer; the quality of that products or services surpasses customer expectation. The level of customer satisfaction is also believed to be enhanced, and the perceived quality of the product or service also increases. In the DPSP-I context, a reasonable logistics service price, the availability and consistency of the service, and cargo safety and security – thanks to the integration of the information, relationship, operation and geographic location – give seaport customers satisfactory experiences. The findings in this study contribute to a scant number of studies on the relationship between service quality and customer satisfaction in the context of ports. This finding is aligned with investigations by Yeo, Thai and Roh (2015), Thai (2016) and Phan, Thai and Vu (2020), which found that the port service quality factor also has a significant positive impact on customer satisfaction. Although this relationship has not been investigated in the maritime sector, it has been confirmed from numerous other studies in many service sectors. The few studies in the transportation sector, including aviation (Anderson, Baggett and Widener, 2009) and high-speed railways (Cao and Chen, 2011), also revealed a positive relationship between service quality and customer satisfaction.

In this study, findings also indicate that port service quality plays a mediating role in the relationship between DPSP-I and customer satisfaction. Particularly, DPSP-I is found to have a direct effect on port service quality, which is a predictor of customer satisfaction. As DPSP-I is also affirmed to directly affect customer satisfaction (see Section 5.6), port service quality thus has a somewhat mediating effect on the relationship between DPSP-I and customer satisfaction. This means that customers' expectations could be surpassed in two ways: by

combining the resources of dry ports and seaports in a unique way under RV theory to satisfy customer satisfaction, or by combining resources to enhance port service quality, thereby achieving customer satisfaction. Furthermore, the path coefficient of indirect effect is bigger than that of direct effect, which means that unique interconnected assets can lead to better customer satisfaction results, thanks to the integration between dry ports and seaports that aims to enhance port service quality. This study is partially consistent with a previous study in logistics by Fernandes *et al.* (2018), in which findings show evidence that the quality of logistics services totally mediates the relationship between logistics capabilities and the satisfaction of clients. In the study by Fernandes and his colleagues (2018), logistics capabilities are defined as a subset of resources that enable a firm to exploit other resources more efficiently and to distinguish itself from its competitors' equivalence with the characteristics of unique resources that result from the integration between dry ports and seaports. Consequently, the relationship between DPSP-I and port service quality–customer satisfaction is a unique asset, which contributes to the understanding of the relationship between SCI and firm performance in the maritime context.

6.3.3. The impact of dry port-seaport integration and port service quality on financial performance

The results of the structural model evaluation in Chapter 5 demonstrate that port service quality has a significant impact on financial performance with $R^2 = 45.1$ and $p < 0.01$. This means that the variance of financial performance (45.1%) can be explained by the variance of port service quality. It can be understood that the improvement of port service quality would enhance seaport finance. As in the discussion in Section 6.3.2, good port service quality, with the outstanding attribute of creating convenience and many alternative options for customers, brings seaports more customers, and this is a factor that directly improves ports' finances. In particular, responsive service attracts both shipping lines and cargo owners. The amount of time a ship is at berth can be reduced thanks to available cargo-handling equipment and timely shared information, and this is a critical factor for shipping operators; competitive service price, safety for cargo, and paperwork convenience are all good points that increase the number of customers who use the port service. Another critical characteristic of port service that seaports offer their customers is flexible alternative locations for loading/unloading cargo: at the seaports or on the customers' doorsteps (seaport-collaborated/integrated dry ports). This characteristic is extremely attractive to customers. A port manager (SP04) advocated that 'the

convenience helps to ensure the safety of the container … and avoid transporting into the city, avoid(ing) the congestion'. The findings in this study, which illustrate the significant impact of port service quality on financial performance, does not align with similar results in the literature, except for a study by Jeevan, Kour and Sharma (2017), which shows the significant relationship between port service quality and financial performance, which is mediated by customer satisfaction.

In terms of the relationship between DPSP-I and financial performance, the finding shows that there is non-significance; this means that there is no direct relationship between DPSP-I and financial performance. In this study, this can be explained by the full mediator that exists between them: port service quality. There are conflicting results in the literature, ranging from industry to industry, with much of the research on this relationship conducted in the manufacturing area. In particular, while Rosenzweig, Roth and Dean (2003) found that SCI has significant direct effects on revenue, sales growth and ROA, Vickery *et al.* (2003) found a non-significant relationship between SCI and financial performance. Later, Droge, Jayaram and Vickery (2004) found that internal integration and the interaction of internal and external integration have a significant direct impact on financial performance. Prajogo and Olhager (2012) found a significant relationship between logistics integration and cost performance. Similar findings are seen in the studies of Huo (2012) and Beheshti *et al.* (2014), which show that internal integration and SCI have a significant direct impact on financial performance. In contrast, in the same study, Huo (2012) concluded that customer integration had a non-significant relationship with financial performance. Yu *et al.* (2013) show that the relationship is fully mediated by customer satisfaction. Vickery *et al.* (2003) found that customer service fully mediates the relationship between integration and financial performance. In the service industry, particularly in the maritime supply chain, service quality and customer satisfaction are critical factors that would be prioritised; hence, the relationship between SCI and financial performance is mainly mediated by service quality and/or customer satisfaction. However, the research on the indirect relationship between SCI and financial performance is still scant.

In this study, findings also indicate that port service quality plays a mediating role in the relationship between DPSP-I and financial performance. Specifically, the relationship between DPSP-I and financial performance is found to be non-significant, while port service quality significantly impacts financial performance. As DPSP-I is also affirmed to directly affect port service quality (see Section 5.6), port service quality thus has a fully mediating effect on the

relationship between DPSP-I and financial performance. This finding supports the argument that the financial results would be enhanced if the integration between dry ports and seaports that targets port service was quality-oriented. In particular, information integration, operational integration, relationship integration and geographical integration need to be designed and coordinated in a way that aims to enhance various features of port service quality, such as speed and timeliness, price competitiveness, cargo receipt/delivery reliability, the availability and consistency of port service and the efficiency of port operation and management. Consequently, the efficiency of costs, revenue and profit of seaports could be reached.

6.3.4. The impact of dry port-seaport integration and customer satisfaction on seaport financial performance

In this study, findings indicate that the impact of both DPSP-I and customer satisfaction on financial performance is non-significant. While the former has been discussed in Section 6.3. 3, the latter finding differs from numerous previous studies, which have found a significant direct relationship between customer satisfaction and financial performance. This study; therefore, argues that the importance of customer satisfaction in achieving competitive advantage has been examined in both the service and manufacturing environments. As suggested by the service–profit chain (Heskett *et al.*, 1994), there is a positive relationship between customer satisfaction and financial performance (Yu *et al.*, 2013; Hairuzzaman, 2019).

These findings from the literature lead to an explanation for the finding in this study: the relationship between customer satisfaction and financial performance should be mediated by customer loyalty. Customer satisfaction and financial performance are linked through the increased number of similar transactions and the attendant learning that results from a higher level of customer loyalty (Chang and Thai, 2016). Specifically, increased customer satisfaction, which may be attributable to increased performance resulting from improved comprehension of customer wants and needs, drives increased loyalty, which in turn yields a steady stream of future cash flow (Sarigiannidis and Maditinos, 2013). This cash flow is steadier and more certain, in part because high levels of customer satisfaction tend to reduce price inelasticity. This means that a premium can be extracted for the product or service, or fewer price promotions would be required to ensure a purchase. Furthermore, since there are a greater number of purchases from the same buyers, which is attributable to increased loyalty, this customer loyalty leads to reduce transaction costs and the number of failures (Chang and Thai,

2016).

6.4. Conclusion

This study provides a comprehensive understanding of the integration between dry ports and seaports in a developing country through empirical evidence that enriches knowledge of the integration between dry ports and seaports in various contexts. This evidence also outlines how integration impacts the performance of the supply chain nodes, known as seaports, in terms of port service quality, customer satisfaction and financial performance. Particularly, DPSP-I is measured by four factors: three proposed factors from the conceptual model – information integration, operational integration and relational integration – and a new one found from interview findings – geographical integration. The findings also illustrate the direct effects of DPSP-I on port service quality and customer satisfaction. Essentially, they indicate two indirect relationships between DPSP-I and financial performance: DPSP-I and customer satisfaction are fully mediated and partially mediated by port service quality. The findings suggest port operators should use port service quality as a lever to enhance customer satisfaction and financial performance by managing DPSP-I resources.

Chapter 7. CONCLUSION

7.1. Introduction

This chapter presents a summary of the findings, the theoretical and managerial implications, and suggestions for future research. This brief introduction (Section 7.1) is followed by a section revisiting the research objectives and research questions, and summarising the findings (Section 7.2); this illustrates how the study achieves the research objectives and addresses the research questions, and summarises the previous discussions. The implications of the research, which highlight both theoretical and managerial implications, are presented in Section 7.3. Suggestions for further research are proposed in Section 7.4, and, finally, the thesis is rounded off with a concluding statement in Section 7.5.

7.2. Revisiting the research objectives and research questions and summarising the findings

Supply chain integration (SCI) has been studied for decades, and its investigation remains ongoing, due to the benefits it brings to manufacturing and service businesses. As the maritime supply chain has an increasingly important role in facilitating globalisation and international trade, thanks to its capability in transporting large volume shipments over long distances at low costs, the benefits of integration to such transportation are increasingly attracting researchers' attention. However, there is scant research on the integration between the critical nodes of the supply chain – dry ports and seaports – and its effects on the involved parties. The few existing studies on the dry port–seaport dyad focus mainly on the role of dry ports as the extended gates of seaports and are in the field of advanced economics. In these it is seen that the development of dry ports has been well planned under macro strategy, from the location of dry ports to the links between dry ports and seaports. To extend research into the development of the dry port–seaport dyad, this study was undertaken in a developing country context, specifically in the context of Vietnam's maritime sector, in which the historical development of dry ports occurred spontaneously, without macro planning; the aim was to identify the dimensions of dry port–seaport integration (DPSP-I) and explore the impact of such integration on seaport performance. The findings suggest the utility of further studies on the integration of the dyad in different contexts. A summary of the findings is presented in Table 7.1.

Table 7.1- Summary of findings

Research question	***Findings***
RQ1: What is the current status of DPSP-I in Vietnam?	Dry port–seaport integration can be measured by four factors: three developed from the literature (information integration, operational integration and relationship integration) and one identified from interviews (geographical integration). All were found to be reliable and valid through measurement model tests in the quantitative phase of this study. The pattern of DPSP-I in Vietnam is complicated due to the historically spontaneous development of dry ports without an overarching plan. Consequently, there are some dry port–seaport dyads whose relationship is disconnected and involves competition or independence, while in other dyads the relationship is well integrated.
RQ2: How does DPSP-I impact seaport performance in the context of Vietnam?	The unique interconnected resources resulting from DPSP-I significantly effect seaport performance in terms of port service quality (direct relationship), customer satisfaction (partially mediated indirect relationship) and financial performance (fully mediated indirect relationship). The indirect effects are mediated by port service quality
SRQ2.1: How does DPSP-I impact seaport service quality in the context of Vietnam?	Transaction cost economics (TCE) and the relational view (RV) suggest that the inimitable resources resulting from DPSP-I significantly and directly affect seaport service quality; these results are confirmed via evaluation of structural modal and also supported by findings from interviews
SRQ2.2: How does DPSP-I impact seaport customer satisfaction in the context of Vietnam?	Transaction cost economics and the RV suggest that the inimitable resources resulting from DPSP-I significantly and directly affect seaport customer satisfaction. The effect of DPSP-I on customer satisfaction is partially mediated through the port service quality factor. These findings are confirmed via evaluation of structural modal and also supported by findings from interviews.

Research question	*Findings*
SRQ2.3: How does DPSP-I impact seaport financial performance in the context of Vietnam?	Transaction cost economics and the RV suggest that the inimitable resources resulting from DPSP-I have a non -significant direct effect and a significant indirect effect on seaport financial performance, i.e. DPSP-I has a ful ly mediated effect (through the port service quality factor) on seaport financial performance. These findings are confirmed via evaluation of structural modal and also supported by interviews.

This section systematically represents how this study's aim and research objectives were achieved and the research questions answered. The overall purpose of the study is to examine the relationship between DPSP-I and seaport performance in the maritime supply chain, and, in particular, the container port context. Two objectives with two research questions were proposed to achieve the study goal.

The first objective, which relates to the first research question, is to explore the dimensionality of DPSP-I in the context of Vietnam. In order meet this objective, a comprehensive review of the extant literature on relevant topics of SCI in general, and in the context of port areas in particular, was undertaken to provide an understanding of the current dimensions of DPSP-I. Measurement items for the dimensions of DPSP-I were then developed based on the literature; these were explored through the findings from in-depth interviews with senior managers working in the maritime industry in Vietnam, i.e. for seaport operators and their customers. Through exploratory factor analysis and evaluation of the measurement model, the dimensionality of DPSP-I was confirmed to be reliable and valid; thus, the first objective was achieved. In particular, together with three dimensions developed through the literature review (information integration, operational integration and relationship integration), a new dimension associated with the context of dry port development in developing countries, geographical integration, was used to measure the DPSP-I construct. According to the theory of transaction cost economics (TCE), DPSP-I creates unique and non-social specific assets that are hard for competitors to imitate. However, the level of integration varies widely between the dimensions of DPSP-I due to the historical development of dry ports in developing countries, including Vietnam.

The factor found in the study to have the strongest association to DPDP-I is relationship integration; this is based on the fostering of relationships and trust between supply chain partners by valuing and respecting the contribution of each, maintaining long-term collaborative commitment, continuing to make collaborative improvements and extensively investing in specific resources to meet the requirements of mutual customers. A consequence of these actions is the engagement of partners' attitudes and behaviours. Administrative procedures, therefore, can be simplified or eliminated, leading to time and cost savings in the governance of the transaction process between them. In other words, relationship integration resulting from the integration between dry ports and seaports is a specific intangible resource

that enhances the performance of both, enabling them to extend their reach; it is impossible for competitors to imitate.

Analysis of the findings from the interviews and the survey show that the specific context of the Vietnam maritime industry (as described above) presents barriers to integration between dry ports and seaports. Constraints result from both the reasons that are revealed in the literature and from the particular context of Vietnam. One barrier in the literature is dysfunctional behaviour within organisations, including lack of trust, opportunism (Ketkar *et al.*, 2012) and management strategy (Yuen and Thai, 2016a). The emerging issue in the context of Vietnam is the spontaneous development of dry ports. This leads to a variety of patterns of dry port–seaport relationships in Vietnam. On the one hand, in the north, where the distances between dry ports and seaports are short (around 100 km) and transport links between them are less accessible, customers prefer to load/unload their cargo directly at seaports, instead of at dry ports; this leads to weak or competing relationships between the two. On the other hand, in the south there is a density of domestic waterways, which facilitates connections between dry ports and seaports. The high accessibility of seaports from customers' doorsteps (dry ports) leads to strong collaboration between them, bringing mutual benefits to the involved parties in the supply chain: customers can leave their cargo at their doorsteps with reasonable service costs; dry ports can fully support seaports as seaports' extended gates and can thus increase their revenue for services provided; seaports can provide customers with better service in terms of speed, price, cargo security and consistency and availability of service; congestion at ports can be avoided, resulting in cost savings and increased revenue.

The factor found to have the second-strongest association to DPDP-I is operational integration; this refers to any joint plan, operational activities and operational emergencies, and the improvement of the plan and operational ability and capability to enhance the efficiency of cargo flow in the hinterland between dry ports and seaports to meet customer requirements. In the light of TCE theory, this is also a unique intangible resource resulting from the integration between dry ports and seaports and ensuring the transportation of cargo between them with safety, timeliness and cost competitiveness. However, levels of operational integration vary widely; this is supported by the findings of both the qualitative and quantitative analysis. While dry port–seaport dyads whose relationships are independent or competing contain disconnection in the operational process, well-integrated dyads work together in all plans, operational activities and operational emergencies related to cargo transported between dry

ports and seaports; additionally, this process is continually improved, creating a dynamic resource that is hard for competitors to copy. The involved parties have sufficient knowledge of the cargo flow schedule to prepare their resources (facilities, equipment and personnel) well in advance for cargo handling and to collaborate well to deal efficiently with arising emergencies, thus reaching and surpassing performance targets. These findings are in line with Cao and Zhang's (2011) study within the manufacturing sector, ranging across various industries. They identified a set of seven interconnecting dimensions that make up effective supply chain collaboration, which enables the leveraging of resources.

Next, information integration is the third interconnected dimension and specific integrated resource of DPSP-I. It refers to inter-firm information flows and systems that are invested in and integrated to ensure software compatibility, enhancing the accessibility, accuracy and timeliness of information during the operational process and thus ensuring a smoothly operating cargo flow. In this study, the findings from senior managers working in the maritime sector, which are supported by the descriptive statistics, show that different levels of information integration exist due to the developing country context of Vietnam. The information shared may refer to customers' needs and requirements or to cargo transported between dry ports and seaports, and communication may take place by any of a variety of means, including phone, email and compatible information systems. Information integration supported by information technology within a supply chain enhances the availability and accessibility of necessary information; the involved parties are able to prepare their resources well to serve the timeliness and safety of cargo flow. Information integration, therefore, becomes a leveraged resource that seaports can attain through the integration between dry ports and seaports.

Geographical integration is the final DPSP-I dimension; it was identified from interviews and is an attribute associated with the context of developing countries, represented here by Vietnam. This is a new dimension not found in the literature. In previous studies on the maritime industry, dry ports in developed countries have been investigated as the extended gates of seaports and their development occurs under macro planning; the implication of this scenario is that dry port locations are selected to ensure accessibility and good links. However, in developing countries, the history of dry port development is spontaneous and lacks macro planning; this leads to a diversity in port–hinterland systems (Lam Canh Nguyen and Notteboom, 2016) that seriously affects the integration between dry ports and seaports.

Furthermore, conventional hinterland transport, which in the north of Vietnam is based on numerous road links and a few low-capacity rail links and in the south is based on road and river waterways, leads to geographically selective integration between dry ports and seaports. This explains both the qualitative and quantitative results of this study, i.e. why levels of geographical integration vary from low to high. For example, dry ports owned by shipping lines, mainly distributed in the north of Vietnam, are normally located close to seaports and are in competition with them; therefore, the relationship between dry ports and seaports is disconnected. In contrast, thanks to the dense network of domestic waterways in the south, which reduces transportation costs, integration between dry ports and seaports in this region has become popular and strong. In this case, dry ports become the extended gates of seaports, narrowing the distance between seaports and customers' doorsteps. It is obvious that dry ports located in areas that are easy and convenient for cargo owners to access are preferable for integration from the perspective of seaports. Therefore, in developing countries the geographical location of a dry port becomes a critical factor for a seaport considering integration; in other words, geographical integration is a factor in measuring DPSP-I in developing countries, whereas the importance of dry port location in developed countries with efficient link systems is less distinct. In developing countries, geographical integration is an interconnected asset resulting from the integration between dry ports and seaports and enhancing their mutual benefits.

The second objective of this study is to construct and validate a conceptual framework to examine the relationship between DPSP-I and seaport performance in terms of port service quality, customer satisfaction and financial performance; this relates to the second research question, and particularly the Sub-Research Questions 2.1, 2.2 and 2.3. As research on DPSP-I is scant, the existing literature on topics related to SCI and the relationship between such integration and the performance of supply chain members is reviewed. Among theories explaining and considering SCI, TCE and the RV are the most useful theories to explain the efficiency of inter-firm transactions and the outstanding unique resources that the members of a supply chain can acquire when their resources are integrated. In the light of the TCE and RV theories and findings from in-depth interviews, a conceptual model of four constructs (DPSP-I, port service quality, customer satisfaction and financial performance) was proposed. The results of structural equation modelling analysis confirmed the validity and reliability of the measurement models and demonstrated a medium level of overall fit for the proposed model.

Next, bootstrapping tests were used to obtain results showing the causal relationship between DPSP-I and seaport performance in terms of port service quality, customer satisfaction and financial performance.

In terms of the impact of DPSP-I on port service quality (Sub-Research Question 2.1), the findings from the study interviews and survey show that this relationship is direct and positive. This means that the unique and specific interconnected assets resulting from the integration between dry ports and seaports (according to TCE) can directly lead to the improvement of port service quality. Specifically, information integration resulting in the availability, accessibility and transparency of information related to cargo transported between dry ports and seaports facilitates the process of information collecting and processing at seaports and thus the advance preparation of resources to receive incoming cargo. Hence, service availability and the speed and timeliness of cargo handling can be significantly improved – i.e. port service quality can be improved. Next, relationship integration, which simplifies or eliminates administrative procedures to obtain time and cost savings, fosters mutual trust and commitment between dry ports and seaports. This allows seaports to offer customers price competitiveness and port service timeliness. Furthermore, operational integration can provide customers with a service in which dry ports and seaports work jointly in areas from planning to dealing with emergencies. Tight collaboration in the operational process helps the involved parties to be more responsive to almost all circumstances, and errors during operation can be limited or eliminated. This means that port service quality can be greatly enhanced in terms of service consistency, cargo safety and security, port operation and management efficiency. Finally, geographical integration brings seaport services to customers' doorsteps, thanks to the support of integrated dry ports acting as seaports' extended gates. Cargo safety and the reduction of delivery/pick up time to/from customers' premises can be facilitated.

In terms of the impact of DPSP-I on customer satisfaction (Sub-Research Question 2.2), the results obtained from the study interviews and survey show that this relationship is positive and both direct and indirect (mediated by port service quality). This means that the relationship between DPSP-I and customer satisfaction is partially mediated. In other words, customer expectations regarding costs, timeliness, information, safety and security, and operation and management of cargo transported between dry ports and seaports can be fulfilled and surpassed, thanks to the outstanding unique interconnected resources (including information integration, operational integration, relationship integration and geographical integration) that

result from DPSP-I (according to RV theory). Additionally, customers' experiences may surpass expectations if the criteria of port service quality are improved through DPSP-I. The findings from the survey also provide an argument that customer satisfaction can be increased if the unique interconnected resources are invested to enhance the quality of a seaport's service. This suggestion is offered to port policy makers and port operators.

Four hypotheses concerning the relationship between DPSP-I and financial performance (Sub-Research Question 2.3) were tested. The results show that the direct relationship between DPSP-I and financial performance is non-significant; the indirect relationship between them, mediated by customer satisfaction or by port service quality and customer satisfaction, is also non-significant. Additionally, the findings show that the relationships between DPSP-I and port service quality and between port service quality and financial performance contain significant direct effects. Therefore, the indirect relationship between DPSP-I and financial performance, mediated by port service quality, is fully mediated. This means that efficiency in seaport costs, revenue and profits can be reached only by enhancing port service quality through the unique integrated resources that result from DPSP-I. One point from the findings should be noted: that the relationship between customer satisfaction and financial performance is mediated by the mediating factor of customer loyalty. According to Chang and Thai (2016), customer satisfaction and financial performance are linked through the increased number of similar transactions and attendant learning resulting from a higher level of customer loyalty. Sarigiannidis and Maditinos (2013) also argue that customer satisfaction drives increased loyalty, which in turn yields a steady stream of future revenue.

All hypotheses have been addressed, and the second research question, related to the second objective, is therefore answered: the specific interconnected assets that result from DPSP-I have a direct and positive impact on port service quality and an indirect and positive impact, mediated by port service quality, on customer satisfaction and financial performance. This means that port service quality is not only a crucial port performance outcome; it also a mediating factor enhancing other outcomes of seaport performance, including customer satisfaction and financial performance. The detailed implications of this are presented in the next section (Section 7.3).

7.3. Implications of the study

7.3.1. Theoretical implications

The academic research on SCI has been intensively examined over the decades; however, research on DPSP-I is still scarce. There have been studies in shipping and in developed countries; for example, Thai and Jie (2018) investigated the impact of SCI on firm performance in the container shipping industry in Singapore; in the port sector in a developing country, Jeevan and Roso (2019) identified four functions through which Malaysian dry ports can assist seaports to reduce the negative consequences of vessel-size enlargement. This study is therefore a specific case investigating the unique resources resulting from the integration between dry ports and seaports and its impact on seaport performance in the context of developing countries, where the historical development of dry ports is spontaneous and without macro planning. With 80% of world trade transported by sea (International Maritime Organization, 2020), where large volumes can be transported long distances at low costs, research into how to eliminate inefficiency in the container shipping sector is extremely necessary. This study contributes to the literature in several ways. First, it is one of the first studies to quantitatively examine the integration of dry ports and seaports and its impact on seaport performance in a developing country like Vietnam; it thus enriches the integration literature in the maritime supply chain domain. Second, geographical integration, an attribute associated with the development of dry ports in developing countries (i.e. development that is spontaneous and lacking macro planning), is a new factor added to the conceptual model constructed from the literature; it is found to be reliable and valid to measure the construct of DPSP-I. This factor demonstrates that dry port location is an important element in measuring the integration of dry port–seaport dyads. Its finding fills the literature gap in which this factor was ignored due to the implied presence of macro planning in the development of dry ports. This study could therefore be a reference for future research within a similar context.

Findings from this research also extend the application of the TCE and RV theories in maritime SCI, particularly in the context of developing countries. Transaction cost economics is used as an underpinning theory to explain how better firm performance can be achieved through the appropriate adjustment of governance mechanisms for mutual underlying transactions between dry ports and seaports as members of the maritime supply chain. Accordingly, DPSP-I can be seen as an intermediated form of hybrid governance (Cao and Zang 2011) because relational

integration implies the adoption of a strategic connection among supply chain members, characterised by trust, long-term commitment and goodwill, that can help to avoid opportunistic behaviour (Fernandez and Jiménez, 2016). The unique specific interconnected resources that result from DPSP-I (among which geographical integration is a factor missing in other integration studies) may, therefore, in the light of the RV, reach beyond the boundaries of firms, including those in shipping and ports. In this study, joint performance that is above the average (better quality service, customer satisfaction and better financial performance) cannot be achieved in isolation but only through the combined contributions of integrated dry ports and seaports. The findings from this study, therefore, contribute to the theories on inter-firm relationships in the context of the dry port–seaport dyad, which is not simply a supplier–buyer relationship. The partners have many similar functions and provide many similar services; they are not competitors (except due to the historical spontaneous development of dry ports) but, rather, 'symbiotic dyads'; through unique integrated resources, dry ports can support seaports by functioning as their extended gates.

Furthermore, in the light of the TCE and RV theories, the impact of DPSP-I on seaport performance can be leveraged to created multiple positive outcomes. The findings of this study particularly illustrate the importance of port service quality. This is not only an important outcome of seaport performance, but also a crucial mediating factor to raise other performance outcomes, such as customer satisfaction and (especially) financial performance, to levels that they could not reach in isolation.

7.3.2. Managerial implications

Understanding how the integration of dry ports and seaports is measured and how it influences seaport performance helps policymakers, port authorities and operators in Vietnam devise policies and strategies to improve their ports' competitiveness through supply chain collaboration. The results of such collaboration are that, first (in the light of TCE), opportunistic behaviour and the costs of underlying transactions among supply chain members are reduced, thanks to mutual trust and long-term commitment; and second, the outstanding unique resources of the supply chain can be obtained through integration between supply chain members.

In particular, port service quality is found to be a crucial mediating factor facilitating the efficiency of other constructs of port performance, such as customer satisfaction and financial

performance, through interconnected resources attained through DPSP-I. Therefore, from the perspective of both dry ports and seaports, the specific combined resources resulting from DPSP-I (including information integration, operational integration, relationship integration and geographical integration) should be invested in, targeting port service quality orientation; this will bring improvements in financial performance and also help port quality to surpass customer expectations. For example, a focus on information integration (supported by integrated IT systems) facilitates the sharing of accurate and undistorted information among dry ports and seaports on demand, helping ports react more quickly to mutual customers' needs. In this way, customer expectations of cargo timeliness and information can be fulfilled and surpassed. Customer satisfaction can be increased, with a consequent increase in the number of customers using the port service, leading to improved financial performance. Investing in relationship integration by fostering mutual trust between dry ports and seaports could lead to cost and time savings in mutual transactions, again, ensuring customer satisfaction, attracting more customers and improving port financial performance. Similarly, with other combined resources, depending on their specific goals at a specific time, seaport operators should choose which integration aspects to invest in to optimise performance through the leverage of port service quality.

This study also provides policy makers with a strategy for the future development of dry ports. This should involve thorough supply chain-oriented macro planning. First, the Ministry of Transport and the Vietnam Maritime Administration should comprehensively review the current development of dry ports in terms of the overall relationship with seaports. Where dry ports are competing with or independent from seaports, such that the relationship does not contribute to the overall logistics performance within the port–hinterland setting but only benefits a single party, the relationship should be reoriented to benefit the supply chain, with each partner focusing on the functions they can perform best. Where dry ports are well-integrated/in strong collaboration with seaports, acting in their support, they should be encouraged to invest in tangible and intangible resources to enhance the integration; for example, building an efficient multimodal transportation network between dry ports and seaports and manufacturing areas to utilise the resources of the supply chain. The dry ports should become the extended gates of seaports, with full modern functionality, which would support the seaports by relieving seaport cities of some congestion and facilitating improved logistics solutions for shippers in the port's hinterland. This would also help to avoid

competition between seaports and dry ports, which leads to the waste of social resources. New dry ports should strictly follow the macro plan to facilitate the development of advanced inland clearance depots and promote collaboration between seaports and dry ports.

Second, the Ministry of Transport, the Vietnam Maritime Administration and the Vietnam Ports Association should support more research into the development of DPSP-I to benefit the maritime supply chain. For example, periodic conferences and professional meetings on the current status of the port network in terms of backlogs and advantages would enable port operators and involved parties to raise issues and collaborate with academics and government bodies to find solutions for collaboration/integration and develop integration under a master plan. One option could be a hub-and-spoke model of container shipping: large-capacity dry ports that have multimodal transportation links to manufacturing areas and other dry ports and seaports become 'hubs', while small-capacity dry ports that act as container yards function only as 'spokes'.

The findings of this research may also be a useful reference for ports in other countries with similar dry port development attributes in advancing the integration and performance of their seaport–dry port systems. In such cases, a comprehensive review of the current status of DPSP-I and a macro plan should be carried out.

7.4. Research limitations and recommendations for future research

Several limitations to this study need to be acknowledged. First, the data collected in this study was restricted to the Vietnamese maritime industry, involving ports (dry ports and seaports) and port customers (shipping lines and logistics companies) in the qualitative analysis and seaports in the quantitative analysis. Vietnam has a narrow shape and more than 3,200 km of coastline (Thai, 2017); its geographical attributes may affect the development of its ports. Therefore, the findings of this research should be interpreted in the particular context of the Vietnamese maritime sector. This affects the applicability of the findings across developing countries whose geographical attributes differ from Vietnam. Similar research in other developing countries would provide data for comparison and enrich knowledge relating to geographical integration.

Furthermore, inter-organisational trust and commitment are recognised as the heart of relationship integration; however, factors affecting inter-organisational trust and commitment (e.g. leaders' commitment and business culture) have not been taken into account in this study.

Further research should add these as moderators in any proposed models. In addition, this research has only examined financial performance of seaports as the main dependent variable. Future studies will need to extend this research by examining the impact of dryport – seaport integration on other important performance categories of seaports, such as market performance, in order to enhance the robustness of this research.

7.5. Conclusion

This study examines the current status of the integration between dry ports and seaports and its impact on seaport performance. Specifically, the findings show that DPSP-I can be measured by four interconnected resources – information integration, operational integration, relationship integration and geographical integration – in the light of RV theory. The competitiveness of the named resources is also enhanced, in the light of TCE. These inimitable unique resources facilitate outstanding seaport performance outcomes, including port service quality, customer satisfaction and financial performance. In particular, service quality is an important lever by which to raise other outcomes. The study findings are illustrated in the implications of the research in terms of both theoretical implications (related to TCE and RV theories) and managerial implications, which offer suggestions for port operators and policy makers in how to govern the combined resources of dry ports and seaports to reach outstanding outcomes. Finally, the limitations of this study are discussed and suggestions for further research proposed.

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APPENDICES

Appendix 1. The Interview Protocol.

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INTERVIEW PROTOCOL

Title of the research project:

THE EFFECTS OF DRY PORT-SEAPORT INTEGRATION ON SEAPORT PERFORMANCE IN VIETNAM

Section A: Personal information

1. How long has your port been in operation?
2. Could you tell me about your current role in the organisation? How long have you been in this current role? How long have you been in the port industry?

Section B: The integrating factors between dry ports and seaports

1. Does your port/dry port currently have a working relationship with other dry ports/ seaports? If so, where are they located? Also, could you please elaborate on the operational and managerial aspects (if any) of this relationship?
2. Does your port/dry port share information with other dry ports/seaports? If so, why do you think it is necessary to share information between yours? Which information is normally shared and how often? How is the information currently shared between your port and your port partners? What tools are used to share information?
3. Does your port/dry port have any agreement on common shared goals with your dry ports/seaports that have a working relationship with yours? If so, could you please elaborate on which common goals are shared between your port/dry port and other port partners? Why do you think that these common goals are necessary to be shared? Do you think that your organisation's goals could be achieved if your organisation and partners work together towards the common goals? If so, why and how?
4. Does your port/dry port discuss and work together in the planning and operation process with dry ports/seaports that have a working relationship with yours? If so, which plan and operation aspects are jointly discussed and implemented? Why do you need to do so? Also, how do your port/dry port and other partners currently implement that?

5. Does your port/dry port currently share equipment, operation techniques or costs with your partners – other dry ports/seaports? If so, why do you think it is necessary? Also, how do your port/dry port and other partners currently implement that?

6. Does your port share costs and risks with the dry ports/ seaports that are collaborating with yours? Why do you need sharing is necessary? And which tools are used to share? Any evaluation of each other's performance is proceeded? How? Anything else?

7. Are there formal and informal communication channel any contact and messages between your port/dry port and other dry ports/seaports that have a working relationship with yours during the planning and operation processes? If so, can you please elaborate on the details of these channels and how they are being conducted? Also, how do you think these communication channels affect your performance?

8. Does your port/dry port jointly work with your partnering dry ports/seaports in identifying customers' needs, new markets, new knowledge and competitors? If so, why is this necessary? Also, how do your port/dry port and other partners currently implement that?

Section C: The influence of dry port-seaport integration on seaport's service quality

1. In your opinion, what constitute port service quality?

2. It is suggested that port shipping quality is reflected through factors relating to resources (e.g. availability and condition of handling equipment, etc.), service outcomes (e.g. speed & reliability of service, etc.), process (e.g. experience with port's staff, etc.), management (e.g. port efficiency, etc.), image (e.g. port's reputation, etc.) and social responsibility (e.g. port's safety & environmental operations, etc.). What is your view on this?

3. Do you think the current working relationship between your port/dry port affect port service quality in any way? If so, how?

4. Do you think the current working relationship between your port/dry port and your partners affect your/the seaports' resources in anyway? If so, how do you measure the impact on equipment availability and condition, facilities and infrastructures? etc.

5. Do you think the current working relationship between your port/dry port and your partners affect your/the seaports' service outcomes in any way? If so, how do you measure the impact on the seaports' speed and reliability of service provision, security? Etc.

6. Do you think the current collaboration between your port/dry port and your port partners affect your port/the seaports' process (e.g. staffs' attitude toward customer's needs and requirements, their professionalism in using ICT applications in customer service, etc.). If so, how do you measure this impact?

7. Do you think that, thanks to the current working relationship with your port partners, your port could select and deploy all physical and human resources to meet customers' needs and expectations efficiently in anyway? If so, how?

8. Is there any improvement to seaports' social responsibility to their employees and other stakeholders as well as their environment safe operations thanks to the current working relationship between your port and your port partners? If so, how?

9. Do you think the seaports' reputation in the market can be influenced by the current working relationship between your port and your port partners in anyway? If so, how?

Section D: The influence of dry port-seaport integration and port service quality on customer satisfaction

1. In your opinion, what constitute the satisfaction of seaport's customers? Is there any differences between shipping lines and shippers in relation to the dimensions of their satisfaction with seaport services?

2. In connection with the current working relationship between your port/dry port and port partners, do you think seaport's customer satisfaction (for example, satisfaction about cost, timeliness, goods integrity, information, management, etc.) has been affected by this relationship in any way? If so, how? What is the role of seaport's service quality in this respect?

3. Do you think that the current working relationship between your port and your port partners enhance seaports' overall customer satisfaction in anyway? If so, how? If not, why?

Appendix 2. The Survey Questionnaire.

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STUDY ON THE EFFECTS OF DRY PORT-SEAPORT INTEGRATION ON SEAPORT PERFORMANCE IN VIETNAM

Information and Instructions

1. *Responses will not be associated with individual respondents; only summarised information will be included in the report.*
2. *There is no right or wrong answer; please select a response which is closest to your knowledge and/or experience.*
3. *In this study, the term dry port also encompasses Inland Clearance Depot where container-related operations such as stuffing, un-stuffing, customs clearance, etc. are performed.*
4. *In response to statements in the following tables, please indicate your choice in relation to the dry port that your port is dealing with most regularly (if your port is currently working with more than one dry port).*

A. Dry port-Seaport Integration Practices

For each of the following statements which describe the possible working relationship between your port and the dry port, please tick one box on the following scale to indicate your response.

Code	Level of Agreement / Dry port-Seaport Integration Practices	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
		1	2	3	4	5
II1	My port shares with the dry port the information of containers transported in the hinterland between our ports.					
II2	The information of containers that would be transported in the hinterland between my port and the dry port can be integrated into our information system without manual input.					
II3	My port and the dry port work together to address issues in sharing information related to containers transported in the hinterland between our ports as soon as they arise.					
OI1	My port and the dry port exchange our operational plans relating to containers transported in the hinterland between our ports.					
OI2	My port and the dry port coordinate operational activities relating to containers transported between our port and the dry port.					
OI3	My port and the dry port jointly respond to operational emergencies relating to containers transported in the hinterland between our ports.					
OI4	My port periodically discusses with the dry port ways to improve operational plans relating to containers transported in the hinterland between our ports to meet mutual customers' requirements.					

Code	Level of Agreement / Dry port-Seaport Integration Practices	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
		1	2	3	4	5
OI5	My port periodically discusses with the dry port ways to improve our operational ability and capability to meet mutual customers' requirements.					
RI1	My port values the contribution of the dry port in providing services that suit our and customers' requirements.					
RI2	My port values long-term collaborative service contracts with the dry port.					
RI3	The level of my port investment in specific equipment, capacity, and personnel to meet the requirements of our customers with the dry port is extensive.					
RI4	My port periodically discuss with the dry port for assessment and improvement of our collaborative relationship.					
GI1	The geographical location of the dry port that my port collaborates with is convenient for cargo receipt and delivery from/to cargo-owner					
GI2	My port and the dry port are well connected in terms of transport time					
GI3	My port and the dry port are well connected in terms of transport cost					

B. Port service quality

B1. Please provide your assessment on the following aspects of your port's service quality on the following scale (from 1 being "very low"/"very slow" to 5 indicating "very high"/"very fast").

Code	Your port's operational performance \ Your assessment	Very low/ Very slow	Low/ Slow	Neutral	High/ Fast	Very High/ Very fast
		1	2	3	4	5
PSQ1	The speed of your port's service delivery for customers including those of the dry port.					
PSQ2	The level of competitiveness of your port's price of service.					
PSQ3	The level of safety and security of shipments in your port, including those of the dry port.					
PSQ4	The level of error in issuing invoices and documents in your port.					
PSQ5	The level of consistency of your port's service provision for customers, including those of the dry port.					
PSQ6	The level of availability of your port's services for customers including those of the dry port.					
PSQ7	The level of improvement of your port's services through feedback from customers including those of the dry port.					
OPSQ	The overall level of efficiency of your port's operation and management.					

B2. Are there any other operational performance improvements in your port thanks to your port integration with the dry port that have not been mentioned above? If so, please specify below.

C. Customer satisfaction and financial performance

Please provide your assessment on the following aspects of your port's customer satisfaction and financial performance on the following scale (from 1 being "very low" to 5 indicating "very high").

Code	Your assessment / Customer satisfaction and financial performance	Very low	Low	Neutral	High	Very high
		1	2	3	4	5
CP1	The level of satisfaction with the cost of your port's service from your customers including those of the dry port.					
CP2	The level of satisfaction with your port's service timeliness from your customers including those of the dry port.					
CP3	The level of satisfaction with the safety and security of containers through your port from your customers including those of the dry port.					
CP4	The level of satisfaction with the information about containers through your port from your port's customers including those of the dry port.					
CP5	The overall level of satisfaction with the operations and management of your port from your port's customers including those of the dry port.					

Code	Your assessment / Customer satisfaction and financial performance	Very low	Low	Neutral	High	Very high
		1	2	3	4	5
FP1	The level of increase of your port's revenue over the last 5 years					
FP2	The level of increase of your port's profit over the last 5 years					
FP3	The extent of your port 's cost efficiency in the past 5 years					

D. Information for Classification

D1. How long have you been working in the port industry?

☐*Less than 1 year* ☐*1 to 5 years* ☐*More than 5 years*

D2. What is your designation in the current organisation?

D3. Does your port currently have any formal service contract with the dry port?

☐*Yes* ☐*No*

D4. If yes, how long is the duration of the above mentioned formal service contract?

☐*Less than 1 year* ☐*1 to 5 years* ☐*More than 5 years*

This is the end of the questionnaire.

Thank you very much for your valuable contribution!

Appendix 3. The Result of Non-Response Bias Test.

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
II1	Equal variances assumed	2.428	.123	1.725	86	.088	.376	.218	-.057	.810
	Equal variances not assumed			1.810	55.962	.076	.376	.208	-.040	.793
II2	Equal variances assumed	1.152	.286	1.958	86	.053	.364	.186	-.005	.733
	Equal variances not assumed			2.088	58.298	.041	.364	.174	.015	.712
II3	Equal variances assumed	1.717	.194	2.776	86	.007	.549	.198	.156	.943
	Equal variances not assumed			2.917	56.238	.005	.549	.188	.172	.927

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
OI1	Equal variances assumed	4.999	.028	3.318	86	.001	.651	.196	.261	1.042
	Equal variances not assumed			3.649	63.064	.001	.651	.179	.295	1.008
OI2	Equal variances assumed	4.975	.028	3.403	86	.001	.656	.193	.273	1.039
	Equal variances not assumed			3.640	58.810	.001	.656	.180	.295	1.016
OI3	Equal variances assumed	11.230	.001	3.551	86	.001	.631	.178	.278	.985
	Equal variances not assumed			4.168	73.983	.000	.631	.151	.330	.933
OI4	Equal variances assumed	10.494	.002	3.022	86	.003	.582	.192	.199	.964

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
	Equal variances not assumed			3.499	71.648	.001	.582	.166	.250	.913
OI5	Equal variances assumed	4.939	.029	3.033	86	.003	.516	.170	.178	.854
	Equal variances not assumed			3.326	62.626	.001	.516	.155	.206	.826
RI1	Equal variances assumed	8.902	.004	3.039	86	.003	.582	.192	.201	.963
	Equal variances not assumed			3.512	71.339	.001	.582	.166	.252	.913
RI2	Equal variances assumed	2.824	.097	2.957	86	.004	.570	.193	.187	.953
	Equal variances not assumed			3.242	62.559	.002	.570	.176	.219	.922

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
RI3	Equal variances assumed	3.371	.070	2.202	86	.030	.430	.196	.042	.819
	Equal variances not assumed			2.417	62.746	.019	.430	.178	.074	.786
RI4	Equal variances assumed	6.257	.014	2.485	86	.015	.492	.198	.099	.886
	Equal variances not assumed			2.938	75.129	.004	.492	.168	.159	.826
GI1	Equal variances assumed	5.071	.027	2.074	86	.041	.356	.172	.015	.698
	Equal variances not assumed			2.227	59.370	.030	.356	.160	.036	.677
GI2	Equal variances assumed	.162	.688	1.346	86	.182	.225	.167	-.107	.556

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
	Equal variances not assumed			1.332	48.658	.189	.225	.169	-.114	.564
GI3	Equal variances assumed	2.064	.154	1.320	86	.190	.237	.179	-.120	.593
	Equal variances not assumed			1.397	57.244	.168	.237	.170	-.103	.576
PSQ1	Equal variances assumed	1.885	.173	1.751	86	.083	.303	.173	-.041	.647
	Equal variances not assumed			1.850	57.018	.069	.303	.164	-.025	.631
PSQ2	Equal variances assumed	3.227	.076	2.234	86	.028	.414	.185	.046	.783
	Equal variances not assumed			2.390	58.775	.020	.414	.173	.067	.761

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
PSQ3	Equal variances assumed	.994	.322	2.129	86	.036	.419	.197	.028	.810
	Equal variances not assumed			2.357	64.086	.022	.419	.178	.064	.774
PSQ4	Equal variances assumed	.171	.680	2.313	86	.023	.423	.183	.059	.786
	Equal variances not assumed			2.378	53.332	.021	.423	.178	.066	.779
PSQ5	Equal variances assumed	.004	.951	1.591	86	.115	.304	.191	-.076	.683
	Equal variances not assumed			1.587	49.649	.119	.304	.191	-.081	.688
PSQ6	Equal variances assumed	4.130	.045	2.446	86	.016	.447	.183	.084	.810

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
	Equal variances not assumed			2.597	57.716	.012	.447	.172	.102	.791
PSQ7	Equal variances assumed	3.611	.061	2.183	86	.032	.410	.188	.037	.783
	Equal variances not assumed			2.305	56.917	.025	.410	.178	.054	.766
PSQ8	Equal variances assumed	2.214	.140	2.627	86	.010	.484	.184	.118	.850
	Equal variances not assumed			2.754	55.909	.008	.484	.176	.132	.836
CP1	Equal variances assumed	6.165	.015	2.059	86	.043	.368	.179	.013	.723
	Equal variances not assumed			2.374	70.953	.020	.368	.155	.059	.677

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
CP2	Equal variances assumed	4.455	.038	1.892	86	.062	.327	.173	-.016	.670
	Equal variances not assumed			2.208	72.950	.030	.327	.148	.032	.622
CP3	Equal variances assumed	5.801	.018	1.532	86	.129	.250	.163	-.074	.573
	Equal variances not assumed			1.696	64.175	.095	.250	.147	-.044	.543
CP4	Equal variances assumed	.881	.351	1.301	86	.197	.216	.166	-.114	.546
	Equal variances not assumed			1.367	56.156	.177	.216	.158	-.101	.533
CP5	Equal variances assumed	.923	.339	1.320	86	.190	.237	.179	-.120	.593

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
	Equal variances not assumed			1.397	57.244	.168	.237	.170	-.103	.576
FP1	Equal variances assumed	6.047	.016	2.505	86	.014	.430	.172	.089	.772
	Equal variances not assumed			2.690	59.370	.009	.430	.160	.110	.751
FP2	Equal variances assumed	3.592	.061	3.430	86	.001	.525	.153	.221	.830
	Equal variances not assumed			3.612	56.534	.001	.525	.145	.234	.816
FP3	Equal variances assumed	.957	.331	1.805	86	.075	.319	.177	-.032	.671
	Equal variances not assumed			1.853	53.090	.070	.319	.172	-.026	.665

Appendix 4. The Ethics Clearance Letter-RMIT BCHEAN

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Melbourne VIC 3001 Australia
Tel. +61 3 9925 5596
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Notice of Approval

Date:	11 April 2018
Project Number:	21384
Project Title:	*The Effects of Dry Port-Seaport Integration on Seaport Performance in Vietnam*
Risk Classification:	Low Risk
Chief Investigator:	Dr Vinh Thai
Other Investigator:	Professor Caroline Chan
Student Investigator:	Ms Thi Ngoc My Nguyen
Project Approved:	**From: 11 April 2018 To: 26 February 2021**

Terms of Approval:

Responsibilities of the Principal Investigator
It is the responsibility of the principal investigator to ensure that all other investigators and staff on a project are aware of the terms of approval and to ensure that the project is conducted as approved by BCHEAN. Approval is only valid while the investigator holds a position at RMIT University.

1. *Amendments*
   Approval must be sought from BCHEAN to amend any aspect of a project including approved documents. To apply for an amendment submit a request for amendment form to the BCHEAN secretary. This form is available on the Human Research Ethics Committee (HREC) website. Amendments must not be implemented without first gaining approval from BCHEAN.
2. *Adverse Events*
   You should notify BCHEAN immediately of any serious or unexpected adverse effects on participants or unforeseen events affecting the ethical acceptability of the project.
3. *Participant Information and Consent Form (PICF)*
   The PICF must be distributed to all research participants, where relevant, and the consent form is to be retained and stored by the investigator. The PICF must contain the RMIT University logo and a complaints clause including the above project number.
4. *Annual Reports*
   Continued approval of this project is dependent on the submission of an annual report.
5. *Final Report*
   A final report must be provided at the conclusion of the project. BCHEAN must be notified if the project is discontinued before the expected date of completion.
6. *Monitoring*
   Projects may be subject to an audit or any other form of monitoring by BCHEAN at any time.
7. *Retention and Storage of Data*
   The investigator is responsible for the storage and retention of original data pertaining to a project for a minimum period of five years.

Regards,