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Siti Salma Norman[1], and Mohamad Rosni Othman[2]*

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REVIVING THE KLANG VALLEY ECONOMY DURING PANDEMIC THROUGH DIGITALISATION OF THE MARITIME LOGISTICS INDUSTRY

SITI SALMA NORMAN[1], AND MOHAMAD ROSNI OTHMAN[2*]

[1] Faculty of Maritime Studies, Universiti Malaysia Terengganu, Kuala Nerus, Malaysia. [2] Malaysian Maritime Logistics and Transport Centre (MALTRAC), Universiti Malaysia Terengganu, Malaysia. Kuala Nerus, Malaysia.

**Corresponding Author: rosni@umt.edu.my*

Abstract: The maritime logistics industry is an international business ecosystem and backbone of Malaysia's economic development. Due to the COVID-19 pandemic, we have witnessed a drastic decline of industries all over the world, which may take a very long time to recover. This paper discusses the digital transformation of the maritime logistics industry based in the Klang Valley of Peninsular Malaysia as a strategic plan to improve existing business processes and make it resilient in face of the challenges brought on by the pandemic. We evaluated the digitalisation practices of maritime logistics companies to identify enablers that can help restore the economy as the industry tries to move on under the shadow of COVID-19. The Fuzzy Delphi (FD) method is used to collect and analyse data based on the response of 18 experts with more than five years of industry experience. A total of 15 key enablers were determined and ranked in terms of priority, with the top three being changes in the long-term industry growth rate, marketing innovation and implementation of digital platforms. These key enablers may then be used to develop good strategies to enhance competitiveness and build the resilience of this sector against the disruptions brought on by the pandemic.

Keywords: Maritime logistics, digitalisation, COVID-19 pandemic, competitiveness, Fuzzy Delphi.

Introduction

In this era of COVID-19 pandemic, many industries are experiencing a downturn due to operating challenges caused by the implementation of laws and social restrictions to curb the spread of the fatal disease. As the most important industry in the world supply chain, maritime logistics has also been critically affected. Starting from the implementation of the first Movement Control Order (MCO) in March 2020, followed by the volatile waves of infection in the past two years and low crude oil prices, the maritime business and supply chain has been facing many disruptions; making the business climate challenging and affecting the nation's economic development and social well-being. Many orders of industrial supplies had to be cancelled or could not be delivered on time due to shipping interruptions caused by port loading and unloading delays and congestion as workers are forced to comply with the new normal. Shipping firms face enormous cost overruns because of the lack of freight or vacant ships. Operating costs, such as late penalty charges, loan payments and crew cost; all these have impacted the cash flow of many logistics companies.

The first half of 2020 witnessed the beginning of the MCO in Malaysia, with stay-home orders, travel bans and restrictions imposed on social life. These have led to increased unemployment, government bailouts and decline in the nation's economy. The second half of the year was quite unexpected, but it was agreed that Gross Domestic Product (GDP)

would decline by one figure over the whole year, and that lockdowns would be relaxed as infections declined. Almost all companies worldwide have started developing strategic working plans and specific committees to comply with restrictions imposed by their respective governments. Companies have to undergo operating, organisational and regulatory changes, which has made it difficult for employees to work. Therefore, a comprehensive strategy is necessary to ensure that the workplace can operate again, with workers going back to their routines by working from home. This study aims to evaluate the digitalisation practices among maritime logistics companies in the Klang Valley in Selangor, Malaysia. This evaluation is important to ensure the effectiveness of digitalisation in enhancing the maritime logistics sector, whose role has become much more critical during the pandemic.

Since the pandemic began, the maritime logistics industry has experienced a slowdown. Malaysia, as a maritime nation, has been severely affected since its economy is strongly dependent on imports and exports. The local shipbuilding industry has yet to recover and major projects are being reduced, especially in the upstream sector (Bernama, 2020).

The pandemic has affected maritime transport operations and developments in the supply chain and trade ecosystem. Thus, greater technological utilisation while considering the digital divide is important (UNCTAD, 2020). Therefore, this study also explores the potential of digitalisation in enhancing industry competitiveness and resilience. The research investigated the maritime logistics business based on problems that occurred, and what kind of digitalisation framework may be applied, and how far digitalisation instruments can help boost the industry.

This research paper will reveal problems related to the maritime logistics industry amidst the COVID-19 outbreak and determine several digitalisation instruments that may be applied in the industry, besides exploring the effectiveness of the instruments.

We highlight the importance of digitalisation for maritime logistics industry players to survive and revive their business level amid the pandemic. The companies should be encouraged to adapt instruments such as the block chain system, which has been used by large companies in the maritime cluster (Othman, 2011). This is very important to sustain the main economic centre of the country's maritime logistics sector in this disruptive era.

Literature Review

As a key factor in economic growth and social security, the international economy is in fact dependent on the significant expansion of logistics (Jahn *et al.*, 2017). The logistics system is meant to store and transport goods in an efficient, convenient and effective manner; an arrangement, coordination and monitoring of procedures from point to point to comply with customer requirements, including inbound, outbound, internal and external cargoes (CSCMP, 2016). It involves the coordination of production and supply of a product or service to guarantee efficient and successful management.

Maritime logistics is the transportation of cargo using multimodal modes of transport by sea, air and land. Freight transportation by water is widely utilised in bulk due to lower cost. Even though the maritime logistics chain looks like a simple system, many do not know that the industry actually involves the use of multiple languages, connections and institutions. And because of these, the process of communicating, documenting and approving a shipment is typically slowed down. A lot of paperwork is involved to carry out a transactional delivery, such as Bills of Lading (BL), Purchase Orders (P/O),

commercial invoices, goods declaration, and other certifications needed based on the particular freight. Therefore, the delay caused by paperwork may trickle down to shipping and container operations in ports.

Originating from Wuhan, China, in December 2019, COVID-19 has spread rapidly across the world. The Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) has been identified as the pathogen by the International Committee on Taxonomy of Viruses (ICTV) (Yew *et al.,* 2020). This fatal pandemic is threatening global health and trade, besides destabilising development in the entire world. However, despite these difficulties, maritime logistics is still essential and needs to operate with new Standard Operating Procedures (SOP). Good logistics planning has become all the more important, especially to ensure delivery of food and medical supplies, as certain modes of transport become restricted.

Figure 1 shows the development output of global maritime trade from 2006 to 2020 by the United Nations Conference on Trade and Development (UNCTAD). It shows a massive decline from 2017 before falling into a recession in 2020, which is when the pandemic.

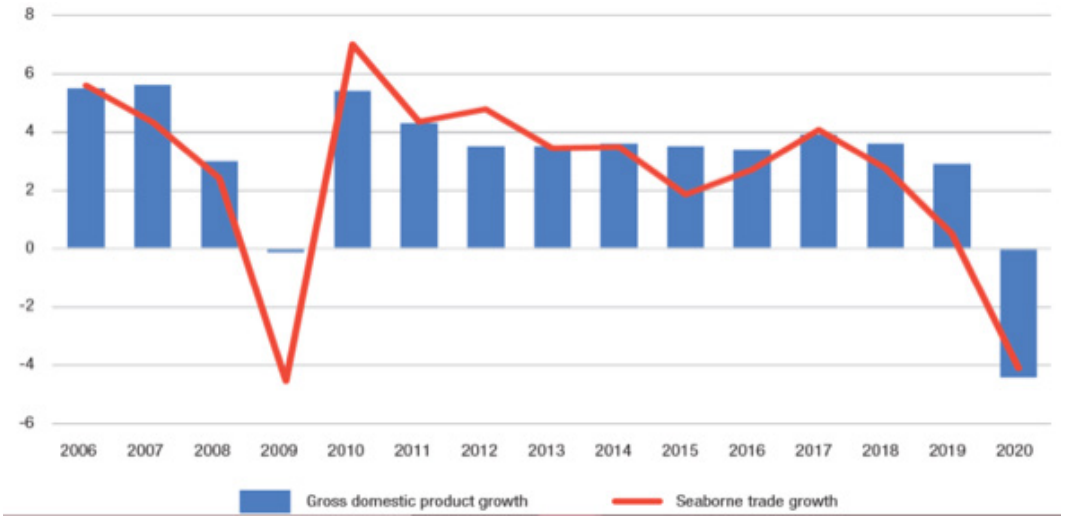

Figure 1: Development of international maritime trade and global output, 2006–2020 (UNCTAD, 2020)

In an effort to curb the pandemic, the government has implemented various SOP in everyday life. Due to this, many industry players have been affected by extra expenses, such as detention and demurrage charges and also repositioning costs (Yew *et al.,* 2020). The maritime logistics industry is one of the crucial sectors in which the flow of commerce could not afford to be severely disrupted. The industry must be flexible to adapt to the new norm, which is very crucial and needs to be implemented accordingly. Logistics industry players need to enhance their abilities in terms of preparedness, detection, characterisation, response and support to restore societal order. With this, there is a need for maritime logistics companies to start incorporating advanced technologies in their operational ecosystem.

Industry competitiveness in the Klang Valley has few main driving forces, which have been used as a tool in this research.

Among them are changes in long-term industry growth rate; increasing globalisation; emerging new internet capabilities; changes in who buys the products/services and how they use it; production/services innovation, technological change and manufacturing/ service process innovation; marketing innovation; entry or exit of major firms; diffusion of technical know-how; changes in cost and efficiency; growing buyer/demand preferences for differentiated products/ services; reduction in uncertainty and business risks; regulatory influences and government policy changes; and, changing societal concern, attitudes and lifestyle. As stated in the Maritime Transport 2020 review, additional disruptions in supply chains and the economy may be the result of new pandemic waves, resulting in a further deterioration of growth. The resilience to volatile catastrophes is likely to be poor owing to unequal resource flows that may impact the system's resilience, since volatile conditions can make comparing demand for resources with availability more challenging. Therefore, it is anticipated that the shift in preparation for disasters that is also affected by environmental stability may have an influence on resistance. The more volatile the environment gets, the less the logistics industry is able to react to interruptions, and the harder the system is to recover from interruptions. Thus, since the Klang Valley is one of the important maritime logistics industry hubs in the nation's economic development, then changes in the long-term industry growth rate may affect the industry's competitiveness.

As in the context of growing globalisation, several nations have increased interest in collecting value indicators. Logistics play an essential role in national competitiveness (Arvis *et al.,* 2018). It may assist the policies of national development programmes, as well as increasing a country's competitiveness (Ojala & Rantasila, 2012). Logistics companies have to adopt new competitive methods and technologies to increase the performance of supply chain systems as a result of increasing demand and globalisation. They may want to identify areas to improve and integrate these with new technologies for flexible and effective material flow and information (Woolven, 2001).

In this context, we may distinguish between two fundamental trends: the deepening processes of globalisation and the primacy of creative economic development. It is exceedingly difficult to carry out a successful business in the setting of globalised socioeconomic processes (Prokopenko & Kochubei, 2021). A universal system or standardisation of the electronic data interchange is crucial for industry stakeholders in the transmission, reception and response to all information required on arrival, residence and departure of ships, persons and goods by the logistics companies.

New digital technologies, such as block chain, artificial intelligence, the Internet of Things (IoT), big data analysis, autonomous drones, competitive landscapes and customer expectations have evolved in transportation (Verhoef *et al.,* 2019). To be competitive, the services provided by the company need to become flexible and inexpensive (Raza *et al.,* 2020). Shipping firms must adapt to demands of customers and provide adequate transport to ensure the most effective operation of their ships (Plomaritou, Plo-maritou, & Giziakis, 2011). Digital skills and skilled workers, which the demand for is anticipated to intensify in future as new technologies develop, may be an issue for shipping. Sufficient human resources are required for further development and implementation of technology within the maritime industry through cooperation between universities and the private sector in knowledge investment, new research and training

programmes (Jovi *et al.,* 2020; Koga, 2015). By implementing digitalisation ecosystem/ tools with the emerging new internet capabilities, maritime logistics companies in the Klang Valley can improve their capabilities amidst the COVID-19 outbreak.

Maritime logistics businesses need to start and progress to Supply Chain 4.0 in order to stay competitive, productive and relevant. Digitalisation in the maritime logistics sector must be extended to encompass beyond internal software and wall data storage, with the whole maritime logistics industry in mutual collaboration. When enterprises deal effectively with drivers, deployment of maritime logistics 4.0 may improve the performance of individual enterprises, as well as the entire sector. For example, the collective interchange of real–time information through Supply Chain 4.0 is an excellent solution to the problem while tracking fast changes in client preferences (Imran & Gamal, 2021). Thus, rapid-changing and scenario planning for changes in who buys the services/products and how they use it is important, which are affecting the logistics industry and companies' competitiveness.

Given that a country's level of technological readiness and innovation potential form the basis for improved logistical effectiveness, it can be pointed out that those with high technological advances and innovation capacities are more likely to achieve a digital transformation. Vice versa, as Industry 4.0 development depends on logistical efficiency and intelligent provision in accordance with the correct time, quality and location requirements, it may be noted that IT investitures and innovations are essential to enable Logistics 4.0. In the courier business, for instance, there is the development of digital innovation to track consignments. FedEx Corporation in the United States was the first to deploy a digital management system comprising very early prototypes of portable computers that could scan bar codes to give customers real–time tracking of their consignments in 1979 (Baldwin, 2013). Thus, production innovation, such as digitalisation of documentation and booking processes, e–business tools and equipment online connectivity have risen as a key solution to increasing industry resilience by securing business continuity during a crisis.

Technological changes and manufacturing innovation may greatly decrease the costs of shipyards and shipping companies. The adaptation of cloud services/ servers/block change platforms to manage fleet data and centralised procedures in freight procurement can increase the competitiveness of the industry.

For the continuation and survival of partners in the sector, the exploration and development of long-term connections among maritime logistics players is a fundamental idea in relation to marketing paradigm (Osobajo *et al.*, 2021). Marketing awareness is still a growing business concept for shipping firms to expand their client base and future success. The plan for change is to engage employees/marketing managers to develop and implement strategies that highlight a multidisciplinary group and new skills. The necessity for collaborations with higher-learning institutions, particularly for modern start-ups in the industry, is certainly important (Šekularac Ivošević, 2021). Thus, marketing innovation is important for the sustainability of this industry.

New operators may try to service established shipping routes or lines. The issues that these operators face is not heavy regulations or mono-political administration, but obstacles to efficient competition. The admission and departure of freight transport do not appear to be necessary since regulatory hurdles are not present and there is a lack of natural monopolies in this kind of business (Llanto & Navarro, 2012). The structure of the market is governed by individual producers,

the logistics company's entry, and departure (exit) actions. Entering concept is the long-term process of entering the industry or business by marine logistics firms if the industrial profit is higher. The Exit concept is the long-term process of decreasing output and closing marine logistics businesses in reaction to the losses of the industry. Thus, the entry or exit of major firms in the maritime logistics industry is important. These decisions are influenced by future profit expectations, which depend on the nature of market competition.

The capacity of a company to turn ideas, experiences and know-how into new processes, technologies, systems and products may be seen as an innovative ability. To achieve this, it is necessary for the innovation process in the company to be properly linked with its vision and strategy (Michele Acciaro & Christa Sys, 2020). Thus, technical expertises like using 3D printing and additive engineering (3DP) in replacement parts generation may help reduce delivery times, increase parts availability, simplify procurement processes, reduce stock inventory and transportation costs, and reduce port fees by cutting maintenance delays.

The derived need for shipping evolves from the requirement to own commodities to an integrated demand for the ownership of value-added goods in time, reliability, and cost-effectiveness (Panayides, 2006). Transport expenditures are also rising as better service quality is required, particularly for increased reliability and just-in-time deliveries. As a result, the inventory component decreases within the total logistics costs while the transportation component increases. The implementation of digital logistics platforms may enhance work procedures of maritime logistics companies in the Klang Valley by connecting shippers with other carriers and freight forwarders. Giaglis *et al.* (2002) continues to argue that markets offer buyer demand information to vendors, and that the latter provides sellers with economic input to meet expected requirements. While sellers are largely determined by market signs, intermediaries can support sellers by keeping them closer to the purchaser, receiving and interpreting the market signals and alerting sellers to changes (Dagman & Landstrom, 2004). Thus, growing demand preferences for differentiated services/products instead of standardised services/products, such as an autonomous vehicles and robotics; virtual, augmented, and mixed reality; the IoT; and, digital security (bloc change) may be used as value-added services by maritime logistics companies in the Klang Valley to ensure business sustainability.

Uncertainty, the capital intensity and risks of investing in ports and ships have caused the maritime logistics business to perform irregularly. While there is substantial scientific and management interest in the relative influence of corporate strategies and profitability, insights into contemporary strategy challenges remain restricted. Significant insecurity has been established with respect to price and costs, especially after the elimination of the conference system in liner shipping, which stimulates vertical integration to control transport prices and costs (Parola *et al.,* 2014). The Klang Valley is one of the areas with the highest COVID-19 cases due to its high population density. Thus, reducing uncertainties and business risks are the best strategic plans for the industry.

Globally, business transactions are strongly linked to government institutions. The most significant factor of these is the regulating authority. Another determinant for transboundary e-commerce is government or regulatory policy. The regulatory environment can play an essential role in influencing the performance of trade facilitation as stated by Wilson *et al.* (2003). The typical government regulatory institution's policy may contribute to inefficiency and bureaucracy. There are

different drivers of globalisation according to past studies. One is the internet, generally regarded as a driver of cultural and technical globalisation, which promotes market globalisation (Cho & Tansuhaj, 2013). Globalisation, especially e-commerce, is promoting increasing uniformity of different areas. Cross-border e-commerce may be preferred by consumers in more globalised nations because global systems, rules and legislation may reduce market uncertainty (Choa & Lee, 2017). Thus, the influences of government policies may bring positive impact on profitability growth of the industry.

Internet and mobile communications integration has led to changes in society that expose consumer behaviour (Yu, 2011). The setting and internal assumptions of customers, such as time and technology, have changed at sea by triggering distinct consumer behaviour patterns (Yu, 2011). In parallel with this expanding trend of online buying, marketing researchers have developed frameworks that allow practitioners to comprehend online consumption. There is, however, a host of elements in shaping internet consumers' behaviour, such as belief, attitude and lifestyle (Pavlou & Chai, 2002). Thus, changing societal concerns, attitudes and lifestyles is a driving factor for digitalisation practices among maritime logistics companies.

Methodology

The Delphi method, which is the best known qualitative, structured and indirect interaction futures method (Woudenberg, 1991), was used to solicit the opinion and judgment of industry experts. The method was originally a long-range method of aggregating the forecasts of experts on multidisciplinary issues (Dalkey, 1962). It was based on a structured process in collecting and synthesising knowledge from a group of experts by means of a series of questionnaires, accompanied by controlled opinion feedback, as shown in Figure 2 (Adler, 1996).

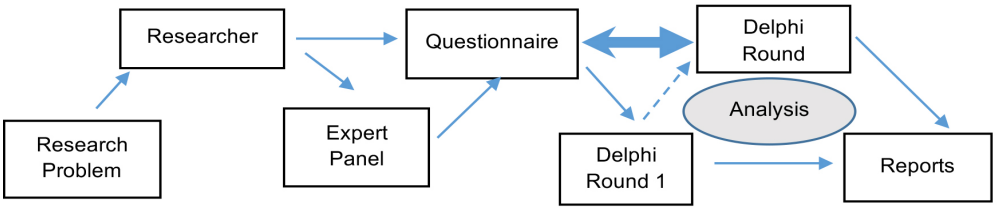

Figure 2: Research design using the Delphi method

Step 1: Research Problem

A research problem might be a statement about an area of concern, a condition to be improved, a difficulty to be eliminated, or a troubling question that existed in scholarly literature, in theory or practice that pointed to the need for meaningful understanding and deliberate investigation. Since the COVID-19 pandemic began, the maritime logistics industry had slowed down because of order delays and cancellations, especially by overseas customers. Thus, it directly affected the Malaysian economy since the country was strongly dependent on imports and exports. The pandemic had led industry players to adopt sustainable practices with focus on accelerated introduction of technologies and digitalisation. Therefore, greater technological utilisation while taking the digital divide into consideration was important. This meant encouraging attempts to step up the digital transition to increase sustainability of transport networks (UNCTAD, 2020).

Step 2: Determination and Formulation of Questions

Particular care was given to the choice and formulation of questions for the experts. They were as follows:

1. What were the problems that arose in the maritime logistics industry during the COVID-19 outbreak?

2. What kind of digitalisation framework could be applied for the country's maritime logistics industry?

3. How far could the digitalisation instruments help to boost the maritime logistics industry in the Klang Valley at the end of the pandemic?

Step 3: Selection of Experts

The panel experts had vast knowledge in the field and were prepared to commit to the study. There were 18 experts and all of them had more than five years of working experience, and were directly involved in maritime logistics, logistics, digitalisation and maritime technology fields.

Step 4: Formulation of First Questionnaire

The first questionnaire contained a reminder on the nature of the study.

Step 5: Analysis of Answers (Delphi Round 1)

The first round of answers were analysed to determine the influence of key factors (competition, location, connection, government, and chance) on the strength of the industry.

Step 6: Formulation of Subsequent Questionnaires (Delphi Round 2-4)

Each expert was informed of the results of the first round and asked to provide a new answer and justify it if it differed from the general tendency.

Step 7: Summary Process and Drawing up of Final Report

It was important to note that the analysis of data elicited through Delphi surveys would be carried out using statistical method when aggregating the answers for a median score (mean values). It was important that the study strived for stability rather than consensus. On the other hand, there had been several studies supporting the use of the Delphi method. In general, the method was useful to explore and unpack specific, single-dimension issues (Helmer, 1983). There was less support for its use in complex, multi-dimensional modelling. In these cases, the evidence did suggest that data gathered by Delphi surveys was a useful input when supported by data gathered from other sources in complex scenario-building (Armstrong, 1985).

Results and Discussion

Based on the argument by Creswell and Creswell (2017), the authors concluded that managers who had served between five and ten years in their respective fields could be considered as industry experts. These experts also participated in the study on a voluntary basis. The number of experts in this study's Delphi's Fuzzy Technique concurred with Jones and Twiss (1978), who stated that the number should be between ten and 50. It had also been asserted by Adler and Ziglo (1996) that the opinion of ten to 15 experts was sufficient in the event of a high level of agreement and uniformity.

The statement of the main driving forces for industry competitiveness consist of; changes in the long-term industry growth rate; increasing globalization; emerging new internet capability; changes in who buys the products/services and how they use it; production/services innovation; technological change and manufacturing/ services process innovation; marketing innovation; entry or exit of major firms; diffusion of technical know-how; changes

in cost and efficiency; growing buyer/ demand preferences for differentiated products/services; reduction in uncertainty and business risks; regulatory influences government policy changes; and, changing societal concern, attitudes, and lifestyles in maritime logistics company at Klang Valley, Selangor has been shown in Table 1.

Table 1: Delphi statements on main driving forces of marine logistics industry competitiveness

Criterion	Statements of Delphi
1	Klang Valley is one of the important maritime logistics industry areas towards our nation's economic development. Changes in long-term industry growth rate can affect the competitiveness of the industry. **(Changes in long-term industry growth rate)**
2	The Klang Valley is one the maritime logistics industry areas with the highest COVID-19 cases since January 25, 2019, until the current date. The Movement Control Order (MCO) ghas resulted in great negative impact on the Klang Valley maritime logistics industry. Thus, reduction of uncertainty and business risk is the best strategic plan for the industry. **(Reduction of uncertainty and business risks)**
3	Delays caused by paperwork may result in delay of container deliveries in ports. By changing to digital ecosystem/tools with emerging new internet capabilities, maritime logistics companies in the Klang Valley may improve their inventory control and sustain their business amid the COVID-19 pandemic. **(Emerging new internet capabilities)**
4	Single window or standardisation of electronic data exchange among stakeholders in this industry is important. Making the transition to full-fledged single window will allow maritime logistics companies in the Klang Valley to support transmission, receipt and response of information required for the arrival, stay and departure of ships, persons and cargo, including notifications and declarations for Customs, immigration, port and security authorities, and increasing globalisation competitiveness. **(Increasing globalisation)**
5	The implementation of digital logistics platforms that can be integrated towards a paperless workflow using digital information and big data can enhance the work procedures by connecting shippers with logistics services and other carriers and freight forwarders. This is also important to help improve business analytics and planning processes in the pandemic to make changes in cost and efficiency. **(Changes in cost and efficiency)**
6	Production innovation, such as digitalisation of the documentation and booking processes, e-business tools and equipment online connectivity have become key solutions in increasing the resilience of maritime logistics industry and securing business continuity during the pandemic. **(Production/services innovation)**
7	Emerging new Internet capabilities, such as an Artificial intelligence (AI) combined with big data, may utilised all available information in the industry. **(Emerging new internet capabilities)**

8	Technological change and manufacturing or services process innovation may greatly decrease the cost of shipyards and shipping companies. Using cloud services/servers/block change platform in various activities, including global access to fleet data and a centralised procedure for freight procurement and monitoring by maritime logistics companies may increase competitiveness in the industry. **(Technological change and manufacturing/services process innovation)**
9	Diffusion of technical know-how across maritime logistics companies, such as the use of 3D printing and additive engineering (3DP) in generating ship spare parts may reduce lead times, enhance parts availability, simplify procurement process, reduce inventory and transportation costs, and decrease port fees by cutting maintenance delays and increasing the service life of existing equipment. **(Diffusion of technical know-how)**
10	Marketing innovation is important to sustain business for the long-term. **(Marketing innovation)**
11	Positive regulatory influences and government policies have positive impact on profitability growth of the industry. **(Regulatory influences and government policy changes)**
12	Changing societal concerns, attitudes and lifestyle is a driving factor for digitalisation practices among maritime logistics companies and can help business to recover with the digitalisation ecosystem. **(Changing societal concern, attitudes and lifestyle)**
13	Rapid changing and scenario planning for changes in who buys the services/ products and how they use it is important, which affect the logistics industry and company competitiveness. **(Changes in who buys the products/services and how they use it)**
14	Growing demand preferences for differentiated services/products instead of standardised services/products, such as an autonomous vehicles and robotics, Virtual, augmented and mixed reality (VR), the IoT and digital security (bloc change) may be used as value-added services for business sustainability. **(Growing buyer/demand preferences for differentiated products/services)**
15	Market structure is determined by the entry and exit decisions of individual producers (logistics company). These decisions are driven by expectations of future profits which, in turn, depend on the nature of competition within the market. **(Entry or exit of major firms)**

In a study, 15 basic criteria have been identified from the literature. Using a five-point Likert scale, the opinion of ten experts was gathered to determine the importance of these criteria. Linguistic expressions and Fuzzy numbers were: Very Important (0.75, 1, 1); Important (0.5, 0.75, 1); Moderately Important (0.25, 0.5, 0.75); Unimportant (0, 0.25, 0.5); and, Very Unimportant (0, 0, 0.25).

Table 2: Fuzzification of linguistic expressions for importance of criteria

EXPERTS	FUZZY DELPHI SCALE														
	1			2			3			4			5		
1	0.4	0.6	0.8	0.4	0.4	0.8	0.2	0.4	0.6	0.4	0.6	0.8	0.2	0.4	0.6
2	0.6	0.8	1	0.6	0.8	1	0.6	0.8	1	0.6	0.8	1	0.6	0.8	1
3	0.6	0.8	1	0.6	0.8	1	0.6	0.8	1	0.6	0.8	1	0.6	0.8	1
4	0.4	0.6	0.8	0.6	0.8	1	0.2	0.4	0.6	0.6	0.8	1	0.6	0.8	1
5	0.6	0.8	1	0.4	0.6	0.8	0.6	0.8	1	0.6	0.8	1	0.6	0.8	1
6	0.4	0.6	0.8	0.6	0.8	1	0.4	0.6	0.8	0.4	0.6	0.8	0.6	0.8	1
7	0.6	0.8	1	0.4	0.6	0.8	0.4	0.6	0.8	0.2	0.4	0.6	0.6	0.8	1
8	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8
9	0.6	0.8	1	0.6	0.8	1	0.6	0.8	1	0.6	0.8	1	0.4	0.6	0.8
10	0.6	0.8	1	0.2	0.4	0.6	0.4	0.6	0.8	0.4	0.6	0.8	0.6	0.8	1
11	0.6	0.8	1	0.6	0.8	1	0.6	0.8	1	0.4	0.6	0.8	0.4	0.6	0.8
12	0.6	0.8	1	0.6	0.8	1	0.4	0.6	0.8	0.4	0.6	0.8	0.6	0.8	1
13	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8
14	0.6	0.8	1	0.2	0.4	0.6	0.6	0.8	1	0.4	0.6	0.8	0.4	0.6	0.8
15	0.4	0.6	0.8	0.6	0.8	1	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8
16	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.6	0.8	1
17	0.6	0.8	1	0.4	0.6	0.8	0.6	0.8	1	0.4	0.6	0.8	0.4	0.6	0.8
18	0.6	0.8	1	0.6	0.8	1	0.6	0.8	1	0.4	0.6	0.8	0.6	0.8	1
AVERAGE	0.522	0.722	0.922	0.478	0.667	0.878	0.467	0.667	0.867	0.444	0.644	0.844	0.500	0.700	0.900
	m1	m2	m3	m1	m2	m3	m1	m2	m3	m1	m2	m3	m1	m2	m3

EXPERTS	6			7			8			9			10		
1	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.6	0.8	1
2	0.6	0.8	1	0.6	0.8	1	0.2	0.4	0.6	0.2	0.4	0.6	0.6	0.8	1
3	0.6	0.8	1	0.6	0.8	1	0.6	0.8	1	0.6	0.8	1	0.6	0.8	1
4	0.4	0.6	0.8	0.6	0.8	1	0.4	0.6	0.8	0.6	0.8	1	0.2	0.4	0.6
5	0.6	0.8	1	0.6	0.8	1	0.6	0.8	1	0.6	0.8	1	0.6	0.8	1
6	0.4	0.6	0.8	0.6	0.8	1	0.2	0.4	0.6	0.4	0.6	0.8	0.6	0.8	1
7	0	0.2	0.4	0.4	0.6	0.8	0.6	0.8	1	0.6	0.8	1	0.4	0.6	0.8
8	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8
9	0.4	0.6	0.8	0.6	0.8	1	0.4	0.6	0.8	0.6	0.8	1	0.6	0.8	1
10	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.6	0.8	1
11	0.4	0.6	0.8	0.2	0.4	0.6	0.6	0.8	1	0.6	0.8	1	0.6	0.8	1
12	0.6	0.8	1	0.6	0.8	1	0.6	0.8	1	0.4	0.6	0.8	0.6	0.8	1
13	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8
14	0.6	0.8	1	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8
15	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8
16	0.4	0.6	0.8	0.6	0.8	1	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8
17	0.6	0.8	1	0.6	0.8	1	0.4	0.6	0.8	0.4	0.6	0.8	0.6	0.8	1
18	0.4	0.6	0.8	0.4	0.6	0.8	0.6	0.8	1	0.6	0.8	1	0.6	0.8	1
AVERAGE	0.444	0.644	0.844	0.489	0.689	0.889	0.444	0.644	0.844	0.467	0.667	0.867	0.511	0.711	0.911
	m1	m2	m3	m1	m2	m3	m1	m2	m3	m1	m2	m3	m1	m2	m3

EXPERTS	11			12			13			14			15		
1	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8
2	0.4	0.6	0.8	0	0.2	0.4	0.2	0.4	0.6	0.2	0.4	0.6	0.2	0.4	0.6
3	0.6	0.8	1	0.6	0.8	1	0.6	0.8	1	0.6	0.8	1	0.6	0.8	1
4	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8
5	0.6	0.8	1	0.6	0.8	1	0.6	0.8	1	0.4	0.6	0.8	0.6	0.8	1
6	0.6	0.8	1	0.4	0.6	0.8	0.6	0.8	1	0.4	0.6	0.8	0.6	0.8	1
7	0.2	0.4	0.6	0.4	0.6	0.8	0.4	0.6	0.8	0.2	0.4	0.6	0.4	0.6	0.8
8	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8
9	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.6	0.8	1
10	0.6	0.8	1	0.4	0.6	0.8	0.4	0.6	0.8	0.6	0.8	1	0.4	0.6	0.8
11	0.6	0.8	1	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.6	0.8	1
12	0.6	0.8	1	0.6	0.8	1	0.4	0.6	0.8	0.4	0.6	0.8	0.6	0.8	1
13	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8
14	0.6	0.8	1	0.6	0.8	1	0.2	0.4	0.6	0.4	0.6	0.8	0.4	0.6	0.8
15	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8
16	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8
17	0.6	0.8	1	0.6	0.8	1	0.4	0.6	0.8	0.6	0.8	1	0.6	0.8	1
18	0.4	0.6	0.8	0.4	0.6	0.8	0.6	0.8	1	0.6	0.8	1	0.6	0.8	1
AVERAGE	0.478	0.678	0.878	0.433	0.633	0.833	0.422	0.622	0.822	0.422	0.622	0.822	0.478	0.678	0.878
	m1	m2	m3	m1	m2	m3	m1	m2	m3	m1	m2	m3	m1	m2	m3

The fuzzy average method was used for the aggregation of expert opinion. The simple equation $(l+m+u)$ / 3 was also utilised for defuzzification of opinion means. The threshold was set at 0.7. The results are summarised in Table 2.

Table 3: Value ‘d’ construct (Threshold value)

EXPERTS	ITEM														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0.2	0.3	0.4	0.1	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1
2	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.4	0.4	0.1	0.1	0.7	0.3	0.3	0.4
3	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.3	0.3	0.3	0.2
4	0.2	0.2	0.4	0.2	0.2	0.1	0.2	0.1	0.2	0.5	0.1	0.1	0.0	0.0	0.1
5	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.3	0.3	0.0	0.2
6	0.2	0.2	0.1	0.1	0.2	0.1	0.2	0.4	0.1	0.1	0.2	0.1	0.3	0.0	0.2
7	0.1	0.1	0.1	0.4	0.2	0.7	0.1	0.2	0.2	0.2	0.4	0.1	0.0	0.3	0.1
8	0.2	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.0	0.0	0.1
9	0.1	0.2	0.2	0.2	0.2	0.1	0.2	0.1	0.2	0.1	0.1	0.1	0.0	0.0	0.2
10	0.1	0.4	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.0	0.3	0.1
11	0.1	0.2	0.2	0.1	0.2	0.1	0.4	0.2	0.2	0.1	0.2	0.1	0.0	0.0	0.2
12	0.1	0.2	0.1	0.1	0.2	0.2	0.2	0.2	0.1	0.1	0.2	0.3	0.0	0.0	0.2
13	0.2	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.0	0.0	0.1
14	0.1	0.4	0.2	0.1	0.2	0.2	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.0	0.1
15	0.2	0.2	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.0	0.0	0.1
16	0.2	0.1	0.1	0.1	0.2	0.1	0.2	0.1	0.1	0.2	0.1	0.1	0.0	0.0	0.1
17	0.1	0.1	0.2	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.2	0.3	0.0	0.3	0.2
18	0.1	0.2	0.2	0.1	0.2	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.3	0.3	0.2
d value for each item	0.145	0.196	0.181	0.132	0.170	0.158	0.170	0.158	0.158	0.166	0.166	0.141	0.121	0.121	0.166
d value construct	0.157 (The panel experts have achieved their consensus on the items)														

Table 3, shows the fuzzy score values that had been ranked based on expert consensus. Table 4 and 5 shows the ranking of each item in the Main Components of safety and health implementation. As it was noted, different methods could be used for fuzzy aggregation and defuzzification of calculated values. The acceptance and rejection of criteria were also subject to the threshold value that was determined by 0.7 (>75%).

Table 4: Defuzzification results of aggregated expert values

ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Item d ≤ 0.2	18	15	16	17	17	17	17	16	17	17	17	12	12	12	17
Percentage of item d ≤ 0.2	100%	83%	89%	94%	94%	94%	94%	89%	94%	94%	94%	67%	67%	67%	94%
Overall percentage of item d ≤ 0.2	88%														

The feedback of experts were analysed to quantify the threshold "d" (see Table 4 and 5). From the data sheet it was found that the overall scores of the "d" value for 15 criteria was 0.157, which meant it surpassed the requirement (≤ 0.2) to proceed to the next Fuzzy Delphi process in determining group consensus percentage. The consensus percentage that the panel experts must exceed was a minimum of 75 per cent before it could proceed to the next process. The overall percentage score for this process was 88 per cent, which meant that the group agreement had surpassed the minimum percentage value. The decision whether to retain or discard some items that scored a low percentage value was determined in the final process, which involved determining the α cut-off or defuzzification value.

Table 5: Defuzzification results of aggregated expert values

ITEM	NILAI SKOR		RANK
	FUZZY EVALUATION	AVERAGE OF FUZZY NUMBER	
1	13.000	0.722	1
2	12.133	0.674	7
3	12.000	0.667	8
4	11.600	0.644	10
5	12.600	0.700	3
6	11.600	0.644	12
7	12.400	0.689	4
8	11.600	0.644	10
9	12.000	0.667	8
10	12.800	0.711	2
11	12.200	0.678	5
12	11.400	0.633	13
13	11.200	0.622	14
14	11.200	0.622	14
15	12.200	0.678	5

Table 6: Ranking of items based on defuzzification results

ITEM	NILAI SKOR		RANK
	FUZZY EVALUATION	*AVERAGE OF FUZZY NUMBER*	
1	13.000	0.722	1
10	12.800	0.711	2
5	12.600	0.700	3
7	12.400	0.689	4
11	12.200	0.678	5
15	12.200	0.678	5
2	12.133	0.674	7
9	12.000	0.667	8
3	12.000	0.667	8
4	11.600	0.644	10
8	11.600	0.644	10
6	11.600	0.644	12

Table 6, shows that the item No. 1 had the highest level of consensus among experts, followed by items No. 10, 5, 7, 11, 15, 2, 9, 3, 4, 8, and 6. Items No. 12, 13 and 14 were rejected due to the lower level of the consensus among the experts.

Expert Opinion on Driving Forces of Industry Competitiveness

In this survey, 15 structured questions were posed to experts that involved all 14 main driving forces for competitiveness in the maritime logistics industry. For changes in long-term industry growth rate, it received the highest level of consensus among the experts, which was a 100 per cent agreement. For driving forces ranked from No. 2 to 12, namely marketing innovation, changes in cost and efficiency, regulatory influences government policy changes, entry or exit of major firms, diffusion of technical know-how, increasing globalization and production or services innovation, all of them received a 94 per cent consensus. For emerging new internet capability and technological change and manufacturing/ services process innovation, it received 89 per cent level of consensus among experts. The reduction in uncertainty and business risks item got 83 per cent agreement among the experts. The remaining driving forces, which were changing societal concern, attitudes and lifestyle, changes in who buys the products/services and how they use it, and growing buyer/demand preferences for differentiated products/services gained only 67 per cent agreement, which disqualified them from the main driving forces listing.

The Klang Valley was one of the most important maritime logistics hubs that contributed to the nation's economic development. Changes in long-term industry growth rate could affect the competitiveness of this industry. Therefore, it would be the main priority of logistics companies to focus on this key driver to revive their business during the pandemic. The other top key driver was marketing innovation, in which every industry player

could focus on how to attract customers through innovative digital marketing. Ntex, changes in cost and efficiency was also one of drivers that needed to be focused on. The implementation of digital logistics platforms that could be integrated towards digitised and paperless workflows might enhance work procedures of companies. Hence, it was important to guide the industry to improve its business analytics and planning processes to make changes in cost and efficiency. Other drivers, such as regulatory influences and government policy changes, entry or exit of major firms, diffusion of technical know-how, increasing globalisation, and the production or services innovation using digitalisation tools also needed focus to regain economy stability of the maritime logistics industry.

Conclusion and Implication

The maritime logistics industry is the cornerstone of international business and economy development. The COVID-19 pandemic had caused the world economy to decline and Malaysia was no exception. In addition, there were very little details in literature about the impact of the pandemic on the maritime logistics industry. Consistent with the research objective, this study undertook a qualitative approach and explored 15 significant drivers that had been ranked by industry experts on their priority, which could motivate companies to digitalise their operations.

While our research techniques had made significant theoretical and practical advances by employing the Fuzzy Delphi technique, there were several constraints that should be resolved in future research. The 15 key drivers of competitiveness could be evaluated through quantitative research. This study was focused on a specific logistics hub in Malaysia. Given the differences across industrial sectors and nations, our research could be duplicated in other industries and countries, most notably in developing economies. Future studies might quantitatively evaluate if or how the competitive drivers mitigated the unfavourable links in the industry between obstacles and digitalisation.

Disclosure Statement

No potential conflict of interest was reported by the author(s).

Notes on Contributors

Siti Salma
Mohamad Rosni Othman

ORCID

Mohamad Rosni Othman http://orcid.org/0000-0001-7348-9407

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