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Shippers' Choice Behaviour in Choosing Transport Mode: The Case of South East Asia (SEA) Region

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A B S T R A C T

Using South East Asia as a case study, shippers' choice of transport modes taking into consideration their economic and environmental impacts was examined in this research. A triangulation of both quantitative and qualitative methods was deployed. First, a quantitative analysis using secondary data was conducted to establish the index score, which includes four quantitative factors (transport distance, cost, time, and CO2 emission), for each transport mode. In addition, in order to examine at what level of the importance weight shippers would change their decision on transport mode, a sensitivity analysis involving the four aforesaid factors was also conducted. Next, an in-depth interview with a major shipper in Singapore was also carried out to qualitatively validate the aforesaid four quantitative factors as well as two additional qualitative factors, namely, customer service and shipper-forwarder relationship in relation to shipper's choice. The results from this study indicate that shippers might change to the short-sea shipping (SSS) mode when the importance weights of cost and CO2 emission increase, and to trucking mode when the weight of time decreases. It was also found that cost is the most important factor when shippers choose carriers/forwarders, whereas CO2 emission is not an important factor at the current stage. However, if the government imposes financial measures such as fine and/or tax for CO2 emission, shippers would choose eco-friendlier transport modes. This research is the first study considering the environmental issue as one of important factors that influence shippers' choice behaviour. This research also facilitates managers' understanding on how shippers may select LSPs taking into account important factors including the environmental consideration.

1. Introduction

Shippers' choice behaviour is important to logistics service providers (LSPs). It influences shippers' final decision to choose the types of LSP

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and the optimal mode of transport for their cargo and can be influenced by various factors such as service charges and quality. Many studies have addressed shippers' choice behaviour when selecting various types of LSP in terms of service reliability, deliver time and charges, and quality (e.g. Nir, Lin, and Liang, 2003; Tiwari, Itoh, and Doi, 2003; Reis, 2014) and also the increasingly important aspect of CO2 emission (Patterson, Ewing, and Haider , 2008; Regmi and Hanaoka, 2015; Tao, Wu, and Zhu, 2017). The current focus of environmental issues in the transport and logistics industry is mainly on air pollution. According to the International Maritime Organisation (IMO) (2009), the transport sector produces roughly 27.7% of the world's carbon emissions, in which 21.3% are from road transport (trucks and cars), 2.6% from aviation, 0.5% from rail, and 3.3% from all marine transport, in which 2.7% come from international shipping and 0.6% from domestic shipping and fishing. Since the shipping sector contributes more than 90% of international trade in terms of volume (International Chamber of Shipping ICS, 2013) and due to its low percentage of carbon emission, shipping, including short sea shipping (SSS), has been recognised as the eco-friendliest transport mode among others.

The above advantage of SSS has been discussed in many existing studies in several countries and regions such as Canada, Europe, and Australia. However, the research conducted on SSS in the Southeast Asia (SEA) region is scant. SEA is an important region as it strategically connects North Asia with Europe from the shipping perspective. The geography of SEA consists of a peninsula and many islands, which is very appropriate for the development of shipping. Generally, shipping within regions with short sailing routes such as SEA and Europe has been termed SSS to distinguish it from ocean shipping with long sailing routes, although defining SSS is "a difficult task that has not reached academic agreement yet" (Douet and Cappuccillli, 2011). In the case of SEA peninsula, shippers usually use SSS or trucking to transport cargo. The transport cost, time, and environmental impacts of these two transport modes are very different. In order to compare shippers' choice behaviour in relation to these two transport modes, this study selects several countries located in SEA peninsula, including Singapore, Malaysia, Thailand, Vietnam, Myanmar and Cambodia. Therefore, this study uses SEA as a case study to analyse shippers' choice behaviour on choosing transport mode through an economic benefit analysis with three platitude factors (i.e. distance, time, cost) and an increasingly important environmental factor (i.e. CO2 emission).

The rest of this paper is structured as follows. Section 2 presents a review of the related literature including SSS, trucking and choice behaviour. Section 3 describes the methodology, and Section 4 presents the data analysis. Discussion and conclusions drawn from the analysis are elaborated in Section 5.

Table 1
ASEAN trade by modes of transportation

Transport Modes	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Water transport (total import)	106,467	125,299	117,501	120,388	119,964	117,127	126,981	122,717	126,010	105,927
Water transport (total export)	101,297	99,660	106,145	119,730	126,844	136,485	139,939	151,112	155,359	105,624
Road transport (total import)	3,261	3,428	3,218	3,417	8,194	13,247	13,806	15,843	16,823	16,366
Road transport (total export)	7,096	8,608	8,170	7,751	8,372	9,122	10,182	10,779	12,380	13,419
Rail transport (total import)	912	846	1,000	1,335	879	755	731	516	868	7
Rail transport (total export)	367	376	411	1,072	524	315	297	233	106	90
Air transport (total import)	1,581	2,046	1,957	1,463	1,477	1,336	1,527	1,588	1,912	1,689
Air transport (total export)	1,566	1,661	2,210	1,690	1,625	1,462	1,680	1,659	1,778	1,504
Total	**224,551**	**144,269**	**234,448**	**258,853**	**269,887**	**281,858**	**297,153**	**290,615**	**317,248**	**246,639**
Share of water transport	92.52%	86.85%	95.39%	92.76%	91.45%	89.98%	89.83%	94.22%	88.69%	85.77%
Share of road transport	4.61%	8.34%	1.37%	4.31%	6.14%	7.94%	8.07%	3.71%	9.21%	12.08%
Share of rail transport	0.57%	0.85%	0.60%	0.93%	0.52%	0.38%	0.35%	0.26%	0.31%	0.04%
Share of air transport	1.40%	2.57%	1.78%	1.22%	1.15%	0.99%	1.08%	1.12%	1.16%	1.29%

Source: Computed from ASEAN-Japan Transport Partnership – AJTP Information Centre (2017)

2. Literature Review

In the SEA region, the two most important types of transport modes chosen by shippers are SSS and trucking. This is evidenced by the shares of these two modes of transport in the total ASEAN's trade during the period of 2004 – 2013 (see Table 1), which are always higher than those of rail and air transport modes. In order to compare the economic impacts of these two transport modes, this study selects several SEA countries in which cargo can be transported by both SSS and trucking modes, including Singapore, Malaysia, Thailand, Vietnam, Myanmar and Cambodia. Based on the data obtained, the scope of this study focuses on two regions. The first region is Thailand and its neighbouring countries including Cambodia, Malaysia, Vietnam, and Myanmar. The second region is centred on Singapore, as there is a huge amount of cargo in the SEA region going through this country.

2.1. *Short Sea Shipping (SSS)*

Various authors have provided numerous definitions of the concept. Balduini (1982) is perhaps the first who defined SSS as "a maritime transport between ports of a nation as well as between a nation's port and the ports of adjacent countries", while being "a feeder service in competition with a road service, which creates for the first time, the opportunity for modal transfer" (Stopford, 2009), to name just a few. The definition of SSS varies along with the regions/continents. In Europe, the European Commission (1999) defined SSS as "the movement cargo and passengers by sea between ports situated in geographical Europe or between those ports and ports situated in non-European countries having a coastline on the enclosed seas bordering Europe". In America, the US Maritime Administration (MARAD) defined SSS as "a form of commercial waterborne transportation that does not transit an ocean" (Rodrigue, Comtois, and Slack, 2017). The literature review also presents other definitions of SSS, such as those by Paixão and Marlow (2002) and Brooks and Forst (2004). In summary, SSS is defined in this study as sea transport that focuses on shipping activities between ports located in the SEA region.

Several studies addressed SSS from a geographic perspective, for instance North America, Europe, and Australia. For example, Paixão and Marlow (2002) noted that SSS works in Europe because around 60% - 70% of industrial production capacity is located near its seacoast and/or inland waterways network. Brooks and Frost (2004) examined the critical limitations and impediments to further growth of SSS services in Canada and identified a number of issues that Canadian policymakers need to address. Bendall and Brooks (2011) examined several lessons, which answered four research questions involving SSS in Australia, drawing conclusions about the role of the regulatory environment in promoting or deterring the development of land transport-competitive short sea services.

Meanwhile, Koliousis, Koliousis, and Papadimitriou (2013) also estimated the impacts of road transport deregulation on SSS in the EU. However, no study of SSS in the SEA region has been found.

Many benefits of shipping have been identified and they are also reflected in SSS. The benefits of using SSS have been mentioned and discussed in many studies. For example, based on the benefits of using SSS, Medda and Trujillo (2010) even stated that SSS is regarded as the most sustainable and economically competitive mode of transport compared to trucking. The benefits of using SSS include:

(1) Reduction of road congestion (Perakis and Denisis, 2008; Medda and Trujillo, 2010)
(2) Ability to attract freight from other modes (Medda and Trujillo, 2010)
(3) Energy efficiency improvement (Paixão and Marlow, 2002; Perakis and Denisis, 2008; Medda and Trujillo, 2010)
(4) Ability to improve sustainability and be friendly environment, e.g. reduce air pollution (Paixão and Marlow, 2002; Perakis and Denisis, 2008; Medda and Trujillo, 2010)
(5) Road safety improvement (Perakis and Denisis, 2008)
(6) Reduction of highway noise (Perakis and Denisis, 2008)
(7) Reduction of infrastructure expenditures (Paixão and Marlow, 2002; Perakis and Denisis, 2008).

However, from the shipper's point of view, SSS is deemed as a disadvantageous mode as it is slow and complex (Brooks and Frost, 2004). Paixão Casaca and Marlow (2005) identified a number of weaknesses of SSS, such as port-to-port service rather than door-to-door service, poor marketing management, and low levels of industry reliability awareness. Medda and Trujillo (2010) also listed the disadvantages of SSS including low frequency, low reliability, higher risk of damages to goods, and complicated logistics and documentary procedures, etc.

2.2. *Trucking*

Trucking or haulage companies deliver cargo through road network. In many parts of the world, trucking is a vital way of transport internationally. In some areas of the world, it accounts for 100% of the international freight traffic; whereas in others, the share of trucking is lower, yet it still plays a significant role in the international freight traffic as it controls the 'first mile' and 'last mile' of the cargo delivery (David, 2013).

The advantages of using the trucking mode comparing with other transport modes are well identified in the literature as follows:

(1) Relatively less capital cost (Rodrigue, Comtois, and Slack, 2017)
(2) High relative speed of vehicles (Rodrigue, Comtois, and Slack, 2017)
(3) Flexibility of route choice (Rodrigue, Comtois, and Slack, 2017)
(4) Door-to-door service providing (Rodrigue, Comtois, and Slack, 2017)
(5) Less waiting time (Button, 2010)

There are however some disadvantages of using the trucking mode, including (1) Less economics of scale (Button, 2010), (2) More maintenance cost (Rodrigue, Comtois, and Slack, 2017), and (3) More pollution produced per container per mile, including air and noise pollution, and congestion (Borowski, Powałka, Kupczyk, and Sikora, 2013; EPRS, 2015)

Although the advantages and disadvantaged of the trucking mode are well discussed in the literature, similar to the case of SSS, no study related to trucking in the SEA region has been found. Most of the transport related papers in SEA are in the areas of air transport or intermodal transport. Therefore, this research contributes to enhance knowledge by addressing this literature gap.

2.3. *Choice behaviour*

Choice behaviour, as defined by several dictionaries, means the act of selecting among two or more alternatives, usually after a period of deliberation (Definitions.net, 2017). The concept is rooted in the choice theory developed by Glasser (1925). In the marketing field, choice behaviour has been addressed in many aspects, such as products marketing (Insch and Jackson, 2013; de Tavares Canto Guina and de Moura Engracia Giraldi, 2015), tourism (Cheng and Chen, 2014; Campo and Alvarez, 2014), education (Li, Liu, and Rojas-Méndez, 2013), and transport mode selection (Asensio, 2002; Buehler, 2011).

In the context of maritime transport, many studies address shippers' choice behaviour on choosing ports and carriers. For example, Burdg and Daley (1985) found that carriers and shippers have different perceptions toward their modal choice behaviour and the differences in perception truly reflect marketing situations. Many other studies attempting to identify and explain the various factors in shippers' port choice, using various methodologies, include those by Mangan, Lalwani, and Gardner (2002), Malchow and Kanafani (2001, 2004), Nir, Lin, and Liang (2003), Yeo, Lee, and Oh (2004) and Ugboma, Ugboma, and Ogwude (2006). There are also several studies of freight transport choice by shippers, e.g. Brooks (1984, 1985), Wilson, Bisson, and Kobia (1986), and D'Este and Meyrick (1992), but they centred on inter-modal choice and carrier selection, rather than addressing the more specific question of choice between competing ports.

There are various factors influencing shipper's choice behaviour. Based on the literature that has been reviewed in this study, these factors can be roughly classified into six categories, including distance (Tiwari, Itoh, and Doi, 2003), time (Tiwari et al., 2003; Tongzon 2009), cost (Lu 2003a; Nir et al., 2003), environmental issue (Hunecke Blöbaum, Matthies, and Höger, 2001; Srivastava, 2007), service quality (Bowersox, Closs, and Cooper, 2012; Yang and Sung, 2014), and customer relationship (Gibson, Sink, and Mundy, 1993; Gibson, Rutner, and Keller, 2002). Notably, some factors seem interrelated, such as distance, time and cost, but they cannot be merged together. For example, longer distance will of cause increase transport time and cost; however, with the same distance, cost and time will be different depending on the transport modes (i.e. trucking and shipping). This study therefore adopts these six factors, which are explained in the following paragraphs.

It was argued in some studies that the distance to the port of destination will have an impact on shippers' choice behaviour. For example, Tiwari et al. (2003) investigated shippers' port and carrier selection behaviour in China. The results showed that the distance of the shipper from a port, specifically the distance to destination (in case of exports), and distance from origin (in case of imports) play an important role. Shippers prefer using the nearest port as it takes lower transport cost, transport time, and less cargo damage. The length of transport time is important in logistics as shippers prefer using less time on transporting their cargo from origin to destination. Many studies have indicated that shippers' choice behaviour on choosing a transport mode is affected by its transit time (McGinnis, 1990; Murphy and Faris, 1993; Evers and Johnson, 2000; Lu 2003a; Nir et al., 2003; Tiwari et al., 2003; Tongzon, 2009). As speed is one of the important elements in logistics, shippers tend to use the transport mode, which takes less transport time. Tongzon (2009) evaluated the major factors which influence port choice from the Southeast Asian freight forwarders' perspective, and found that "efficiency" is the most import factor that affects forwarders' port choice. The efficient port operations represent fast cargo transport time, which would improve shippers' willingness on using shipping transport mode. Meanwhile, Tiwari et al. (2003) found that port congestion could affect shippers' choice behaviour. The more serious port congestion, the longer transport time, and this reduces shippers' willingness on using the shipping transport mode. In this study, transport time is considered as a factor that influences shippers' choice behaviour and it includes waiting for port/road congestion, loading/unloading cargo to ship/truck, and transport time on the sea/road.

A product or service cost also has a directly impact on customer's choice behaviour. Equivalently, many studies have indicated that cargo transport cost also influences shipper's choice behaviour (Brooks, 1984, 1985, 1990; Bardi, Bagchi, and Raghunathan,1989; McGinnis, 1990; Lambert, Lewis, and Stock, 1993; Crum and Allen 1997; Evers and Johnson, 2000; Lu 2003a; Nir et al., 2003). Brooks (1984, 1985, 1990) found that shippers' choice behaviour is affected by the size of the company. Smaller shippers prefer using carrier's service with lower transport cost; whilst large shippers prefer service-oriented carriers such as high frequency of sailings, good reputation, less transit time, and directness of sailing. Lambert et al. (1993) analysed shippers' choice behaviour when choosing less-than-truckload (LTL) carriers and the results confirmed three important factors including high-quality customer service, accurate billing, and competitive rates. Meanwhile, Nir et al. (2003) also found that the more travel cost, the more negative effects to the shipper.

The environmental issue has been drawing the attention from scholars in recent years. The transport sector contributes a lot of air pollution, acid rain, maritime water quality problems, and noise (Coyle, Novack, Gibson, 2015). Different transport modes produce different levels of pollution, which have an impact on users' decision on choosing transport mode. McKinnon (2015) evaluated the possible influence of UK shippers on carbon emissions from deep-sea container supply chains and found that shippers assign a relatively low weighting to environmental criteria in deep-sea carrier selection. Tao, Wu, and Zhu (2017) addressed the subsidy of modal shift (from road to rail/water) for reducing CO2 emission and concluded that the subsidies can serve as short-term solutions, but a policy package is required as a long-term strategy. In terms of shippers choosing transport mode for cargo delivery, it is intuitive that they might not consider the pollution made from carriers. However, the governments might levy fine of pollution emitted from carriers, and carriers might in turn transfer the fine to shippers. In other words, the more environmental friendly transport mode chosen by shippers, the less fine of pollution emission they need to cast.

As the logistics industry is a service industry, many studies have addressed the impact of customer service on shippers' choice behaviour (Bagchi, Roghunathan, and Bardi, 1987; Bardi et al., 1989; McGinnis, 1990; Whyte, 1992; Lambert et al., 1993; Murphy and Faris, 1993; Crum and Allen, 1997; Evers and Johnson, 2000; Lu 2003a; Bowersox et al., 2012; Yang and Sung, 2014). Based on the previous studies, customer service can be categorised into several elements, including reliability, loss/damage/claims processing, and equipment availability/service flexibility. Bagchi et al. (1987) investigated how JIT influences attributes for carrier selection and found that customer service receives the most attention from organisations. Crum and Allen (1997) surveyed managers in the motor carrier industry to investigate carrier perceptions of the importance that shippers attach to carrier selection criteria. The result indicated that reliability is the most important factor among the 22 selected criteria. Yang and Sung (2014) addressed customer service improvement for international logistics in shipping companies and found that customers focus on three aspects of customer service, including quick response, cargo safety, and ability to solve problems. Therefore, the current study also considers customer service as an important factor, which influences shippers' choice behaviour.

The impact of shipper-carrier or shipper-forwarder relationship on shippers' choice behaviour has been addressed in some earlier studies, such as those by Gibson et al. (1993) and Gibson et al. (2002). Some researchers have studied shipper-carrier relationships within the context of logistics performance and supply chain collaboration (Lai, 2004; Lu, 2003b; Lemoine and Dagnaes, 2003). In addition, La Londe and Cooper (1989) addressed "partnership" from the supply chain management perspective and defined it as "a relationship between two entities in the logistics channel that entails a sharing of benefits and burden over some agreed upon time horizon". Gentry (1996) described the importance of carrier selection in buyer and supplier partnerships from the transportation management perspective. Gardner, Cooper, and Noordewier (1994) addressed shipper-carrier and shipper-warehouse operator's relationships and indicated that carriers and warehouse operators prefer more partnership in the relationships with their core customers. In this current study, shippers would choose carriers or forwarder to transport their cargo, and thus the relationship between them and carriers/forwarders should also be considered.

All of the above mentioned six factors were considered in this study. However, as four among these factors (i.e. distance, time, cost, and CO2 emission) are quantitative while the other two (i.e. customer service and shipper-forwarder relationship) are qualitative in nature, different methods were conducted to analyse these factors. The detailed discussion for these methods is presented in next section.

3. Methodology

This research employs a methodical approach as follows. First, following a comprehensive literature review, four quantitative and two qualitative factors influencing shippers' choice behaviour of transport modes were identified. The first wave of data collection relating to the four quantitative factors was then conducted both from secondary sources (two popular internet websites) as well as primary one (a shipping company in Singapore and a logistics company in Thailand). This is followed by the analysis of the first wave of collected data through the computation of index scores and sensitivity analysis. Last but least, the second wave of data was conducted through an interview with a major shipper in Singapore to obtain insights on both aforesaid quantitative and qualitative factors. Figure 1 illustrates the research approach in this study.

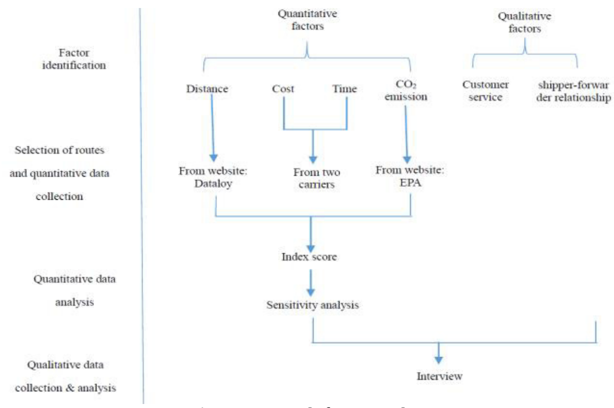

Fig. 1. Research framework

3.1. *Selection of transport routes and quantitative data collection*

Through reviewing the sailing routes which are publicly available in the homepage of five Asia-based shipping companies with operations in the SEA region including Evergreen, Yang Ming, Wan Hai, APL, and OOCL, the main sea routes within the six countries in this region were identified as reflected in Table 2 and Figure 2. The selected ports and their connecting ports are presented in Table 2. Several of these ports are geographically close to each other, including Singapore, Pasir Gudang Johor, and Tanjung Pelepas in one group, and Cat Lai Port Ho Chi Minh and Vietnam International Container Terminal (VICT) in the other. Hence, to make Figure 2 clearer, this study uses the Port of Singapore and Cat Lai Port Ho Chi Minh to represent these two port groups. As can be seen from Figure 2, some routes are more advantageous in terms of distance when using the trucking (compared to the SSS) mode. For example, from Bangkok to Yangon and vice versa, the transport distance is shorter when using the trucking mode compared to that of the SSS mode.

In total, data was collected for eight routes, in which five routes involve Singapore and the other three routes are via Thailand, and both trucking and SSS modes can be used in each route. In this study, the transport between countries rather than individual ports was examined, in which representative ports are used to represent countries. For example, this study uses Port Klang to represent Malaysia, Bangkok Port for Thailand, Cat Lai Port Ho Chi Minh for Vietnam, Sihanoukville for Cambodia, and Yangon for Myanmar. Relevant details of various sea and road routes, including transport distance, time, cost, and CO_2 emission were collected. Specifically, transport distances were collected from a website (Dataloy, 2015), which has been commonly used in the industry as it is a free database and provides comprehensive maritime data. Data about transit time was collected from a Singapore-based shipping company and a Thailand-based logistics company, which have operations in the SEA region, and from the aforesaid website. Data about freight rates were also collected from the above-mentioned shipping and logistics companies, while figures about CO_2 emission were calculated based on a report of the US Environmental Protection Agency (EPA, 2008) which indicated that trucks produce 0.297 Kg of CO2 per ton-mile and the number from ships is 0.048 Kg of CO2 per ton-mile. In addition, while some data were provided by the Singapore-based shipping company and the Thailand-based logistics company which participated in this study, the freight costs on several routes by the trucking mode, including all routes by the trucking mode from Singapore, were not available and are thus assumed to be three times higher than those by the SSS mode as suggested by ERIA (2010).

Table 2
Selected ports and their connecting ports in the SEA region

Country	Ports	Connected ports
Singapore	Port of Singapore	Port Klang, Pasir Gudang Johor, Tanjung Pelepas, Penang, Kuantan, Cat Lai Port Ho Chi Minh, Haiphong, VICT, Bangkok, Laem Chabang, Yangon, Songkhla, Sihanoeville
Malaysia	Port Klang	Port of Singapore, Penang, Yangon, Cat Lai Port Ho Chi Minh, Pasir Gudang Johor, Laem Chabang, Tanjung Pelepas
	Pasir Gudang Johor	Port Klang
	Tanjung Pelepas	Laem Chabang, Penang, Kuantan, Cat Lai Port Ho Chi Minh, Port of Singapore,
	Penang	Port of Singapore, Port Klang, Tanjung Pelepas
	Kuantan	Tanjung Pelepas, Cat Lai Port Ho Chi Minh
Thailand	Laem Chabang	Port of Singapore, Cat Lai Port Ho Chi Minh, Bangkok, Port Klang, Tanjung Pelepas
	Bangkok	Port of Singapore, Laem Chabang, Sihanoukville
	Songkhla	Port of Singapore, Sihanoukville
Vietnam	Cat Lai Port Ho Chi Minh	Port of Singapore, Klang Port, Da Nang, Tanjung Pelepas, Kuantan, VICT
	Da Nang	Cat Lai Port Ho Chi Minh
	Haiphong	Cat Lai Port Ho Chi Minh
	VICT	Port of Singapore, Cat Lai Port Ho Chi Minh
Myanmar	Yangon	Port of Singapore, Port Klang
Cambodia	Sihanoukville	Port of Singapore, Bangkok, Songkhla

Source: Authors, compiled with data from shipping companies' websites

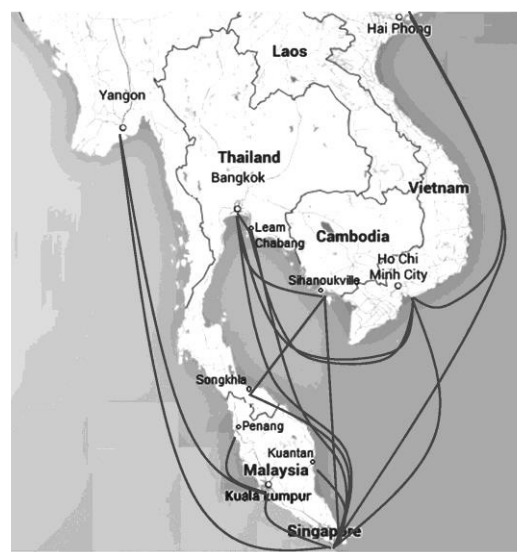

Fig. 2. Key shipping routes in the SEA region

3.2. *Quantitative data analysis*

This study aims to analyse the benefits and impacts of SSS if being fully utilised in SEA. This can be achieved by comparing the quantitative factors of transport distance, time, cost and CO2 emission between SSS and trucking using the economic benefit analysis. The model used to calculate the total transport cost for each route is established in Equation (1), which was adopted from Baumol and Vinod (1970) but also revised to only reflect cost items relating to transport from the shipper's perspective.

$$\text{Total transport cost} = \text{transport freight} + \text{ICC} \quad (1)$$

where ICC refers to the in-transit inventory carrying cost of the transport shipment. The computation of ICC is denoted in Equation (2). Inventory carrying cost is often computed as a percentage of the cargo value (Coyle, Bardi & Langley, 2003), and in-transit inventory carrying cost only occurs during the transport time where shipment is onboard transport vehicles.

$$\text{ICC} = \text{cargo value} \times (\text{ICC rate}/365) \times \text{transit time} \quad (2)$$

Where

- Cargo value is assumed to be USD 5,000 for a standardised containerised shipment,
- ICC rate is a percentage number usually between 20% to 30%, and the most common one is assumed to be 25% following the "rule of thumb" suggested by REM Associates of Princeton (2015),
- Transit time is in days.

In order to compare the economic impacts of trucking to those of SSS, this study employs the index score method, which uses trucking route's total transport cost as the reference point (assuming trucking's index score being 1) and calculates the ratio of SSS's total transport cost accordingly. This method is useful in research as it helps researchers to create a composite measure from various related items (Hawken and Munck, 2012). In this study, the index score for both trucking and SSS mode is denoted in Equation (3) below:

Index score = a% distance + b% transport cost + c% transport time + d% CO2 emission (3)

Where

a + b + c + d = 100%

It is noted that this index score method is developed based purely on quantitative factors, which are distance, cost, time and CO2 emission rather than qualitative ones such as service quality and customer relationship. In addition, it is assumed that the Incoterms agreed between shippers and consignees are either C-terms or D-terms, thus shippers reserve the right to arrange transportation and select the appropriate mode of transport. As this research deals with shippers' choice behaviour, this assumption is necessary because they are only in the position to choose the mode of transport if C or D terms are used. In terms of cost and CO_2 emission, the data for these factors should ideally be collected from both transport operations and those in ports and inland depots (e.g. loading/unloading from ships and container movements). However, because the data of operations in ports and inland depots are not easy to obtain, only related data in transport operations were collected.

Cargo shipments in each route can be transported by either SSS or trucking and the two modes' index scores can be calculated accordingly using Equation (3). The lower index score of a mode implies that shippers could pay less in terms of opportunity cost on that mode, which is better than the other mode from the same route. The importance weights can be changed according to the shipper's emphasis on their shipment. For example, if a shipper emphasises more on the importance of transport cost than that of other factors, he can increase the weight of transport cost to obtain an index score and make the final decision on choosing transport mode. Different weights produce different index scores and could impact on shippers' final decision on choosing transport mode. In order to understand the impact of different weights on the model, a sensitivity analysis was further conducted to investigate the sensibility of the model.

Sensitivity analysis was conducted by increasing the importance weight of a single factor and reducing the one of other three factors equally in the same route. Since the trucking mode's index score had been assumed as 1, we only need to analyse the SSS mode's index score at different levels of importance weights. For example, if a shipper emphasises more on transport cost and increases its importance weight to 40%, then the other three factors' weights will be reduced to 20% respectively. Based on the SSS mode's index score, shippers would change transport mode when the SSS mode's index score becomes more than 1 (i.e. change to the trucking mode) or less than 1 (i.e. change to the SSS mode).

3.3. *Qualitative data collection and analysis*

After the sensitivity analysis, an in-depth interview was further conducted in July 2015 to examine how the aforesaid four quantitative factors (i.e. distance, cost, time, and CO_2 emission) and two qualitative factors (i.e. customer service and shipper-forwarder relationship) influence shippers' choice behaviour. The interview was conducted via email and followed by phone with the logistics manager of a shipper company, which is a major player in the Fast Moving Consumer Goods (FMCG) industry in Singapore as well as other countries in the SEA region.

According to the interviewee, this shipper company currently outsources their key logistics services to a few international freight forwarders but also has a significant role on the selection of transport mode. Therefore, data from this interview can be combined with the quantitative data analysis to provide insights on shipper's choice behaviour when it comes to transport mode selection.

4. Findings

4.1. *Results of quantitative data analysis*

Table 3 presents the data of four factors (transport distance, cost, time, and CO_2 emission) and index score (with the importance weight of each factor being 25%) of each mode on different routes.

Table 3
Transport distance, freight cost, time, and index score

Route	Code	Transport Mode	Distance (Km)	Cost (USD)	Time (Day)	CO_2 (Kg)	Index score (25% each factor)
Singapore - Malaysia	SM	By truck	380	540	0.17	2363.0	1
		By SSS	391	180	0.68	393.0	1.38
Singapore - Thailand	ST	By truck	1870	240	2.10	11628.5	1
		By SSS	1543	80	2.67	1550.7	0.59
Singapore - Vietnam	SV	By truck	2830	540	1.5	17598.2	1
		By SSS	1184	180	2.05	1189.9	0.51
Singapore - Cambodia	SC	By truck	2480	1140	1.25	15421.7	1
		By SSS	1123	380	1.94	1128.6	0.58
Singapore - Myanmar	SB	By truck	2565	2100	1.33	15950.3	1
		By SSS	2080	700	3.6	2090.4	0.94
Thailand - Myanmar	TB	By truck	915	3800	2.23	5689.9	1
		By SSS	3612	780	6.25	3630.1	1.90
Thailand - Malaysia	TM	By truck	1510	1130	1.63	9389.8	1
		By SSS	1192	260	3.33	1198.0	0.80
Thailand - Cambodia	TC	By truck	652	2350	0.98	4054.4	1
		By SSS	491	380	0.95	493.5	0.46

Source: Authors

The higher index score relating to a mode means shippers have to pay more opportunity cost on that route. As can be seen from Table 3, the SSS mode's index score on Singapore - Malaysia and Thailand - Myanmar routes are higher than that of the trucking mode, whilst it is the opposite on other routes. This implies that, from the perspective of opportunity cost, shippers would better choose the trucking mode on Singapore - Malaysia route (which is relatively short distance between these two countries, while it takes more distance and time to deliver the cargo should shippers choose the SSS mode) and Thailand – Myanmar route (in which the distance if using SSS is much longer than that of trucking because of the geographical locations). However, although the index score for SSS from Singapore to Malaysia is higher than that of trucking, there are still some reasons to encourage the continuing development of the SSS industry in Malaysia. First, trucking does not have the advantage of economies of scale and the capacity is relatively small (Button, 2010) while the majority of cargo flow between Singapore and Malaysia is still delivered by ships. Secondly, the difference of index scores between SSS and trucking is just a small gap. Thirdly, as one of the spoke countries in the SEA maritime hub-and-spoke system, Malaysia should pay more attention to its maritime service to improve or maintain its international logistics competitive standing. Meanwhile, the route of Thailand – Myanmar is in a difference situation, as (1) the nature of geographical locations in terms of distance is the main weakness for developing SSS between Thailand and Myanmar; and (2) the SSS index score is almost double than that of trucking, which generates a disproportionate high opportunity cost for developing SSS between Thailand and Myanmar.

On another note, the SSS mode would be the preferred choice on other routes i.e. Singapore - Thailand, Singapore - Vietnam, Singapore - Cambodia, Singapore – Myanmar, Thailand – Malaysia, and Thailand - Cambodia. The reason that the index score suggests using SSS mode for Singapore-based routes is mainly because of the advantageous geographical location of Singapore, which generates a relatively high opportunity cost if trucking mode is used. The situation in Thailand – Malaysia route is different as the main cargo distribution centre in Thailand is located in Bangkok, which is a relatively long distance to Malaysia. Thus, given this distance, it could be more economically appropriate for using SSS rather than trucking mode.

4.2. *Sensitivity analysis*

Sensitivity analysis was used to investigate at what level of the importance weight shippers would change their decision on transport mode. It was conducted by increasing a factor's weight and reducing equally the other three factors' weights. Accordingly, Figures 3 - 6 present the analysis results corresponding to each of the four factors and indicate whether shippers would prefer using trucking mode (i.e. index score higher than 1) or SSS mode (i.e. index score less than 1) at different weight levels of the four factors respectively.

A sensitivity analysis on transport distance was firstly conducted to examine whether shippers' choice on transport mode would significantly change along with transport distance. The result is presented in Figure 3, which illustrates that no change of transport mode would occur as the weight of transport distance increases in all the routes. This result implies that transport distance would not have a big impact on shippers' choice of transport mode in the SEA region. In addition, it is noted that the curve of TB (Thailand – Myanmar) route rises up significantly, which means that when the importance weight of transport distance increases, shippers have to pay two to four times of opportunity cost higher if their shipment is transported by the SSS mode.

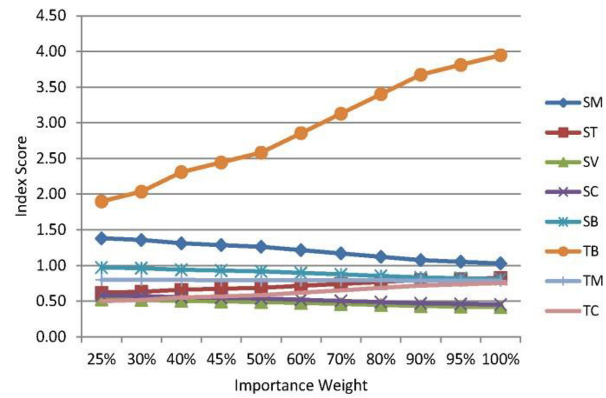

Fig. 3. Sensitivity analysis of transport distance

Figure 4 presents the sensitivity analysis on transport cost. The result shows that when increasing the importance weight of transport cost, it is the SSS rather than the trucking mode would be chosen as the freight cost of SSS is usually lower than that of trucking mode. As can be seen from Figure 3, the choice of transport mode would be shifted from trucking to SSS on two routes, namely Singapore – Malaysia (SM) and TB. Specifically, when the importance weight of transport cost is increased to 50.5%, the choice of trucking mode would be shifted to SSS on the route of SM. Likewise, when the importance weight of transport cost is increased to 65%, the choice of trucking mode would be changed to SSS on the route of TB. In addition, it is noted that when the importance weight of transport cost increases to 100%, all curves convergence at 0.2. This finding implies that if transport cost is the only factor to be considered when choosing transport mode, shippers could save five times in terms of opportunity cost by using SSS compared to trucking.

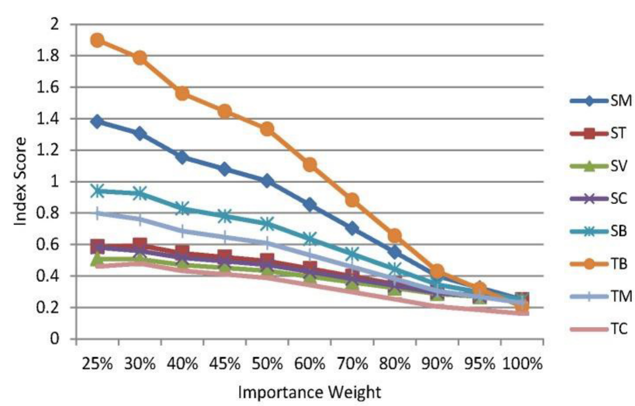

Fig. 4. Sensitivity analysis of transport cost

Figure 5 presents the sensitivity analysis on transport time. The result shows that when increasing the importance weight of transport time, it is the trucking mode rather than the SSS mode would be selected by shippers as the former is usually faster than the latter. In addition, it is observed that the choice of transport mode would change from SSS to trucking on five routes, including ST (at 69% importance weight level), SV (at 68%), SC (at 58%), SB (at 27%), and TM (at 38%). In addition, it is observed that the ratios of SSS transport time/trucking transport time on the eight routes are 4 times (SM), 2.8 times (TB), 2.7 times (SB), 2 times (TM), 1.55 times (SC), 1.37 times (SV), 1.27 times (ST), and 0.97 times (TC) respectively. This finding implies that shippers would easily change their decision to the trucking mode when the ratios of transport time are high, excluding the SM and TB routes on which shipments have already been transported by the trucking mode.

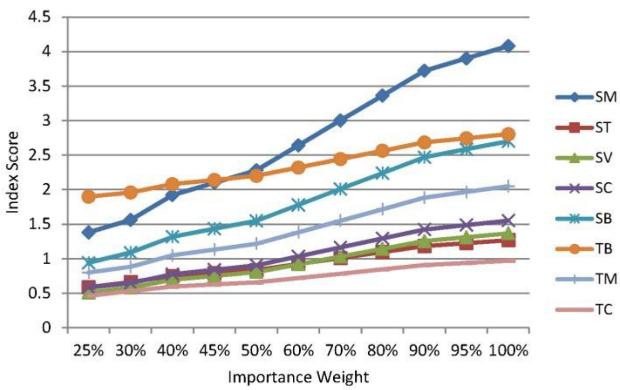

Fig. 5. Sensitivity analysis of transport time

Figure 6 presents the sensitivity analysis on the importance weight of CO2 emission. The result shows that when increasing the importance weight of CO2 emission, the attention would be shifted to the SSS mode as trucking usually produces more CO2 than that of SSS. In addition, it is observed that the choice of transport mode would change from trucking to SSS on the SM and TB routes at the CO2 weight level of 49% and 79% respectively.

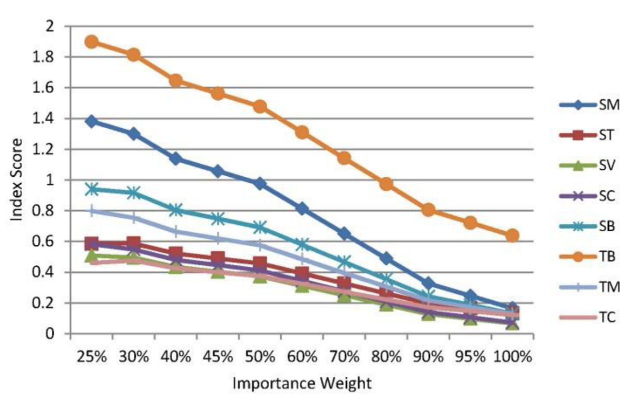

Fig. 6. Sensitivity analysis of CO_2 emission

4.3. *Results of quantitative data analysis*

When asked about perception of the proposed factors for selecting a transport mode, the interviewee confirmed that all these six factors (i.e. distance, cost, time, CO_2 emission, customer service, and shipper-forwarder relationship) are considered in her company, yet some factors are more important than others. For example, at the time the interview was conducted, this company mainly focused on carriers' cost, lead-time, and customer service level. The interviewee also explained that the most important factor is cost, followed very closely by lead-time. This finding is expected. In the transport logistics industry, because of price competition, cost is the most important factor that logistics managers would concern. Managers need to ensure the cost of operations is brought down to the lowest level to ensure sustainability of the business. Meanwhile, lead-time refers to carriers' transport time, which is also an important factor in the transport logistics industry. As shippers prefer to use a fast transport mode in order to launch their products to the market as soon as possible, an efficient transport mode has a competitive advantage and can impact on shippers' choice of transport mode (Tongzon, 2009).

In terms of CO_2 emission, as the government has not put much effort on this issue at the time of interview in terms of compulsory legislation, CO_2 emission was not an important factor for the shipper's choice of transport mode. However, if the government increases fine or tax, or charges an environment fee on CO_2 emission, the shipper would consider CO_2 emission as an important factor and increase its importance weight. As carriers would normally try to transfer the fine or tax to shippers, using a transport mode with less CO_2 emission would reduce the charge from the fine or tax of carriers.

Regarding the shipper-carrier/shipper-forwarder relationship, results from the in-depth interview show that this factor is also an important one that influences shippers' choice behaviour. In this respect, the interviewee further explained that they only select and work with forwarders who have connections with them and will not use those or carriers that they are not familiar with. Therefore, building a good relationship with shippers is critically important as this could impact on their final decision on choosing the appropriate transport mode.

5. Conclusion

This study examines shippers' choice behaviour of transport modes through the analysis of six factors including transport distance, cost, time, CO_2 emission, customer service, and shipper-forwarder relationship in the SEA region. Key sea routes in the SEA region were firstly identified and reflected in a map. In total, data on eight routes, including five via Singapore and three via Thailand were collected, and shipments can be transported by both trucking and SSS modes on each route. Through the method of index score analysis, the results indicate that shippers would better choose the trucking mode on the routes of Singapore - Malaysia and Thailand - Myanmar, while the SSS mode would be the preferred choice on the routes of Singapore - Thailand, Singapore - Vietnam, Singapore - Cambodia, Singapore – Myanmar, Thailand – Malaysia, and Thailand - Cambodia. In addition, sensitivity analyses were conducted on the four factors of selection to investigate at which level of each factor's importance weight the choice of transport mode would be shifted from one to the other. In this connection, the results show that transport distance is not an important factor that would impact on the change of transport mode in the SEA region from the transport distance perspective. However, this finding should be interpreted with caution as the results might be different in other regions such as Europe and North America. From the transport cost perspective, the results indicate that when increasing the importance weight of transport cost, SSS would be the preferred choice compared to trucking. However, from the transport time perspective, it was found that trucking would be a better choice when increasing the importance weight of transport time. Meanwhile, the results also indicate that the choice of transport mode would be shifted to SSS when increasing the importance weight of CO_2 emission. Nevertheless, findings from the in-depth interview indicate that cost is the most important factor in shippers' choice of forwarders/carriers, whereas CO_2 emission is not an important issue for the time being. However, if the government puts more emphasis on environmental issues in the transport logistics industry and implements regulations to impose fine and/or tax to the relatively "un-eco-friendly" transport modes, shippers would consider

CO_2 emission as an important factor and increase its importance weight when choosing forwarders/carriers. Therefore, although most shippers consider cost and time as the main factors when choosing carriers, there could be other shippers who emphasise on other factors, such as service quality and customer relationship, depending on other considerations, for example, how much the culture in the country where the transport transaction takes place emphasises on business relationship. Some shippers may even emphasise on CO_2 emission because they are national or government-linked companies and need to be the role model as required by the government's environmental policies.

There are several contributions derived from this study. Firstly, although SSS is popularly used in the SEA region, studies involving SSS in this region are scant. This study therefore addresses the contemporary gap and contributes to the existing literature with the economic impact analysis of both trucking and SSS modes in the SEA region in relation to shippers' choice behaviour. Secondly, as the environmental issue has been attracting increasing attention in recent years, this study is one of the first research that includes the environmental factor into transport mode choice behaviour model. Through this model, shippers can understand the importance of the environmental factor when choosing a transport mode. Thirdly, findings from this study confirm the theory that when shippers emphasise on transport cost, SSS would be preferred to trucking as the former is usually cheaper than the latter. Meanwhile, when shippers emphasise on transport time, trucking would be a better choice as this transport mode is usually faster than shipping. Finally, this study proposes an index score method, which combines all four important factors when choosing a transport mode. This proposed method would also facilitate the understanding of shippers' choice when each of these factors is examined in the sensitivity test.

There are, however, several research limitations in this study. Firstly, although some freight costs were provided by companies participated in this study, other actual cost data, especially for trucking on some routes, could not be obtained and thus they could only be assumed by the ratio proposed in the earlier literature. However, the results of this research are still considered reliable as the assumed data were based on the validated literature. Secondly, this study simplified the practical situation by not including data related to the operations in ports and inland depot, as well as the distance from the place of origin to the port of loading and that from the port of discharge to the place of destination due to data unavailability. It is therefore suggested for future research to address this issue in order to enhance the accuracy and reliability of research finding. Thirdly, this study has not obtained data related to air freight for comparison because of the lack of industry connection. This leads to a non-comprehensive research on SEA region which includes peninsula and islands, and thus cargoes need to be delivered by ships or air freight. It is therefore suggested for future research to include air freight into the quantitative model and expand the region to include the whole of SEA. Fourthly, based on the economic benefit analysis, this study has analysed shippers' choice behaviour from only four quantitative factors (distance, cost, time, and CO_2 emission). It is therefore suggested for future similar research on shippers' choice behaviour to include other quantitative factors or even qualitative factors in the analysis, such as service quality and shipper and forwarder/carrier relationship, and refine the index score method accordingly.

References

ASEAN-Japan Transport Partnership. (2017). "Statiatics – ASEAN". AJTP Information Centre, http://www.ajtpweb.org/ajtp/statistics/index.html. Accessed January 26th 2016.

ASENSIO, J. (2002), "Transport mode choice by commuters to Barcelona's CBD." Urban Studies, Vol. 39 No. 10, pp. 1881-95.

BAGCHI, P.K., ROGHUNATHAN, T., and BARDI, E.J. (1987), "The implications of just-in-time inventory policies on carrier selection." Logistics and Transportation Review, Vol. 23 No. 4, pp. 373-83.

BALDUINI, G. (1982), Short-sea Shipping in the Economy of Inland Transport in Europe: A Report of the Sixtieth Round Table on Transport Economics Held in Gothenburg, Sweden. OECD Publications and Information Centre, Washington, DC (April 1–2), pp. 37–65.

BARDI, E.J., BAGCHI, P.K. and RAGHUNATHAN, T. (1989), "Motor carrier selection in a deregulated environment." Transportation Journal, Vol. 29 No. 1, pp. 4-11.

BAUMOL, W. & VINOD, H. (1970), "An Inventory Theoretic Model of Freight Transport Demand". Management Science, Vol. 16, No. 7, pp. 413-421.

BENDALL, H.B., and BROOKS., M.R. (2011), "Short sea shipping: lessons for or from Australia." International Journal of Shipping and Transport Logistics, Vol. 3 No. 4, pp. 384-405.

BERGANTINO, A., and MARLOW, P. (1998), "Factors influencing the choice of flag: empirical evidence." Maritime Policy and Management, Vol. 25 No. 2, pp. 157-74.

BOROWSKI, P.F., POWAŁKA, M., KUPCZYK, A. and SIKORA, M. (2013), "Measuring of reduction of CO2 emissions transport fuels on the example of ethanol on Poland." Paper presented at the 2nd International Conference on Energy Systems and Technologies, Cairo, Egypt, February 18 – 21.

BOWERSOX, D.J., CLOSS, D.J. and COOPER, M.B. (2012), Supply chain logistics management. 4th ed. New York: McGraw-Hill.

BROOKS, M.R. (1984), "An alternative theoretical approach to the evaluation of liner shipping: Part I. Situational factors." Maritime Policy and Management, Vol. 11 No. 1, pp. 35-43.

BROOKS, M.R. (1985), "An alternative theoretical approach to the evaluation of liner shipping Part II. Choice criteria." Maritime Policy and Management, Vol. 12 No. 2, pp. 145-55.

BROOKS, M.R. (1990), "Ocean carrier selection criteria in a new environment." Logistics and Transportation Review, Vol. 26 No. 4, pp. 339–56.

BROOKS, M.R., and FROST, J.D. (2004), "Short sea shipping: a Canadian perspective." Maritime Policy & Management, Vol. 31 No. 4, pp. 393-407.

BUEHLER, R. (2011), "Determinants of transport mode choice: a comparison of Germany and the USA." Journal of Transport Geography, Vol. 19 No. 4, pp. 644-57.

BURDG, H.B., and DALEY, J.M. (1985), "Shallow-draft water transportation: marketing implications of user and carrier attribute perceptions." Transportation Journal, Vol. 24 No. 3, pp. 55-67.

BUTTON, L. (2010), Transport Economics. 3rd ed. Northampton, MA: Edward Elgar Publishing.

CAMPO, S., and ALVAREZ, M.D. (2014), "Can tourism promotions influence a country's negative image? An experimental study on Israel's image." Current Issues in Tourism, Vol. 17 No. 3, pp. 201-19.

CHENG, T.M. and CHEN, M.T. (2014), "Image Transformation for Mazu Pilgrimage and Festival Tourism." Asia Pacific Journal of Tourism Research, Vol. 19 No. 5, pp. 538-57.

COMMISSION OF THE EUROPEAN COMMUNITIES. (1999), The Development of Short Sea Shipping in Europe: A Dynamic Alternative in a Sustainable Transport Chain – Second Two-yearly Progress Report. COM, Brussels, p. 317..

COYLE, J.J, BARDI, E.J. & LANGLEY, C.J. (2003). The Management of Business Logistics: A Supply Chain Perspective. 7th edn, Canada: Thomson Learning.

COYLE, J.J, NOVACK, R., GIBSON, B., and BARDI, E. (2015), Transportation: A Global Supply Chain Perspective. Mason, OH: Cengage Learning.

CRUM, M.R., and ALLEN, B.J. (1997), "A longitudinal assessment of motor carrier-shipper relationship trends, 1990 vs. 1996." Transportation Journal, Vol. 37 No. 1, pp. 5-17.

DATALOY. (2015). http://www.dataloy.com/, Accessed January 30th 2016.

DAVID, P. (2013), International Logistics: the Management of International Trade Operation. 4th ed. OH: Cicero Books LLC.

DEFINITIONS.net, (2017). "Definitions for choice behaviour". Accessed 18 August 2016. http://www.definitions.net/definition/choice%20behavior.

D'ESTE, G., and MEYRICK, S. (1992), "Carrier selection in a RO/RO ferry trade Part 1. Decision factors and attitudes." Maritime Policy & Management, Vol. 19 No. 2, pp. 115-26.

DE TAVARES CANTO GUINA, F., and DE MOURA ENGRACIA GIRALDI, J. (2015), "The Country of Origin Effect on Brazilian Beef Trade in Europe: The Moderating Role of Gender, Age, and Product Involvement." Journal of Food Products Marketing, Vol. 21 No. 2, pp. 123-40.

DOUET, M. amd CAPPUCCILLLI, J. F. (2011), "A review if short sea shipping in the European Union". Journal of Transport Geography, Vol. 19, No. 4, pp. 968-976.

EVERS, P.T., and JOHNSON, C.J. (2000), "Performance perceptions, satisfaction, and intention: The intermodal shipper's perspective." Transportation Journal, Vol. 40 No. 2, pp. 27-39.

EPA (2008), Optional Emissions from Commuting, Business Travel and Product Transport http://www.epa.gov/climateleadership/documents/resources/commute_travel_product.pdf. Accessed January 19, 2015.

ERIA STUDY TEAM. (2010), Emerging Development Trends and Challenges in ASEAN Strategic Transport Plan 2011-2015. Jakarta: ASEAN Secretariat and ERIA.

EUROPEAN COMMISSION. (1999), Communication from the Commission to the European Parliament, the Council, the Economic and Social Committee and the Committee of the Regions, The Development of Short Sea Shipping in Europe: a Dynamic Alternative in a Sustainable Transport Chain, Second two-yearly Progress Report, Brussels, COM (1999) 317 final.

EUROPEAN PARLIAMENTARY RESEARCH SERVICE (EPRS) (2015), "Reducing CO2 emissions from transport". Accessed 18 August 2016. http://www.europarl.europa.eu/RegData/etudes/BRIE/2015/569031/EPRS_BRI(2015)569031_EN.pdf

GARDNER, J.T., COOPER, M.C. and NOORDEWIER, T.G. (1994), "Understanding shipper-carrier and shipper-warehouser relationships: partnerships revisited." Journal of Business Logistics, Vol. 15 (2) , pp. 121-43.

GENTRY, J.J. (1996), "The role of carriers in buyer-supplier strategic partnerships: a supply chain management approach." Journal of Business Logistics, Vol. 17 No. 2, pp. 35-55.

GIBSON, B.J., RUTNER, S.M. and KELLER, S.B. (2002), "Shipper-carrier partnership issues, rankings and satisfaction." International Journal of Physical Distribution & Logistics Management, Vol. 32 No. 8, pp. 669-81.

GIBSON, B.J., SINK, H.L. and MUNDY, R.A. (1993), "Shipper-carrier relationships and carrier selection criteria." Logistics and Transportation Review, Vol. 29 No. 4, pp. 371–82.

GLASSER, w. (1925), Choice Theory: A New Psychology of Personal Freedom. 1st ed. NY: HarperCollins Publishers, Inc.

HAWKEN, A. and MUNCK, G.L. (2012), "Cross-National Indices with Gender-Differentiated Data: What Do They Measure? How Valid Are They?". Social Indicators Research, Vol. 111, No. 3, pp. 801–838.

ICS. (2013), Shipping and World Trade. http://www.ics-shipping.org/shipping-facts/shipping-and-world-trade. Accessed January 21, 2016.

IMO GHG STUDY. (2009), (MEPC 59/INF.10) 9 April 2009. London: International Maritime Organization.

INSCH, A., and JACKSON, E. (2013), "Consumer understanding and use of country-of-origin in food choice." British Food Journal, Vol. 116 No. 1, pp. 62-79.

KOLIOUSIS, I., KOLIOUSIS, P., and PAPADIMITRIOU, S. (2013), "Estimating the impact of road transport deregulation in short sea shipping: experience from deregulation in the European Union." International Journal of Shipping and Transport Logistics, Vol. 5 No. 4, pp. 500-11.

LA LONDE, B.J., and COOPER, M.C. (1989), Partnerships in providing customer service: a third-party perspective. Cincinatti, OH: The Council of Logistics Management.

LAI, K.H. (2004), "Service capability and performance of logistics service providers." Transportation Research Part E: Logistics and Transportation Review, Vol. 40 No. 5, pp. 385-99.

LAMBERT, D.M., LEWIS, M.C., and STOCK, J.R. (1993), "How shippers select and evaluate general commodities LTL motor carriers." Journal of Business Logistics, Vol. 14 No. 1, pp. 131-43.

LEMOINE, W., and DAGNÆS, L. (2003), "Globalisation strategies and business organisation of a network of logistics service providers." International Journal of Physical Distribution & Logistics Management, Vol. 33 No. 3, pp. 209-28.

LI, J., LIU, F., and ROJAS-MÉNDEZ, J.I. (2013), "How international students select offshore programs: the influence of image, attitude, subject norm, and perceived behavioral control." Asia Pacific Education Review, Vol. 14 No. 3, pp. 381-90.

LU, C. S. (2003a), "An evaluation of service attributes in a partnering relationship between maritime firms and shippers in Taiwan." Transportation Journal, Vol. 42 No. 5, pp. 5-16.

LU, C.S. (2003b), "The impact of carrier service attributes on shipper–carrier partnering relationships: a shipper's perspective." Transportation Research Part E: Logistics and Transportation Review, Vol. 39 No. 5, pp. 399-415.

MALCHOW, M., and KANAFANI, A. (2001), "A disaggregate analysis of factors influencing port selection." Maritime Policy & Management, Vol. 28 No. 3, pp. 265-77.

MALCHOW, M.B., and KANAFANI, A. (2004), "A disaggregate analysis of port selection." Transportation Research Part E: Logistics and Transportation Review, Vol. 40 No. 4, pp. 317-37.

MANGAN, J., LALWANI, C., and GARDNER, B. (2002), "Modelling port/ferry choice in RoRo freight transportation." International Journal of Transport Management, Vol. 1 No. 1, pp. 15-28.

MCGINNIS, M.A. (1990), "The relative importance of cost and service in freight transportation choice: before and after deregulation." Transportation Journal, Vol. 30 No. 1, pp. 12-9.

MCKINNON, A. (2014), "The possible influence of the shipper on carbon emissions from deep-sea container supply chains: An empirical analysis." Maritime Economics & Logistics, Vol. 16 No. 1, pp. 1-19.

MEDDA, F., and TRUJILLO, L. (2010), "Short-sea shipping: an analysis of its determinants." Maritime Policy & Management, Vol. 37 No. 3, pp. 285-303.

MURPHY, D.J., and FARRIS, M.T. (1993), "Time-based strategy and carrier selection." Journal of Business Logistics, Vol. 14 No. 2, pp. 25-40.

NIR, A.S., LIN, K. and LIANG, G. S. (2003), "Port choice behaviour--from the perspective of the shipper." Maritime Policy & Management, Vol. 30 No. 2, pp. 165-73.

PAIXÃO CASACA, A., and MARLOW, P.B. (2002), "Strengths and weaknesses of short sea shipping." Marine Policy, Vol. 26 No. 3, pp. 167-78.

PAIXÃO CASACA, A., and MARLOW, P.B. (2005), "The competitiveness of short sea shipping in multimodal logistics supply chains: service attributes." Maritime Policy and Management, Vol. 32 No. 4, pp. 363-382.

PATTERSON, Z., EWING, G. O., and HAIDER, M. (2008), "The potential for premium-intermodal services to reduce freight CO 2 emissions in the Quebec City–Windsor Corridor." Transportation Research Part D: Transport and Environment, Vol. 13 No.1, pp. 1-9.

PERAKIS, A.N., and DENISIS, A. (2008), "A survey of short sea shipping and its prospects in the USA." Maritime Policy & Management, Vol. 35 No. 6, pp. 591-614.

REA ASSOCIATES OF PRINCETON, Inc. Methodology of Calculating Inventory Carring Costs (Accessd March 15, 2015) http://www.remassoc.com/portals/0/remprecc.pdf

REGMI, M. B. and HANAOKA, S. (2015), "Assessment of modal shift and emissions along a freight transport corridor between Laos and Thailand." International Journal of Sustainable Transportation, Vol. 9 No. 3, pp. 192-202.

REIS, V. (2014), "Analysis of mode choice variables in short-distance intermodal freight transport using an agent-based model." Transportation research part A: Policy and practice, Vol. 61, pp. 100-120.

RODRIGUE, J.P., COMTOIS, C., and SLACK, B. (2017), The geography of transport systems. Oxon: Routledge.

STOPFORD, M. (2009), Maritime Economics. Routledge, London.

TAO, X., WU, Q., and ZHU, L. (2017), "Mitigation potential of CO2 emissions from modal shift induced by subsidy in hinterland container transport." Energy Policy, Vol. 101, pp. 265-273.

TIWARI, P., ITOH, H., and DOI, M. (2003), "Shippers' port and carrier selection behaviour in China: a discrete choice analysis." Maritime Economics & Logistics, Vol.5 No. 1, pp. 23-39.

TONGZON, J.L. (2009), "Port choice and freight forwarders." Transportation Research Part E: Logistics and Transportation Review, Vol. 45 No. 1, pp. 186-95.

UGBOMA, C., UGBOMA, O., and OGWUDE, I.C. (2006), "An Analytic Hierarchy Process (AHP) approach to port selection decisions–empirical evidence from Nigerian ports." Maritime Economics & Logistics, Vol.8 No. 3, pp. 251-66.

WHYTE, J. (1992), "The freight transport market: buyer–seller relationships and service attributes." International Journal of Physical Distribution and Logistics Management, Vol. 23 No. 3, pp. 29-37.

WILSON, F., BISSON, B., and u, K. (1986), "Factors that determine mode choice in the transportation of general freight." Transportation Research Record, Vol. 1061, pp. 26–31.

YANG, Y.C., and SUNG, C.Y. (2014), "Application of fuzzy quality function deployment on the service quality improvement for international logistics in shipping company." Paper presented at the International Forum on Shipping, Ports and Airports (IFSPA) 2014: Hong Kong, May 19 -21.

YEO, K., LEE, H. and OH, S. (2004), "Extraction of port selection factors for increasing shippers' attraction of small and medium ports (written in Korean)." The Journal of Shipping and Logistics, Vol. 43 No. 4, pp. 33-53.