

# Competitiveness of the Liner Operators: Methodological Issues and Implications

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**Abstract:** In the 21st century, ocean container carriers are facing high competition in cargo volume attraction and retention from their business to business customers. The main focus of this study is on the methodological issues in the analysis of shipping lines' competitiveness. A system review of the literature is conducted in three stages to identify the key factors influential to the competitiveness of liner shipping companies. An initial search has found 897 studies, which were then reduced to 39 after further scanning and review. The systematic review has elicited 15 key selection criteria which were further reduced through analytic hierarchy process to five critical factors influential to the liner shipping companies' competitiveness. For example, among the most frequently cited factors are the freight rate, service quality, scheduling, handling equipment and information technology. Based on the findings from the systematic literature review, a conceptual framework to identify the main determinants of the liner operators is developed, and implications for future research are also discussed.

**Key words:** Liner operators, shippers, freight forwarders, carrier selection, carrier competitiveness, container supply chain.

## 1. Introduction

Even though liner shipping sector is witnessing a high level of concentration in recent times, still competition remains very high among the ocean container carriers regarding cargo capacity attraction to their lines Ducruet and Notteboom [1]. The liner shipping has seen the height of stiff competition in the past decade in terms of container volume attraction and retention on the major and minor routes, exerting pressure on the liner shipping companies to deliver impeccable liner shipping services to their customers Notteboom [2]. According to researchers, this trend of stiff competition is going to intensify in coming years. The impact of the global financial crisis in 2008 has caused an instantaneous switch in the liner shipping sector, compelling the liner shipping companies to employ various strategies in attracting cargo volume to fill their vessels during the economic downturn period Chung, C. C., Chung, Y. S., Tai, A. N. [3].

Liner shipping companies are under pressure to generate enough cargo volume of freight to fill their vessels, which compels the ocean container carriers to embrace trade agreements such as liner conferences, operating agreements and merger and acquisitions in order to remain competitive in the liner shipping market [4, 5].

The competitiveness of the liner companies depends on their ability to provide the required transport service to their customers [6]. The liner operators are devising new strategies to enable them to meet their customers' requirement in order to attract and retain cargo volume [3]. The research focus on the shipping companies' competitiveness has shifted in recent times with researchers focusing on the evaluation of the ocean carriers' competitiveness through the carriers' abilities to effectively coordinate container supply chain flow through seamless integrating of the maritime transport with the hinterland transport chains [7, 8].

The main focus of this paper is on the methodological issues in the analysis of the factors

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influencing the competitiveness of the liner shipping companies. In particular, the study reviews the literature on the liner shipping companies' competitiveness, especially the research methods used to analyse the liner shipping companies' competitiveness. Based on the findings from the literature review, the paper will propose a synthetic conceptual framework to identify and analyse the key factors influencing the competitiveness of the liner shipping companies and discuss the implications for future research.

This paper is divided into five sections. The next section discusses the role of the liner shipping companies in the container supply chains and present transport service buyers' view on the competitiveness of the shipping lines in fulfilling their role in the container supply chains. Section 3 presents a review of existing studies on the liner operators' competitiveness with a focus on the methodologies used to identify the key determinants of the liner operators' competitiveness. Based on the findings from the literature review in section three, Section 4 presents a synthetic conceptual framework on the factors affecting the competitiveness of the liner operators, its determinants and their relationships. The last section is conclusions and discussion on the study's limitations and implications for future research.

## 2. Literature Review

The last decade was a period of significant change in container shipping as liner companies had to face, on the demand side, the new needs of shippers due to globalisation while, on the supply side, chronic fleet overcapacity [9]. During the period of overcapacity, the ocean container carriers strive to secure many bookings as possible, but in times of scarce capacity, the ocean carriers can decide whether to take or reject a booking. The phenomenon of globalisation brings the need for the demand of door-to-door transportation service by the shippers from the ocean

carriers. Cargo owners are demanding uninterrupted transport service throughout the entire transport network from door to door. Shippers have shown interest in the quality delivery of goods through the whole transport chain by a single service provider [10]. It was largely believed that the liner shipping companies provide maritime transport only. However, Heaver [11] noted that in Europe and in North America, all the major shipping lines now offer door-to-door service to shippers, in order to provide reliable fast service through a single supplier. Even though the liner operators' core business is to provide regular maritime schedule services, the demand by its customers for seamless door-to-door services cannot be ignored.

The current demand from shippers calls for synchronisation of different modes of transport of which the liner shipping companies have to play effective coordination role, for example, if a segment in the container chain does not work efficiently in a highly synchronised environment, then the whole chain will be affected [10]. The ocean carriers' collaboration with the other main transport actors within the container supply chain enhances the competitiveness of the ocean carriers [11]. The network coordination by the ocean carriers to integrate other transport network players such as terminal operators, stevedores, road haulers, etc., is paramount in enhancing a smooth flow of freight through the transport logistics chain and reduces delay in the logistics chain. The ocean carriers effective coordination within the transport chain improves the end-to-end transportation flow and helps in reducing the pipeline inventory cost because the coordination by the liner operators minimises delays encountered at the terminals and transshipment points.

The ocean carriers' coordination of the key players and stakeholders within the container supply chain is important in facilitating the free flow of cargo through transport logistics chain. It is crucial for the liner shipping companies to link transport network players

together in providing common platform for information sharing concerning trade. For liner shipping companies to remain competitive, they must provide integrated transport service, that is, a combination of maritime and inland transport service [12].

In recent time, the shippers are evaluating the competitiveness of the ocean container carriers based on the ocean carriers' ability to effectively coordinate other players within the container supply chain. All players within the container supply chain have a different role to play concerning the transportation of cargo, therefore, the ocean container carriers' must effectively coordinate the cargo flow among the transport network players in order to facilitate smooth flow of container movement. The ocean carriers' effective collaboration with terminal operators enables the free flow of cargo through the terminal which has a greater impact on total transport chain [6]. The disruption in the container terminals will have bullwhip effect on other areas of the container supply chain. For example, delay in terminal operations will affect transit time, cost, and delivery reliability.

The ocean carriers' effective coordination within hinterland transport is crucial in reducing total transport delivery cost as hinterland-transport costs are generally higher than the maritime transport costs and that most bottlenecks in the door-to-door chain occur in the hinterland [7].

The ocean carrier's inability to coordinate efficient cargo flow to and from barges, trucks and rail wagons has severe negative effects on the container supply chain. The ocean carriers' ability to process customs documents such as the submission of cargo manifests on time to allow advance or on-time processing of clearance documents by clients with customs authorities also enhances the competitiveness of the ocean carriers from shippers' and forwarders' perspectives.

The recent studies tend to analyse the factors influencing the ocean carriers' competitiveness from

the ocean carriers' capabilities to effectively coordinate hinterland transport chain processes and a seamless integration of maritime transport with the hinterland transport network to enhance global supply chain [6, 13].

The ocean carriers act as the pivotal point linking all actors within the container chain to enhance customers delivery performance. Every single actor in the container supply chain has different objectives, as a result, the actors have a limited role in container transport flow. However, the role of the ocean carriers is critical in coordinating the network actors to facilitate cargo delivery for the shippers.

### 3. Methodology

As mentioned earlier, the present study aims to unveil the key factors influencing the competitiveness of the liner shipping companies through a systematic review of the literature. To do this, extensive search of the literature is conducted using University of Tasmania's MegaSearch<sup>1</sup> and the advanced search tool that allows for different combinations of search key words or subjects and has different search modes (Boolean/Phrase, with all search terms, and SmartText Search).

The search also makes use of Google Scholar and is carried out in specific journals, such as Maritime Economics and Logistics, Maritime Policy and Management, JSTOR Online Journals, Journal of Transport Economics and Policy, Transport Policy, Transport Reviews, Transportation Journal, International Journal of Shipping and Transport Logistics, Taylor and Francis Online, WMU Journal of Maritime Affairs Online, and Journal of Transport Geography.

The search keywords are: "transportation choice", "carrier selection", "carrier mode choice", or a combination of one of the phrases "shipping lines", "liner shipping", "container shipping" with "competitiveness", "competition", "influential

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<sup>1</sup><http://www.utas.edu.au/library>.

factors”, “critical factors” and “container supply chain”. The search focuses on peer-reviewed refereed journal articles published in English in the last 25 years, 1990 to present. EndNote Reference database software (Version 7) is used to manage the research results.

The initial search as described above elicited 897 papers. The study further carefully screened through the abstracts of the identified articles considering papers that discussed issues concerning the above keywords and identified 112 relevant articles to the study. In the second stage, these articles are further screened and systematically reviewed by the second researcher to filter out those that are not relevant to the topic. Thus, a thorough screening was conducted where the study considered publications with the main focus on carrier selection criteria and carriers competitiveness. Articles which focused only on port choice selection and port competitiveness were

excluded. This process further reduced the relevant articles to 70. In the third stage, additional screening was done to further identify studies that used data to analyse carrier selection criteria, carrier competitiveness and ocean carrier supply chain coordination, and this additional process reduced the relevant articles to 39.

Fig. 1 shows the three stages processes in choosing relevant articles while Fig. 2 shows the distribution of the 39 relevant papers per year across the research period (1990~2015) and approximately 50% of the identified papers were published in the last five years.

There are various methodologies employed by researchers in the field of transport logistics, however, the most commonly used in transport related studies are qualitative and quantitative methods. Even though when choosing a carrier for cargo transportation [14-18]. The past studies relied on either qualitative [19, 20] or quantitative data [12, 21-23]. Among those

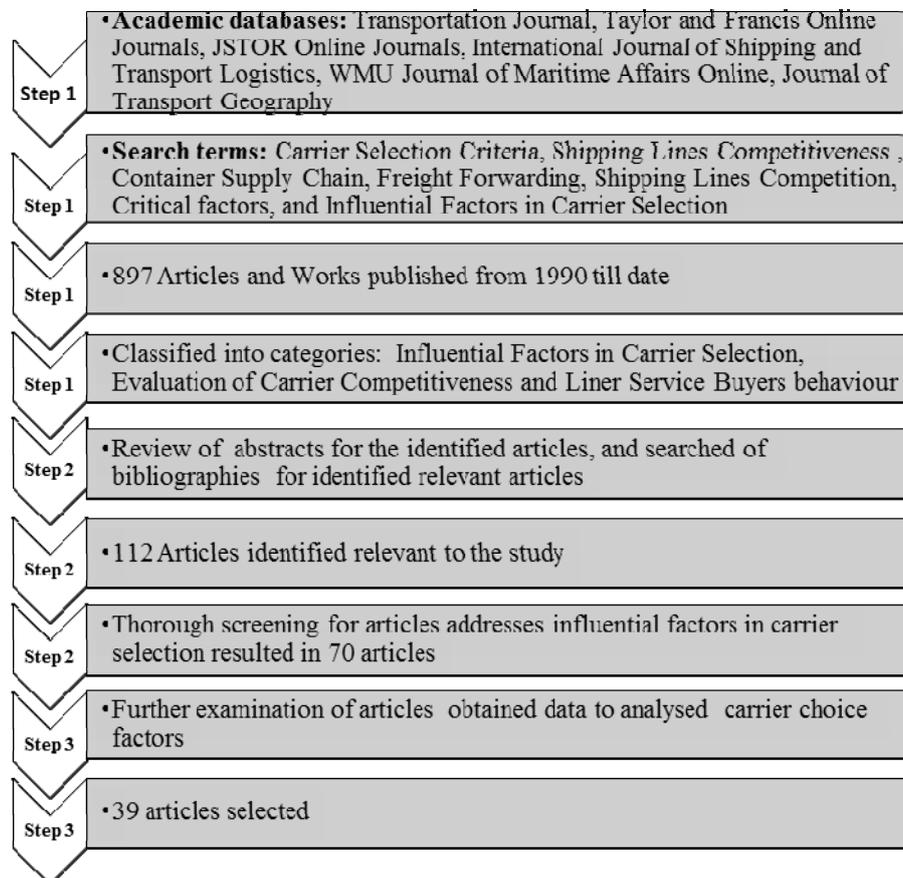


Fig. 1 The selection process of the relevant articles.

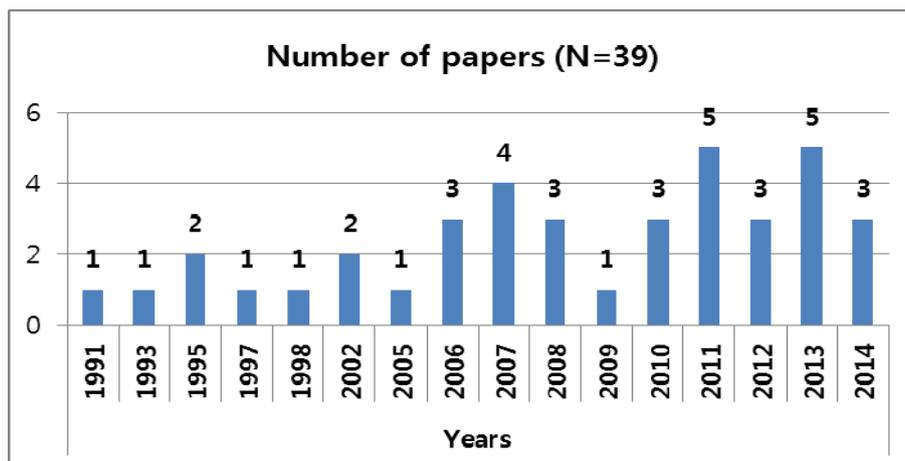


Fig. 2 Distribution of papers per year across the period studied.

studies that use quantitative methods, many employed statistical methods in data analysis. Most of the data came from a survey conducted using shippers, carriers and freight forwarders as demography.

A number of studies used mathematical methods to identify influential carrier selection factors affecting carriers' competitiveness and network integrations of carriers [3, 24, 25]. AHP (analytic hierarchy process) was employed by a number of studies to analyse importance that the transport freight buyers' attached to service criteria [26] and the factors impacting ocean carriers' competitiveness [27].

A discrete choice modelling was applied [28-30] to identify the factors influencing the decision-making of shippers and freight forwarders when choosing carriers. The authors also covered the carriers role in intermodal transport in relation to the carriers' competitiveness. Other methods of modelling, i.e., bi-level modelling approach was used by Boile, Lee and Theofanis [31] to formulate hierarchical relationships between ocean carriers and other transport network players and its effect on carriers' competitiveness.

A case study approach was applied by Mohammaditabar and Teimoury [14] and Venus, et al. [32] to analyse the competitiveness of the liner shipping companies with regards to their network relationship with other players within the liner shipping industry.

Table 1 shows the framework of relevant literature on carrier choice, carrier competitiveness and the freight transport buyers' decision based on the methodological issues.

#### 4. Factors influencing Ocean Carriers' Selection

The carrier selection attributes used in the previous studies have significant variations due to the demographic observed by the studies. Most of the past studies have analysed the carrier selection factors by combining the perspectives of the shippers and freight forwarders together [20, 27, 33]. However, it has been pointed out by researchers that the shippers and freight forwarders have different views on the important factors observed when selecting the ocean container carriers [34]. Shippers analysed the liner operators' competitiveness by employing factors such as cost, transit time, service quality, delivery time, cargo handling equipment, physical financial stability, reliability, on-time pickup when choosing a carrier for cargo transportation [14, 15-18].

Table 2 presents 15 critical influential attributes perceived by transport service buyers in carrier choice selection based on the extant literature. These attributes were considered important by at least four or more studies in the past nine years in the area of transportation choice, that is, carrier selection, carrier competitiveness and carrier network integration.

**Table 1 A review of relevant papers on carrier selection and transport buyers decision.**

Methodology	Frequency	Studies	Percentage
Factor analysis	18	Abshire and Premeaux (1991), Lambert, Lewis et al. (1993), Brooks (1995), Crum and Allen (1997), Pedersen and Gray (1998), Kent and Parker (1999), Gibson, Rutner et al. (2002), Tuna and Silan (2002), Ng and Yu (2006), Lu (2007), Zsidisin, Voss et al. (2007), Hu and Jen (2010), Premeaux (2010), Banomyong and Supatn (2011), Rajesh, Pugazhendhi et al. (2011), Shang and Lu (2012), Yan (2012), Van den Berg, and De Langen (2014)	46%
Simulations	1	Maloni, Paul et al. (2013)	2.5%
Theory of reasoned action	1	Voss et al. (2006)	2.5%
Mathematical modelling	6	Bolduc, Renaud et al. (2007), Gupta (2008), Chou (2010), Alizadeh and Nomios (2011), Chung, Chung et al. (2011), Lin and Yeh (2013)	15.5%
Analytic hierarchy process	5	Mohammaditabar and Teimoury (2008), Wong, Yan et al. (2008), Kannan, Bose et al. (2011), Lirn and Wong (2013), Lam and Zhang (2014)	13%
Discrete choice modelling	4	Wen and Huang (2007), Brooks, Puckett et al. (2012), Ben-Akiva, Bolduc et al. (2013), Gailus and Jahn (2013)	10%
Other types of modelling	1	Chu (2014)	2.5%
Others	3	Dobie (2005), Notteboom (2006), Saldanha, Tyworth et al. (2009)	8%
Toatal	39	18.00	100%

**Table 2 Influential factors in carrier selection.**

Item No.	Factors of selection criteria	Supporting literature	Meaning from the customers' perspective
1	On time pickup/delivery	Voss et al. (2006), Wong, Yan and Bamford (2008), Premeaux (2010), Ben-Akiva, Bolduc and Park (2013), Lin and Yeh (2013)	Ability of carriers to pick-up and deliver cargo on time to customers
2	Reliability of sailing	Lu (2007), Saldanha et al. (2009), Banomyong and Supatn (2011), Gailus and Jahn (2013), Lam and Zhang (2014)	Carriers ability to be reliable to sailing time
3	Reliability of transit time	Wong, Yan and Bamford (2008), Notteboom and Vernimmen (2009), Brooks et al. (2012), Gailus and Jahn (2013), Van den Berg and De Langen (2014b)	Ability of carrier to stick to announced transit time
4	Track and tracing	Dobie (2005), Banomyong and Supatn (2011), Lirn and Wong (2013)	Carrier providing tracking and tracing service of cargo
5	Freight rates/cost	Banomyong and Supatn (2011), Kannan, Bose et al. (2011), Lirn and Wong (2013)	Carrier offering flexible or lower freight rates
6	Door-to-door transport rate	Brooks (1995), Wen and Huang (2007), Boile, Lee and Theofanis (2012), Fransoo and Lee (2013), Van den Berg and De Langen (2014b)	Carrier ability to offer door-to-door rates
7	Professionalism of carrier staff	Lu (2007), Wen and Huang (2007), Banomyong and Supatn (2011), Kannan, Bose and Kannan (2011), Gailus and Jahn (2013)	Carrier front desk staff duty to care about customers
8	Fast response to problem	Lu (2007), Wen and Huang (2007), Mohammaditabar and Teimoury (2008), Lam and Zhang (2014)	Ability of carrier to respond to problem on time
9	Accuracy of bill of lading	Voss et al. (2006), Banomyong and Supatn (2011), Kannan, Bose and Kannan (2011), Gailus and Jahn (2013), Lirn and Wong (2013)	Issuing bill of lading without error
10	Ability to handle safely	Lu (2007), Wen and Huang (2007), Wong, Yan and Bamford (2008), Premeaux (2010), Rajesh et al. (2011)	Safe handling of cargo without damage
11	Availability of special equipment	Premeaux (2010), Banomyong and Supatn (2011), Ben-Akiva, Bolduc and Park (2013), Gailus and Jahn (2013), Lirn and Wong (2013)	Provision of special cargo handling equipment by carrier
12	On-time information on arrival	Lu (2007), Qureshi, Kumar and Kumar (2008), Kannan, Bose and Kannan (2011), Premeaux (2011), Rajesh et al. (2011)	Ability to provide on time information to customers on cargo ETA (esimated time of arrival)/ETD (estimated time of departure)
13	Uses of reliable equipment	Wong, Yan and Bamford (2008), Banomyong and Supatn (2011), Kannan, Bose and Kannan (2011), Premeaux (2011), Ben-Akiva, Bolduc and Park (2013), Lam and Zhang (2014)	No frequent breakdown of equipment during operations
14	Frequency of port calls	Lu (2007), Banomyong and Supatn (2011), Gailus and Jahn (2013), Lirn and Wong (2013)	Carrier ability to obtain berth on arrival
15	Coordination with other actors	Wen and Huang (2007), Frémont (2009), Fransoo and Lee (2013), Van den Berg and De Langen (2014b)	Carrier ability to coordinate other supply chain players

Source: Author.

The researchers have analysed ocean carriers competitiveness based on the influential factors used by transport service buyers when purchasing ocean carriers' services. Reliability in delivery was identified as the important by the shippers when making choice of ocean carrier [12, 15, 35, 36]. Kannan, Bose and Kannan [37] applied the AHP to evaluate the ocean container carriers' selection criteria and found that low freight was ranked as the most important selection criteria by the shippers.

The empirical analysis conducted by Van den Berg and De Langen [12] to examine the ocean container carriers selection criteria from the shippers and freight forwarders' perspectives revealed that both are mainly cost driven. Meixell and Norbis [38] identified cost as one of the influential factors affecting the competitiveness of the ocean carriers, which is consistent with the findings of Mohammaditabar and Teimoury [14]. Again, an analytical study conducted by Lin and Yeh [25] using a multi-commodity reliability model identified delivery cost and time are important factors for the customers in making an optimal carrier selection decision. Additionally, Premeaux [39] investigation of the carriers choice selection variables from the shippers' and carriers' perspectives revealed that the shippers' placed more importance on flexible rates than a response to an emergency or unexpected situations, and providing information and services through a comprehensive web-enhanced electronic-data-interchange. Furthermore, the statistical analysis conducted by Banomyong and Supatn [40] shows that freight rate/cost was observed as the important factor by the shippers and the freight forwarders when making carrier selection.

Transit time and transit time reliability was the important factor perceived by shippers when purchasing transport services from the liner shipping companies [34, 41]. However, the in-depth statistical analysis in a number of studies has identified service quality and carriers' customer service performance as

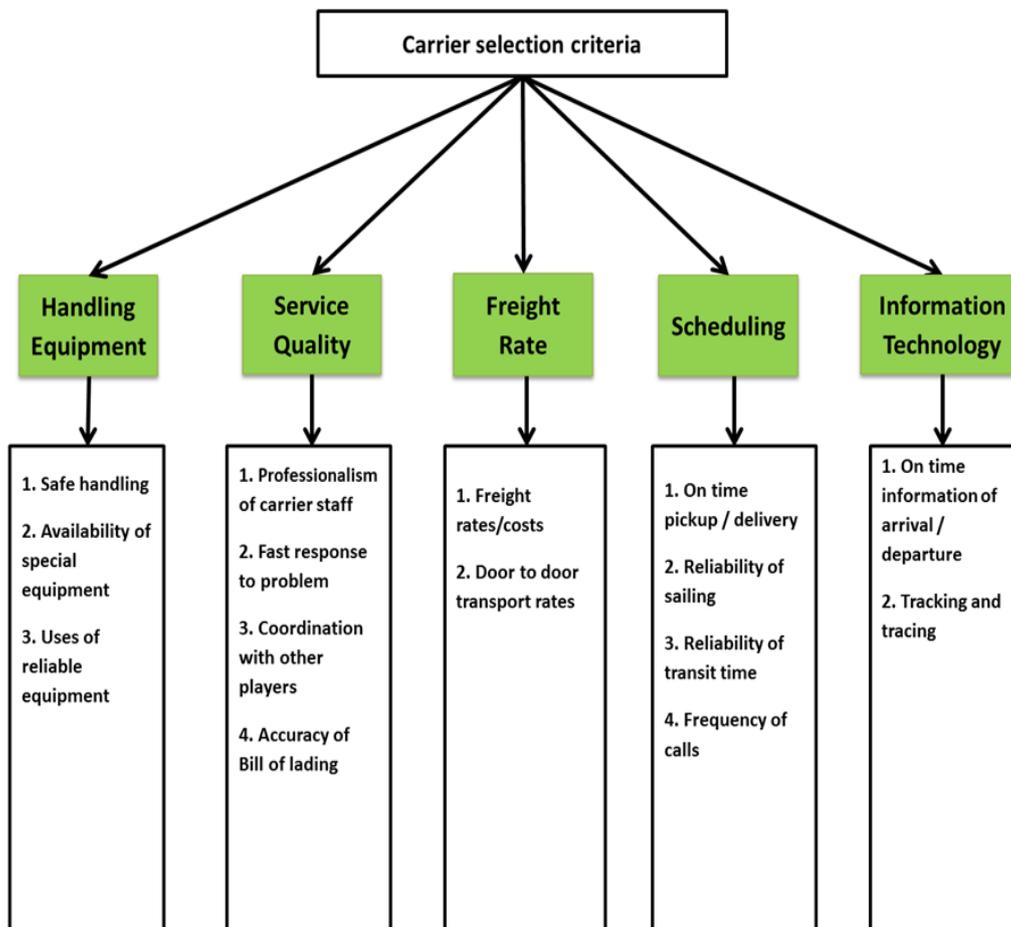
the factors influencing the choice of the shippers [27, 30]. Similarly, the empirical results of Shang and Lu [42] have identified customer relationship management and carrier sales representative expertise as the critical influential factors impacting the choice of carriers.

The empirical analysis conducted by Wen and Huang [28] applied a multinomial logit model by ranking the service factors and found that the bill of lading accuracy, an ability to trace shipments and pickup and delivery service are the three most important factors influencing the choice of the ocean container carriers.

A number of researchers have used AHP to analyse the important factors affecting the choice of carrier [26, 27, 37, 43], the authors have employed AHP to reduce carrier selection criteria in major factors. Pairwise comparisons of the 15 factors mentioned in Table 2 were conducted under the AHP. Wong, Yan and Bamford [27] stipulated that AHP is an effective approach in ranking a given set of alternatives under hierarchically structured criteria involving both objective and subjective judgements. The 15 criteria were categorised into five influential factors based on the literature review as following: service quality, freight rate, handling equipment, schedule, and information technology. Fig. 3 shows the pairwise comparisons of the 15 criteria into five influential factors.

The safe cargo handling equipment was identified as one of the key factors observed by the shippers and freight forwarders in their decision making of choosing an ocean container carrier in the movement of their cargo [26, 27, 30]. A number of studies have identified service quality as the important factor observed by the transport service buyers when buying transport services from the carriers [22, 28, 37].

Scheduling of on-time pick-up and delivery was identified as the determinant factor perceived by the transport service buyers when purchasing transport service [23, 44]. However, information on cargo arrival



**Fig. 3** Critical carrier selection criteria.

and departure were the significant factors perceived by the shippers in carrier selection and Premeaux [45].

It is important for shipping companies to understand the importance that the shippers and freight forwarders attached to the influential factors in order to enable the ocean carriers to provide a require liner service to their customers. The shippers and freight forwarders do not attach equal importance to these five influential factors, the cargo characteristics and the volume of cargo tendered by the shippers and freight forwarders have a significant impact on the weight of importance they attached to these influential factors.

## 5. Conclusions

This paper presents a three-stage systematic review of the literature on the competitiveness of the liner

shipping companies, more especially the review of the research methods applied by the previous papers in identifying the influential factors affecting the competitiveness of the liner shipping companies. An initial search has elicited 897 studies, which has been further screened to reduce the number of relevant papers to 39. Based on the findings from the literature review, a conceptual framework is proposed to help identify and analyse the critical factors influencing the liner shipping companies competitiveness.

This paper makes important contributions. First, the paper analysed relevant carrier selection literature from the last two decades and categorised carrier selection research by the methodology used and examined their research approach and outcome factors. Secondly, the study addressed the carrier selection attributes affecting the competitiveness of the liner

shipping companies from the shippers and freight forwarders' perspectives to enable the liner shipping companies to formulate relevant strategies in attracting their business-to-business customers in order to remain competitive in the highly volatile liner shipping market. Finally, the study reduced the carrier selection attributes into five critical factors that influenced the competitiveness of the ocean carriers from the shippers and freight forwarders' perspective in the international transport logistics chain. The literature review on carrier selection revealed that a considerable amount of studies has been conducted in this area. Most of the studies applied quantitative methods and employed surveys to obtain the influential factors perceived by the shippers and freight forwarders when making decisions in choosing carriers [12, 39, 40, 44].

The review of the current literature identified five groups of influential factors in carrier selection. These are service quality, freight rate, handling equipment, scheduling, and information technology. It is worth mentioning that transport service buyers used the five influential factors interchangeably and do not stick to one factor only. However, service quality and scheduling factors are the two most important factors observed by the shippers and freight forwarders when purchasing the liner shipping services. The review also revealed that some major issues regarding the ocean carriers' competitiveness did not receive much attention from scholars, and these issues are underrepresented in the literature; i.e., ocean carrier supply chain integration and ocean carrier providing of hinterland transport service and the ocean carrier offering of one-shop delivery service. The study noted that the influential carrier selection factors vary from geographical locations. Thus, the factors influencing the competitiveness of the ocean container carriers vary per region. It is important for the liner shipping companies to understand the weight of importance that the shippers and freight forwarders attached to each carrier selection factors. The ocean container

carriers have to be fully aware that the importance attached to carrier selection factors by the shippers and freight forwarders varies across geographical locations. Likewise, the influential carrier selection factors also vary per client groups within the same region which makes it a dynamic issue. The liner shipping companies should pay attention to the five influential factors identified in this study and also carefully consider the categories of the clients group because the volume of cargo tender by each category group to a shipping line within a specific region affects the factors that they consider important.

There are key areas to be considered for future research. Future studies should focus on comparing carrier selection factors across regions and attention should be paid to client groups and size, because clients group like shippers tend to focus on price-related factors while freight forwarders also tend to focus on service quality related factors. The size of shippers also has a significant impact on the influential factors observed when selecting ocean carriers. Smaller shippers may tend to consider different factors than bigger shippers, and hence, their evaluation of carriers' competitiveness may be different from one another. Notwithstanding the size of shippers, the volume of cargo tender by the smaller or bigger shippers to a particular shipping company may also significantly affect the factors that they consider important when selecting that particular carrier. For example, a bigger shipper who gives a small volume of cargo to a particular carrier randomly will assess that carrier differently from the carrier that the bigger shipper gives high volumes continuously.

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