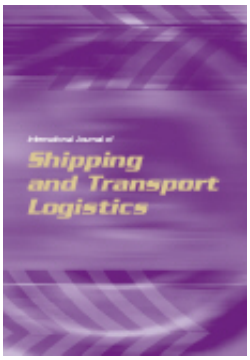

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Expected utilities of liner shipping market trends: how can companies benefit?

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Expected utilities of liner shipping market trends: how can companies benefit?

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Abstract: Recently, liner shipping companies were one of the most profitable companies. To sustain this profitability, companies should use the right strategies. This study aims to define and analyse liner shipping market trends, its expected utilities, and the competitive advantage strategies of companies. In this study, the most adequate strategy that meets the requirements of these trends was obtained by fuzzy AHP-TOPSIS hybrid method. Such market trends as 'digital transformation', 'decarbonisation race', and 'supply chain integration' were seen as the most prominent ones. On the other hand, 'rapid shipping service between ports' had become the most preferable strategy in the context of these trends. These results were discussed by comparing existing literature and interpreted in terms of market conditions. This is the first study evaluated liner shipping market trends in the context of expected utilities theory and tried to determine the best strategy brings competitive advantage by catching market trends.

Keywords: liner shipping market trends; competitive advantage theory; fuzzy AHP-TOPSIS hybrid method; expected utility theory; container transport.

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1 Introduction

Recently, liner shipping market became one of the most profitable markets in the maritime industry. Essentially, since 2008–2009 financial crisis, the market dynamics had been so volatile and even the biggest companies had gone bankruptcy in this process.

However, today liner shipping companies that have survived this process with the appropriate strategies are experiencing historical profitability with COVID-19. Nevertheless, many market forces exist and they have an impact upon the present day market conditions and the future of market dynamics. Over the decade, many factors such as US-China trade war, air emissions restrictions by International Maritime Organization (IMO), physical attacks (especially pirate attacks) and cyber-attacks, COVID-19 pandemic, the Russia-Ukraine war, rapid growth in ship sizes, vertical and horizontal integrations, etc. have shaped the market trends. With the COVID-19 pandemic freight rates have skyrocketed due to excess demand for non-frequently used products (mask, disinfectant, surgical glove, etc.) and home appliances, limited service, congested supply chain and liner shipping companies have gained historically record profits. Liner shipping companies should manage these profits with strategies catching the market trends to sustain these profitability in the mid-term. Literature presents strategies coherent with the market trends. Chen et al. (2022) assessed managerial, tactical, strategic level objectives of liner shipping companies. Wang and Meng (2017), Christiansen et al. (2020), Cheng and Wang (2021) and Dulebenets et al. (2021) handled route optimisation, fleet deployment, and vessel scheduling problems in the liner shipping market. Moreover, Liu et al. (2021) evaluated Artic route in terms of route optimisation for global markets. Many of the studies focused on sustainability approaches in a manner of safety management, emission control measures, sustainable development (Vejvar et al., 2020; Tong et al., 2022; Zhao et al., 2021; Wan et al., 2021). Finally, several studies-based profitability of liner shipping market on economic strategies such as the capacity control, dynamic pricing, consistent forecasting, etc. (Panahi et al., 2017; Zhen et al., 2017; Meng et al., 2019). In this study, current market trends were discussed with a holistic approach. For the first time, market trends were presented with their related expected utilities for liner shipping companies. And, strategies for liner shipping companies to sustain operations in the market conditions affected by trends were originally based on Porter's generic competitive strategies. Motivation of this study to introduce market trends and their related expected utilities for liner shipping companies and to draw a road map by evaluating competitive advantage strategies in terms of catching these trends. So, market trends along with expected utilities were prioritised with fuzzy AHP method and the strategies were analysed in terms of catching these trends by fuzzy techniques for order preference by similarity to ideal solution (TOPSIS) method. These methods have been preferred because they work in harmony with each other in terms of prioritising and ranking criteria and alternatives. As an originality of this study, market trends were integrated in expected utility theory while defining and the strategies against market trends were generated based on competitive advantage theory.

This study tried to determine the best strategy catching the market trends for liner shipping companies. The following section introduced the theoretical background before reviewing the literature related to liner shipping market trends. In the methodology section, fuzzy AHP-TOPSIS hybrid method was explained. Finally, findings were discussed by comparing related literature and interpreted in terms of practitioners.

2 Theoretical background

2.1 Expected utility theory

Smith (1776) linked his 'labour theory of value' with the utility of some particular object [Tekin, (2016), p.88]. Expected utility was first suggested by Daniel Bernoulli in the 18th century and its axioms that used in economic theory were revealed by John Von Neumann and Oscar Morgenstern in the 20th century [Aksoy and Şahin, (2015), p.2]. Theoreticians handled the notion of 'utility' as subjective value felt as monetary outcomes [Kalinowski, (2020), p.40]. According to Bernoulli, in order for one of the options to be preferred, it is not the monetary value that will arise due to the realisation of the result, but the possible expected utility. John Von Neumann and Oscar Morgenstern formulated this idea of Bernoulli and turned it into theory by calculating the expected utilities of the decisions [Abaan, (1998), pp.125–126].

Expected utility was defined as the result obtained by multiplying the expected benefit from decisions made under uncertainty with the probability of the event occurring [Tekin, (2016), p.90]. For instance, assuming that an individual is torn between an alternative where he will definitely (100%) earn \$10, and a second alternative with a 50% probability of earning \$1 and a 50% probability of gaining \$25; the benefits of these alternatives can be measured by calculating their 'expected utility', which is the weighted sum of the possible returns of both alternatives. That is, while the first alternative will provide a benefit of $1 \times U(\$10) = \$10$; the second alternative would yield a utility of $0.5 \times U(\$1) + 0.5 \times U(\$25) = \$13$. In this case (as predicted by the expected utility theory), the decision maker who always makes rational choices will choose the second alternative that gives him \$3 more utility [Howard, (1965), p.83; Karabulut, (2013), p.5519]. In this study, weights of processes that will shape future of maritime transport in terms of their impact area were included rather than likelihood to occur. In this way, the expected benefit of these trends in the transport market for the companies has been tried to be calculated.

Decision making process based on expected utility theory has six core characteristics that are: 'ranking of alternatives (alternatives should be ordered according to their importance level)', 'dominance (most dominant or superior alternatives should be preferred)', 'cancellation (If the amount of risk between the two decision options is equal, the common points between the alternatives should be excluded)', 'transitivity (if someone prefers A to B and prefers B to C, he should also prefer A to C)', 'continuity (if the probability of winning the option with the highest payoff is good enough, that option should be preferred to a sure but moderately rewarding outcome)', and 'immutability (no matter how the problem is presented, the decision will not change according to the immutability principle)' [Tomak, (2009), p.149]. In this regard, this theory with its assumptions on decision making process is considerably coherent with multi-criteria decision making methods to solve multidimensional problems.

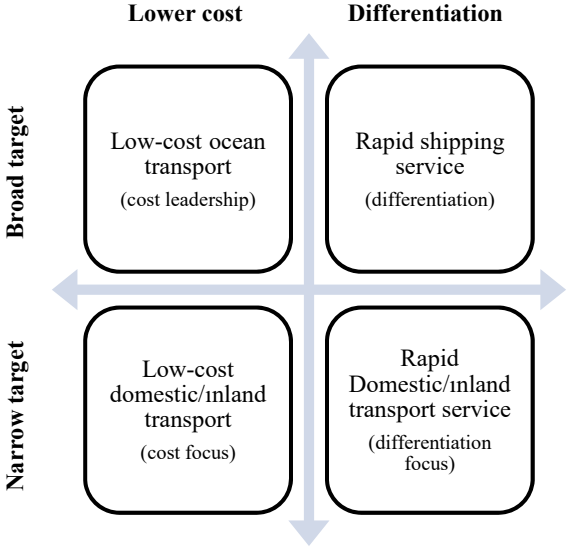
Expected utility theory focused on risk aversion as much as it aims at maximising profit [Schoemaker, (1982), p.532]. Expected utility theory also focused on behaviours of individuals under uncertainty and assumes individuals as homo economicus that behave rationale while making decisions [Tomak, 2009; Karabulut, (2013), p.5519]. In this study, maritime transport companies' point of view on trends in transport market which shape future of supply chain was investigated in the context of expected utility. However, each trend was not handled as an alternative, instead trends and their expected utilities

were thought as criteria. In other words, it was tried to determine impact levels of trends on the future of transport market by considering their expected utilities.

2.2 Competitive advantage

Thanks to Porter (1980, 1985), 'competitiveness' became the focus of strategic management instead of 'strategic planning' which is former prevalent view [Barca, (2005), p.13]. Competitive advantage theory relies on firms' positioning themselves in the market vis-à-vis level of competition [Sarvan et al., (2003), p.80]. According to Porter (1980), firms can competitive advantage by implementing either cost leadership strategies that aim increase in costs and protect market levels in sale price or product (or service) differentiation strategies that aim presenting different services from competitors and pricing over market levels. Moreover, theoretician suggested that firms can implement one of these strategies in niche markets by focusing or in broad markets [Barca, (2005), p.13]. Porter (1985) based the firm's competitive advantage on being more profitable than its competitors. In this respect, the competitive advantage theory coincides with the expected utility theory in terms of the value unit it deals with.

Figure 1 Generic strategies of liner shipping companies



Source: Adapted from Porter (1985)

In short, 'positioning' itself of a firm may determine its profitability level vis-à-vis market average. Firms can take a position in the market with such generic strategies as low cost, differentiation, cost focus, and differentiation focus. The market structure that a firm operates determines which generic strategy makes firms more profitable by overcoming five forces (competition level, potential of new entrants, power of suppliers, power of customers, threat of substitute products) found in the market [Porter, (1985), p.11]. In the light of this theory, generic strategies that liner shipping companies can enable to gain competitive advantage and to obtain a position that will increase their profitability in their own market were modelled and shown in Figure 1. Liner shipping

companies can be cost-effective while their ships are navigating between ports by accurate fleet deployment, energy-efficiency approaches, route optimisation, etc. On the other hand, while there are many services (reliable service, rapid service, service variety, etc.) that companies can differentiate from their competitors in this market, 'rapid service', among which many instruments can be used in service differentiation, has been preferred. For example, companies in this market can provide more rapid service than their competitors by navigating faster, visiting fewer ports, creating a more optimal route, using channel crossings, etc. While determining on which strategies are often used by liner shipping companies, preparatory work was made with representatives of these companies who introduced in Table 4.

3 Literature review

The literature review has two vital missions in the studies:

1 developing a background for empirical study

2 existing as a stand-alone piece (Templier and Paré, 2015).

Background reviews are used to determine the study's design, identify the gap in the literature that the study fills, and establish the theoretical context (Levy and Ellis, 2006). On the other hand, stand-alone reviews effort to interpret existing literature by combining, explicating, explaining, or integrating the existing research (Rousseau et al., 2008). Ideally, a systematic literature review can be conducted before empirical research, and a background review can be used as a subset of the literature from the systematic review. In this sense, good stand-alone reviews may make the development of the quality of background reviews possible. In this study, a background review was conducted to decide on the research design and to determine the criteria of the research model, while a stand-alone review was generated to interpret the aspects of the relevant studies in the literature for strengthening discussion of the study.

A traditional literature review method was employed. First, the Scopus database was chosen due to its ability to access a broader range of top-ranking journals. Second, a search was conducted using the following search string: TITLE-ABS-KEY (liner shipping*) AND TITLE-ABS-KEY (future*) AND TITLE-ABS-KEY (trend*). A search was also limited to the papers published in the years from 2017 to 2022 to reach contemporary trends which are prevalent at present and in the future. Such a limitation was made in order not to include outdated trends in the research model and to reflect the expected utilities of current trends. As a result of searching, 22 articles were determined. Third, the abstracts of each article were reviewed. It was indicated that three of them were irrelevant, so the remaining 19 articles were included in the literature review.

Drozhzhyn et al. (2021) investigated the emergence of liner shipping, compared different definitions of the authors according to their times, and interpreted the characteristics of liner shipping. The structure of the liner shipping market has an idiosyncrasy. While the market actors are in close competition on the one hand, on the other hand, they form alliances to use their capacity effectively. Chen et al. (2022) evaluated shipping alliances in the liner shipping market and emphasised their managerial, tactical, and strategic level objectives toward market trends.

Fleet deployment problem is a very popular topic in liner shipping market. Several studies developed various fleet deployment models. Wang and Meng (2017) introduced container fleet deployment models and evaluated factors that induce fleet deployment problems for container liner shipping companies. Christiansen et al. (2020) compared liner shipping network design methods in consideration of future trends in the market. Cheng and Wang (2021) also proposed a container shipping network optimisation model by considering shippers' inertia and non-inertia preferences. Blank sailing which is a strategy to cancel or skip a particular port or region by liner shipping companies emerged in the first months of the COVID-19 pandemic. For this reason, schedule reliability was questioned many times. Dulebenets et al. (2021) focused on vessel scheduling problems by considering environmental applications, collaborative agreements, uncertainties, etc.

Although route optimisation was evaluated under fleet deployment, new routes or solutions that optimise existing ones had been handled separately in the literature. Liu et al. (2021) compared Far East-Europe routes as the Arctic and Suez Canal-pass and concluded that the Arctic route is not economic for now and soon. Brouer et al. (2017) handled the whole liner shipping optimisation problems at the strategic, tactical, and operational levels by introducing their solving methods and applications. Rahmatdin et al. (2017) selected a specific research area and evaluated feeder services of liner shipping operators in Malaysia and proposed an optimum route in terms of service efficiency. Ports nowadays are connected with each other via invisible networks. Therefore, port networks are a very important determinant in determining routes, especially in liner shipping. Park et al. (2017) investigated the port network of Korean and Chinese ports, compared them in a manner of competitiveness, and revealed the factors that affect the characteristics of new routes for liner shipping companies.

Sustainable approaches have been studied most often in every field especially since 2000s. Vejvar et al. (2020) reviewed literature related to the liner shipping market's sustainability and found that the economic dimension of sustainability was still approached more particularly than other such dimensions as social and environmental. On the other hand, environmentally friendly regulations by IMO for ships is getting stricter and it seems that liner shipping market will be profoundly affected from decarbonisation strategies even in the future. Zhao et al. (2021) presented an optimisation model to transform the ship fleet with sulphur emission reduction technologies. In the social dimension of the sustainability, safety management in maritime transport is a popular issue in the related literature. Tong et al. (2022) investigated which factors affect occurring future accidents in the context of safety management. The resilience to be shown after the accident is as important as learning the causes of the accidents. Wan et al. (2021) evaluated resilience strategies that may be applicable in the liner shipping networks and found that different resilience strategies are effective in different network regions.

Profitability is a primary objective of the whole companies as liner shipping companies aim. Authors focused on different business processes to increase profits. Zhen et al. (2017) developed a non-myopic model for container booking of liner shipping companies by increasing information networks to increase their profits. Pricing strategy is one of the main instruments of liner shipping companies to be more profitable due to the characteristic of the market that they serve. Meng et al. (2019) evaluated capacity control and dynamic pricing methods for revenue management in the container liner shipping industry and concluded that revenue can be managed by forecasting demand, customer

behaviour, and focusing on dynamic processes. At the same time, forecasting container flow in different regions is critical to arranging capacity. Panahi et al. (2017) proposed a mathematical model to forecast the throughput capacity of selected Iranian ports. The liner shipping market is a pioneer in maritime transportation, innovative solutions to increase optimisation are experienced here first. With the 4th Industrial Revolution, business processes in every sector have been digitalised. Shin and Shin (2022) analysed the role of the organisational structure of liner shipping companies on the awareness and utilisation level of digital technologies. They stated that cloud server technology, internet of things (IoT), blockchain, and big data analytics can be forecasted to be core technologies in maritime networks. Recent innovative solutions aimed at increasing both economic profitability and environmental sustainability. Liang et al. (2021) revealed the economic, environmental, and managerial benefits of foldable containers in terms of empty container management. Shostak and Kisarova (2018) proposed a tool for minimising ships' fuel consumption. They also forecasted a decrease in fuel consumption by using a kite on ships. Even these approaches highlight the impact of decarbonisation regulations on future shipping trends.

Lam and Gu (2013) proposed that supply chain integration should be on the agenda of liner shipping companies. Yeun and Choi (2011) justified that ports can enhance their competitiveness by constructing logistics networks along the hinterland. Supply chain integration, which is so important even for the competitiveness of ports, is very important for liner companies as it means reaching their customers directly. Chen et al. (2022) proposed liner shipping companies to form alliances with ports and shippers, this can only be possible with supply chain integration. One of the strategies that Shin and Shin (2022) recommend for liner shipping companies to increase their competitiveness while meeting Industry 4.0 trends was to connect with intralogistics networks.

4 Methodology

This study combined a comprehensive literature review and a fuzzy AHP-TOPSIS hybrid method application. In this study, an analysis was carried out on the trends obtained as a result of a detailed literature review and the strategies reached as a result of semi-structured interviews. The fuzzy AHP and fuzzy TOPSIS methods were preferred due to working conformably with each other in terms of prioritising and ranking criteria and alternatives. Since perception measurement was made within the scope of the study, there was a need to quantify qualitative expressions instead of using real numbers. For this reason, it was decided to use multi-criteria decision making techniques that are experts in quantifying qualitative expressions. Fuzziness and vagueness often happen while solving composite decision making problem by comparing the status of some activities in a problem (Kim et al., 2022). For this reason, it is preferred to use the integrated forms of multi-criteria decision making methods with fuzzy numbers to help better decision making. Fuzzy AHP which is one of these techniques is useful to rank and prioritise criteria to decide on prior ones. Fuzzy numbers were used to harmonise uncertainties, inconsistencies, and subjective evaluations of decision-makers (Demirel et al., 2018). Fuzzy AHP is a widely used and accepted technique due to its characteristic that allows the incorporation of many different research areas, such as port selection, location selection, personnel selection, safety, security and competitiveness (Baştuğ et al., 2022; Li et al., 2020; Mollaoğlu et al., 2019; Balci et al., 2018; Celik and Akyuz, 2018;

Tseng and Cullinane, 2018; Lirn et al., 2015; Nazemzadeh and Vanelslander, 2015). In this study, Fuzzy AHP proposed by Buckley (1985) was used and this method has five main steps: pairwise comparison matrices; consistency ratio calculations for each expert; triangular fuzzy numbers; constructing fuzzy matrices; calculating fuzzy weights; defuzzification (Gumus et al., 2013).

4.1 Fuzzy AHP application steps

Step 1 Pairwise comparison matrices

Pairwise comparisons of experts on criteria were transformed into the matrices.

Step 2 consistency ratio calculation of each expert

The consistency ratios of the matrices were calculated, and each ratio should be less than 0.10. If any consistency ratio related to any comparison matrix is higher than the 0.10 value, then the questionnaire form based on pairwise comparison will be re-evaluated by the relevant expert. The consistency ratio can be calculated using equation (1). The consistency rates of each expert evaluation were shown in Table 4.

$$CI = \frac{(\lambda_{\max} - n)}{(n-1)} \tag{1}$$

n refers to number of criteria.

Table 1 Triangular fuzzy numbers

Real numbers	*Linguistic variables*	*Triangular fuzzy numbers*	*Reverse triangular fuzzy numbers*
1	Equal importance	(1, 1, 1)	(1, 1, 1)
3	Moderate importance	(2, 3, 4)	(1/4, 1/3, 1/2)
5	Strong importance	(4, 5, 6)	(1/6, 1/5, 1/4)
7	Very strong importance	(6, 7, 8)	(1/8, 1/7, 1/6)
9	Extreme importance	(8, 9, 9)	(1/9, 1/9, 1/8)

Table 2 Alternatives' fuzzy scores and linguistic variables

Real numbers	*Linguistic variables*	*Triangular fuzzy numbers*
1	Absolutely poor	(0, 1, 2)
2	Very poor	(1, 2, 3)
3	Poor	(2, 3, 4)
4	Medium poor	(3, 4, 5)
5	Fair	(4, 5, 6)
6	Medium good	(5, 6, 7)
7	Good	(6, 7, 8)
8	Very good	(7, 8, 9)
9	Absolutely good	(8, 9, 9)

Step 3 Triangular fuzzy numbers

Pairwise comparisons were made between the whole criteria used in this study. Linguistic variables were assigned to each comparison level, as shown in Table 1. Table 2 also demonstrated the fuzzy scores and linguistic variables of alternatives (Jiang and Fan, 2002).

Step 4 Constructing fuzzy matrices and calculating fuzzy weights

The pairwise comparison matrices with fuzzy numbers were formed and aggregated the whole evaluations into one matrix by the help of geometric mean.

Step 5 Defuzzification

Finally, the fuzzy scores were converted into crisp numbers. There are many ways to do this. In this study, the authors used the centre of area (COA) method to reveal the best non-fuzzy performance (BNP) values of each criterion, using equation (2). The BNP values indicated that future trends in the liner shipping market may be prioritised.

$$BNP_i = \frac{\left[(u_i - l_i) + (m_i - l_i)\right]}{3} + l_i. \tag{2}$$

4.2 Fuzzy TOPSIS application steps

TOPSIS method was invented by Hwang and Yoon (1981) to help individuals to solve multi-criteria decision making problems. This method suggested that the nearest alternative to the positive ideal solution and accordingly, the farthest alternative to the negative ideal solution is the best alternative. The application steps of the TOPSIS method were demonstrated below:

Step 1 Decision matrix is normalised by the help of equation (3).

$$r_{ij} = \frac{w_{ij}}{\sqrt{\sum_{j=1}^{J} w_{ij}^2}},\ j = 1, 2, 3 \ldots, J, i = 1, 2, 3, \ldots, n \tag{3}$$

Step 2 The weights of each criterion (w_i) that were acquired from the results of the fuzzy AHP method are multiplied with a normalised decision matrix.

$$v_{ij} = w_i * r_{ij},\ j = 1, 2, 3, \ldots, J, i = 1, 2, 3, \ldots, n \tag{4}$$

Step 3 Fuzzy positive ideal solution (FPIS, A^*) and fuzzy negative ideal solution (FNIS, A^-) are determined as follows:

$$A^* = \left\{v_1^*, v_2^*, \ldots, v_n^*\right\} \textit{ maximum values} \tag{5}$$

$$A^- = \left\{v_1^-, v_2^-, \ldots, v_n^-\right\} \textit{ minimum values} \tag{6}$$

Step 4 The distance related to each alternative acquired by the help of FPIS d_i^* and FNIS d_i^- are calculated by equations (7) and (8).

$$d_i^* = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^*\right)^2}, \; j = 1, 2, \ldots, J \tag{7}$$

$$d_i^- = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^-\right)^2}, \; j = 1, 2, \ldots, J \tag{8}$$

Step 5 After Step 4, the closeness coefficient (CC_i) values related to each alternative are calculated by equation (9).

$$CC_i = \frac{d_i^-}{d_i^* + d_i^-}, \; i = 1, 2, \ldots, J \tag{9}$$

Step 6 The ranking of the alternatives is determined by comparing (CC_i) values.

5 Application

This study was designed to reveal future trends in liner shipping market of maritime industry. Moreover, it was tried to help liner shipping companies for determining the most suited strategy to stay competitive while adopting these trends. In this aspect, relevant literature was reviewed, and papers published in the years from 2017 to 2022 were evaluated. Thus, future trends in the market were coded in MAXQDA 2020 qualitative analysis programme. Semantically similar codes (trends) were revaluated. While finalising the codes, either the code giving a narrower meaning was placed inside the more comprehensive one, or a new code with the meaning of both similar codes was added. It was thought that each trend brings market specific utility. Accordingly, as a result of the literature review expected utility of each trend was inferred. In the detailed literature review, it has been determined that the mentioned trends are frequently used together with the words describing their expected utilities in Table 3. Accordingly, future trends in liner shipping market, its definitions, and expected utility of each trend were demonstrated in Table 3.

After determining future trends in the market, analyses were performed. First, survey form to obtain expert opinion was prepared. Future trends were included in the first section of the survey form. It was requested help from selected experts to compare trends with each other. Second, competitive strategies for liners shipping companies (demonstrated in Figure 1) were ranked in terms of adaptation level to future trends. For this purpose, adaptation levels of each strategy to each future trend were evaluated by selected experts. Experts were selected by their proficiency levels on this issue. So, they have worked in different liner shipping companies for at least ten years. They have at least bachelor degree and they are working at managerial position in different departments. It should be touched on an important point that the whole experts are working in the departments that are directly affected by market conditions and encounter future trends first which are operations, sales, and customer services. In the analysis, consistency index of each expert was calculated based on the evaluations. In the pairwise comparison step of the analysis consistency index of the evaluations made by experts should be under 0.10. In Table 4 that also contains title, educational background and experience levels of the experts, it was seen that consistency index belonging to each expert was calculated under 0.10 score.

Table 3 Future trends in liner shipping and expected utility of each trend

Future trends in liner shipping	*Definition*	*Expected utility*	*Reference(s)*
Fleet deployment	Fleet management by planning routes and schedules, or regulating ship speed	Optimising navigational costs and maximising occupancy rates	Liu et al. (2021), Zhao et al. (2021), Wang and Meng (2017), Cheng and Wang (2021), Panahi et al. (2017), Chen et al. (2022), Christiansen et al. (2020), Brouer et al. (2017), Meng et al. (2019), Park et al. (2017), Shin and Shin (2022), Dulebenets et al. (2021)
Safety management	Reducing the likelihood of future accidents	Increasing reliability of the operation just in case	Tong et al. (2022), Zhao et al. (2021), Wan et al. (2021), Dulebenets et al. (2021)
Empty container positioning	Routing empty containers to meet the need based upon imbalance in world trade	Removing waste of time due to lack of empty container	Zhen et al. (2017), Wang and Meng (2017), Cheng and Wang (2021), Liang et al. (2021), Brouer et al. (2017), Meng et al. (2019), Dulebenets et al. (2021)
Compliance with hub-and-spoke	Transferring containers from one hub port to another or transhipment of containers between hub and feeder ports	To gain more from economies of scale and economies of scope	Rahmatdin et al. (2017), Liu et al. (2021), Wang and Meng (2017), Cheng and Wang (2021), Chen et al. (2022), Christiansen et al. (2020), Brouer et al. (2017), Park et al. (2017)
Designing port network	Investing in terminal operations in hub locations	Managing terminals for effective operations	Vejvar et al. (2020), Rahmatdin et al. (2017), Liu et al. (2021), Wang and Meng (2017), Chen et al. (2022), Brouer et al. (2017), Park et al. (2017), Shin and Shin (2022)
Ship capacity increase	Increasing utilisation by enhancing fleet size or making an alliance	Avoiding the idle capacity cost and seizing the growing demand opportunities	Zhen et al. (2017), Liu et al. (2021), Wang and Meng (2017), Cheng and Wang (2021), Liang et al. (2021), Wan et al. (2021), Panahi et al. (2017), Chen et al. (2022), Christiansen et al. (2020), Brouer et al. (2017), Meng et al. (2019), Park et al. (2017), Shin and Shin (2022), Dulebenets et al. (2021)
Supply chain integration	Developing an internal transport network	Managing logistics processes in the hinterland	Vejvar et al. (2020), Rahmatdin et al. (2017), Chen et al. (2022), Park et al. (2017), Shin and Shin (2022), Dulebenets et al. (2021)
Freight stability	Keeping freight rates off from internal, external, or seasonal effects	Maintaining the client portfolio and increasing the viability of investments	Zhen et al. (2017), Zhao et al. (2021), Cheng and Wang (2021), Chen et al. (2022), Meng et al. (2019)
Digital transformation	Harmonisation of traditional services to the 4th Industrial Revolution by using blockchain, big data, IoT, AI, cloud servers, etc.	Optimising operations with the help of instant and cacheable data exchange	Chen et al. (2022), Shin and Shin (2022)
Decarbonisation race	Investing in alternative fuel technology to reduce substantially carbon emissions	To gain a competitive advantage by adapting to carbon emission reduction regulations faster	Vejvar et al. (2020), Liu et al. (2021), Zhao et al. (2021), Wang and Meng (2017), Cheng and Wang (2021), Liang et al. (2021), Panahi et al. (2017), Chen et al. (2022), Christiansen et al. (2020), Brouer et al. (2017), Shostak and Kisarova (2018), Dulebenets et al. (2021)

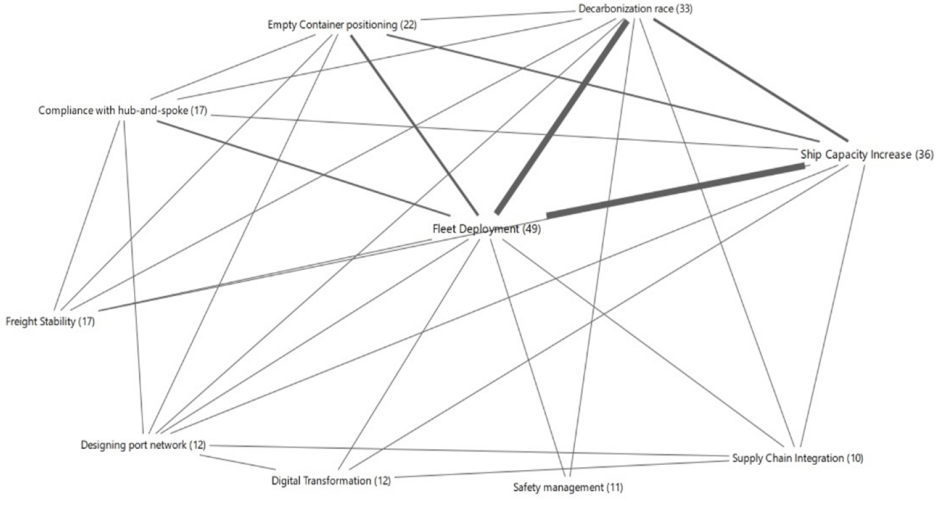
Table 4 Experts and its proficiency levels

Expert	*Title*	*Background*	*Experience*	*Consistency index*
Exp-1	Operations manager	Bachelor	10	0.04
Exp-2	Customer service manager	Bachelor	12	0.03
Exp-3	Operations manager	Bachelor	16	0.06
Exp-4	Operations manager	Bachelor	14	0.03
Exp-5	Operations manager	Bachelor	26	0.01
Exp-6	Operations manager	Bachelor	19	0.03
Exp-7	Sales manager	Bachelor	24	0.02
Exp-8	Sales manager	Bachelor	15	0.04

6 Findings

Every market has various trends in different time periods. Liner shipping market was seen as volatile market and quite sensitive to trends. In this study, future trends in liner shipping market were pointed out by the help of literature. While reviewing literature, detected trends were coded in the MAXQDA 2020 qualitative analysis programme. Thus, the frequency of trends in the literature and interrelationship with each other of trends were analysed in the programme. Accordingly, the criteria that were co-coded at least ten times were visualised in Figure 2.

Figure 2 Code co-occurrence model of future trends in liner shipping



As demonstrated in Figure 2, 'fleet deployment' was codded 49 times and became the most codded future trend in the related literature. 'Ship capacity increase' with 36 times and 'decarbonisation race' with 33 times were hard on the heels of 'fleet deployment'. The whole criteria were codded at least ten times and this situation shows that valid future trends were detected. It was also observed that 'fleet deployment', 'ship capacity

increase', and 'decarbonisation race' have quite strong relationship with each other. This shows that these trends were codded together many times. 'Empty container positioning' also has slightly strong relationship with 'fleet deployment' and 'ship capacity increase'. Similarly, 'compliance with hub-and-spoke' and 'fleet deployment' have slightly strong relationship with each other. Finally, the whole future trends in liner shipping market have relationship each other and they have potential to affect each other.

After the pairwise comparisons between trends were made by experts, weights of the criteria were obtained (seen in Table 5). As a result of the evaluations, it was found that digital transformation has the highest weight score by 0.241. Decarbonisation race of liner shipping companies and supply chain integration of them were separated by hair and they have the second and third highest weight scores by 0.149 and 0.147 accordingly. On the other hand, safety management has the lowest weight score among others. These weight scores which were demonstrated in Table 5 as BNP underpinned to make choice among alternatives in the next step.

Table 5 Fuzzy AHP weights of future trends

	Criteria	*Fuzzy weight*	*BNP*
C1	Fleet deployment	(0.061, 0.061, 0.063)	0.062
C2	Safety management	(0.036, 0.036, 0.038)	0.037
C3	Empty container positioning	(0.112, 0.115, 0.119)	0.116
C4	Compliance with hub-and-spoke	(0.047, 0.047, 0.049)	0.048
C5	Designing port network	(0.050, 0.049, 0.050)	0.049
C6	Ship capacity increase	(0.078, 0.081, 0.085)	0.081
C7	Supply chain integration	(0.144, 0.146, 0.149)	0.147
C8	Freight stability	(0.073, 0.071, 0.070)	0.071
C9	Digital transformation	(0.246, 0.243, 0.233)	0.241
C10	Decarbonisation race	(0.153, 0.150, 0.144)	0.149

Finally, in this step, competitive advantage strategies that can be adopted by liner shipping companies were ranked by selected experts according to conformity level of these strategies to future market trends. For this purpose, the closeness coefficient (CC) scores of each strategy were brought out (see in Table 6) and these strategies were ranked in regard to CC score. 'Rapid shipping service' which proposes faster transport service between ports has the highest CC score and ranked as first competitive advantageous strategy. While 'low-cost ocean transport' has the second highest CC score, on the other hand, 'rapid domestic/inland transport service' and 'low-cost domestic/inland transport' which are related to access to hinterland were ranked as third and fourth strategies accordingly.

Table 6 The fuzzy analysis of the 'CC' scores of alternatives

Strategy	*d+*	*d–*	*CC*	*Rank*
Low-cost ocean transport	0.647	0.745	0.535	2
Rapid shipping service	0.477	0.944	0.664	1
Low-cost domestic/inland transport	0.939	0.438	0.318	4
Rapid domestic/inland transport service	0.714	0.716	0.500	3

7 Discussion

In this first phase of this study, liner shipping market trends were coded by reviewing literature. As a result of the code co-occurrence analysis of market trends, it was revealed that fleet deployment has the highest frequency in the literature. Fleet deployment problem has been frequently studied and several models to solve the problem were brought out. However, fleet deployment issue cannot be recent trend, this topic has been popular for a long time. But then, trends which are ship capacity increase and decarbonisation race have been frequently studied. These issues are recently popular topics for related literature over the past decade.

On the other hand, market trends such as digital transformation, decarbonisation race, and supply chain integration were illustrated by liner shipping company professionals. Particularly, issues that are digital transformation and supply chain integration should firstly be defined, because these are brand new topics for liner shipping literature. So, it is ordinary that these brand new topics are appeared in related literature less frequently. Thus, difference between perceptions of practitioners and theoreticians has been due to time spans covered by some trends are different from each other.

In the literature, the most of the studies studied onto develop model to solve fleet deployment problem. Some of them studied on measures against environmental contaminants. Finally, some of the studies placed in related literature focused on the strategies to increase profitability of liner shipping companies. Unlike, Wan et al. (2021) handled such trends as environmental concerns and economic upheaval as a risk element by adding terrorism on among these trends. They tried to develop strategies for liner shipping networks to inhibit being dangerous of these risks in the context of resilience. Chen et al. (2022) evaluated alliances in liner shipping market by reviewing related literature. They handled recent trends as research topics and correlated among the studies in terms of research design and models. They expected that diversification and flexibility of cooperation modes, intelligent operations, multi-objective optimisation, environmental protection and a sound supervision mechanism are future research topics in the literature related to alliances in liner shipping management. Apart from literature, this study concentrated on liner shipping market trends and their expected utilities.

The expected utility theory, which is generally used in economic studies in the literature, was used in this study to explain the implications of market trends. Thus, the reflections of these trends in the liner shipping market were better explained. Moreover, this study tried to determine competitive advantage strategies for liner shipping companies to overcome market forces. It was made use of Porter's generic competitive advantage strategies, while determining strategies for liner shipping companies to yield from market trends. This generic strategies were rendered to become specific to liner shipping companies by conducting pre-interviews with sectoral representatives. In this manner, this study is an original study that defined market trends along with its utilities and tried to determine the most appropriate strategy in terms of conformity level to market trends to gain competitive advantage.

8 Conclusions

Recently, liner shipping market is the most profitable market in the maritime transport industry due to the basic reasons such as spread of containerisation, correct price policy, cost effectiveness by blank sailings, etc. However, various market forces threaten companies and these forces have transformed into trends. This study tried to reveal competitive advantage strategies to overcome these forces and to make liner shipping companies catch the trends of the market. For this purpose, market trends were found out by reviewing literature and competitive advantage strategies of Porter (1985) were adapted for liner shipping companies by analysing contemporary services of these companies. Then, market trends were weighted and competitive advantage strategies were ranked in terms of conformity levels to these trends. Thus, the most appropriate strategy has been tried to reveal for liner shipping companies to attune to market trends according to selected experts.

According to the results, the market trends such as digital transformation, decarbonisation race, and supply chain integration were seen by liner shipping company professionals as the most prominent trends. It was seen that COVID-19 pandemic and its effects are highly effective on the evaluations of the experts. COVID-19 accelerated digital processes due to especially remote teleworking and touchless working principals. So, digital transformation was perceived as the most urgent trend to be fulfilled by the experts. Although, maritime transport is known as the most environmentally friendly transport mode, EU policy on emission reduction and correspondingly IMO regulations force companies to generate a solution for decarbonisation. Further to that, executions such as 'Climate Pledge' which forces companies transporting Amazon products to become carbon free until 2040 that is ten years earlier than IMO projection, also increase the urgency of decarbonisation for liner shipping companies. Recently, liner shipping companies provide inland transport service via third party logistics service providers. However, liner shipping companies began to provide this service by themselves with COVID-19 pandemic by acquiring logistics companies. Particularly, profitability of liner shipping companies triggered by increased freight rates and cost effectiveness with COVID-19 and blank sailings, and port congestions originated from truck driver shortage had driven companies to be directly integrated into and control supply chain.

Finally, the best strategy catching the market trends for liner shipping companies to become more competitive advantageous was tried to be determined. Rapid shipping service strategy was determined as the strategy has the highest conformity level to the trends. Recent developments such as high freight rates, port congestions and first come first served rule, decreasing port charges based on decreased port calls due to blank sailing, descending the share of fuel price in total expenses, etc. might have directed the experts to feature becoming more faster of box ships between ports. Additionally, experts partially ignored the strategies onto access to hinterland. According to experts, liner shipping companies should consider strategies related to transportation between ports rather than inland access solutions to fulfil requirements of market trends.

This study puts liner shipping market trends in theoretical basis. Market trends were defined in terms of expected utility theory. This theory describes an economic problem on how to make optimal decisions when coming up against an uncertainty in a mathematical model (Jia et al., 2020). This economic theory was used in this study to explain the reflections of market trends on liner shipping companies. These trends were

tried to be expressed along with the strategies that companies should develop to fulfil requirements of the trends in terms of competitive advantage theory. Generic competitive advantage strategies were used as alternatives for making decision on which one is best fitted strategy for liner shipping companies to yield from market trends. Beyond that theoretical contribution, this study also gives practitioners suggestions on catching the trends. Each trend with its practical expected utility was defined. Besides, the most competitive advantageous strategies tried to be developed. For the further studies, relationships of liner shipping market trends can be analysed, alternatives may be based upon different competitive advantage theories, the experts can be selected among customers of liner shipping companies, and different MCDM methods may be employed in the analysis.

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