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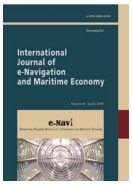

Original article

Factors influencing Malaysian Maritime Industry in Remaining Sustainable in Global Trade

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Abstract

Maritime sector has played a critical role for the growth and development of the Malaysia in facilitating global trade. Malaysia rely on the sector for the import and export of goods as around 90% of the nation trade is carried through maritime transportation. Although there are increasing in trade performance, Malaysian maritime industry is still facing a hard times to safeguard Malaysia's economic interests and to retain its competitive advantage as a leading maritime nation. Therefore, this paper aims to identify, analyses and evaluate the factors that influencing Malaysian maritime industry in remaining sustainable in global trade. In order to explain how the influencing factors affect the Malaysian maritime industry, a systematic hierarchical structure was developed. Then, by employed Analytical Hierarchy Process (AHP) technique, the priorities among various criteria was determined through the judgments of experts using a set of scales. The results of this study will assist the shipping entities to cope with those challenges and for Malaysia maritime sector to remain a key enabler of international trade.

Keywords: Analytical Hierarchy Process (AHP), Influencing Factors, Malaysian Maritime Industry, Sustainability

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1. Introduction

Malaysia is a country that is rich with abundance natural resources, such as oil and gas, rubber, palm oil, and tin ore. Malaysia has emerges as maritime nation due to its location surrounded by sea and also strategically located at the world most busiest shipping lane. Hydrographically, the total area of Malaysia's territorial water is 65,023.4 km2 with an exclusive economic zone of 450,233.0 km^2 (Till & Tsjeng, 2017). The tremendous growth of shipping activities in Malaysia over the years underlines the value of the maritime sector to its economic well-being and the importance of the seas to the lives of its people (Nor & Nazery, 2008). More than half of the world's shipping tonnage passes through Malaysian water and the global trade activities is essential for the growth of the Malaysian economy. Maritime industry have been identified as major contribution of economic prosperity to the nation (Osnin, 2004). Extensive maritime industry, which includes ship building, oil and gas, ports and terminal, shipyards as well as ship services are the essential components of the Malaysia's maritime clusters (Othman, Jeevan, & Rizal, 2016). Maritime clusters can be defines as an industrial complex, an agglomeration of interlinked industries, and a ommunity-based network (Doloreux, 2017). It is undeniable the vital of the shipping industry for the country's economy as it exhibits nearly 90% of trade. To date, sustainability issues in maritime have received attention as is renowned as among of the biggest challenges of Malaysia. Sustainability Development Goals (SDGs) are a comprehensive agenda agreed upon globally that aims to stimulate actions towards economic, environmental and social sustainability (Wang, Yuen, Wong, & Li, 2020). All in all, to strengthen the role of maritime industry in supporting global trade, it is highly desirable to ascertain the influencing factors to ensure that the industry sustain in global trade.

Thus, this paper aims to identify the influence factors of Malaysia maritime industry to remain sustainable in global trade. In order to achieve this objective, mathematical method by Analytical Hierarchy Process (AHP) is employed. The priorities among various benchmarks were determined through the judgments of experts using a set of scales. Previous studies have been conducted in a context similar to our study, AHP approach, to enhance the effectiveness of sourcing decisions (Gaudenzi & Borghesi, 2006; Liu, et al. 2008 and Radivojević & Gajović (2014). Lee et. al (2014) have identify and weight the factors influencing a country's shipping competitiveness and shipping policy by using AHP approach. Taking a close look at the existing literature, nevertheless, studies on a comprehensive evaluation of influencing factor of country's sustainability in global trade are fail to drawn considerable attention of academicians, practitioners and policymakers, which is reflected by a few number of papers written in this area. Hence, it is very important to consider a comprehensive evaluation on the influencing factors to ensure that the maritime industry sustains the country's global trading as per carried out in this paper.

2. Literature review

In Malaysia, the development of shipping industry is a profitable broadcast for country's financial. Lee et al. (2014) reported, referring to the International Maritime Organisation (IMO) (2008), over 90% of the global trade volume was transported via sea and maritime transport was considered as a foremost mode of transportation of goods. Shipping industries has impact on global supply chain management reflected by the world's total container ship dead-weight tonnage. However, it is necessary to ascertain the possible of influence factor to ensure the Malaysia maritime industry sustain in global trade comprising foremost several issue, operational issue, environmental issue and human resource issues. These aspects are further discussed as per following;

2.1 Operational issue

The operational issue is one of the influence factors that affect this shipping industry. This involves the rising cost, flattening demand growth, security risks, low cargo rates and oversupply of vessels. The expansion of shipping industry also benefits to the fine infrastructure and service system developments. However, high cost at port caused the rising cost of trading activities (Lee et al., 2014). Higher price of fuel also caused the increasing of transportation cost. This situation will impact the shippers and the merchants whose need more investment to ensure the sustainability of the business. Flattening demand growth also causes the oversupply of certain goods. Low demand of goods may cause the oversupply

at the port. Implementation of cabotage policy to protect the Malaysian shipping industry also impact on the additional freight cost to importers as well as rising cost in shipping rates (Ruslan et al., 2019).

Malaysia maritime industries are based on seawater route for transportation the merchandise. The seaborne commerce also exposed to the maritime piracy attacks. The Regional Cooperation Agreement on Combating Piracy and Armed Robbery against ships in Asia (ReCAAP) reported in 2014 about 140 incidents in Southeast Asian waters. These incidents involved the threat from piracy, armed robbery (Graham, 2015). Its strategic trade route and geographic structure are exposed to this pirate threats. This incident directly affects the global economy due to the total lost of goods, additional cost of paying ramsons and insurance premiums to the affected companies (Khondaker, 2013). Dillon (2005) was classified the definition of piracy attacks into three major maritime crimes: corruption, sea robbery, piracy, and maritime terrorism. Increasing numbers of these maritime crimes will affect the economy and financial to the shipping industry and as well as to world trade.

2.2 Environmental issue

In shipping industry, ships are used as transportation for merchandise around the world definitely. Most of the countries face the environmental issue which caused from increasing activities of maritime business including Malaysia. Marine pollution is the major issue caused by shipping activities such as tanker oil spills, and ballast water which has been recognized as threats to aquatic life. Despite the fact that the shipping activities are important to Malaysia's economy, it also needs to ensure the sustainability of the environment from the pollution. Offshore oil spills also caused the water pollution and impact on the coastal environment, public health and communities. It also causes the economic loss referring to the total amount of liability and compensational funds which are regulated according to legislation (Fatihah et al., 2019).

Malaysia as a developing country, the shipping activities is a good prospective industry to the growth of Malaysia's economy. However, this country also encounter the global emission of carbon dioxide (CO_2) where the mainly sources of energy are from fossil fuels. High demand of energy due to the rapid economic growth and industrialization are ensued to a significant increase of this emission of harmful gaseous to the atmosphere. The emission of sulphur from this industry also causes the pollution. Uncontrolled emission of these harmful gaseous may lead to the greenhouse effect and this situation is not good for our health, environment and future generation. Therefore, this as a challenge to the developing countries like Malaysia to reduce the emission and balance with the needs of economic development which consume the energy from this fuels (Indati & Bekhet, 2014).

Strict enforcement of emission regulations has been implementing by the government to control the pollution. In order to reduce the water pollution, International Convention for the Prevention of Pollution from Ships (MARPOL) has put a standard for Very Large Crude Carrier (VLCC) to be double-hulled, in order to reduce accidental tanker oil spills (Indati & Bekhet, 2014). The implementation of Ballast Water Management Convention 2004 (BWMC) by the International Maritime Organization has been regulated to control the ballast water discharge (Zaideen, 2019). New International Maritime Organization (IMO) regulations to lower the sulfur cap for air emissions from ships in January 2020. The shippers need to achieve the new low-sulphur standard. Firstly, the shippers can run liquefied natural gas (LNG), can continue use HSFO and process the emissions using an exhaust gas cleaning system (EGCS) or known as scrubber (Halff et al., 2019). Generally, when a new regulation implemented, it cause in increasing the cost to the shippers. Though, the shippers need to execute the guidelines to ensure the business undergo smoothly.

2.3 Human resource issue

Human resource issue is also identified as influence factor for Malaysia maritime industry to remain sustainable in global trade. Deficiency of seafarers, shortage of shore-based operation workers and labour disputes and strikes are the major issue in human resource. Total global demand for seafarers is influenced by financial sector, regulatory and technological changes. The investment climate as well as flag state regulations directly impact the use of labour saving technology (with the corresponding reorganisation) on board ship, whereas individual flag states may have regulations that either enable or prohibit such reorganisation. The

seafarers demand for maritime transport depends on size and number of used ships as well as increase the demand for seafarers (Wagtmann & Poulsen, 2009).

is partially or totally abolished, this will affect the labour market. Less sponsorship for cadets or trainees, and difficulty in finding berth for training and employment on board ships cause unable the practical training which is the important requirement to obtain the

The difficulty to find young seafarers and maritime officers has led to a prolonged ageing of seafarers labour force on board. In certain cases, the maritime education finance is cut and/or the preferential tonnage tax regime

certification (Osnin, 2004). The summary of the recognized factors of influence Malaysian maritime industry to remain sustainable in global trade is shown in Table 1.

Table 1: Main Issues in Malaysian Maritime Industry

Main issue	Sub-criteria	References
Operational Issues	• Rising cost • Flattening demand growth • Security risk • Low cargo rates • Oversupply of vessel	Lee et al., (2014); Ruslan et al., (2019); Graham (2015); Khondaker (2013); Dillon (2005)
Environmental Issues	• Greenhouse effect and danger of aquatic life • Strict enforcement of emission regulations • Depend intensely on specific new technologies	Fatihah et al., (2019); Indati & Bekhet (2014); Zaideen (2019); Halff et al., (2019)
Human Resource Issues	• Deficiency of seafarers • Shortage of shore-based operation workers • Labor disputes and strikes	Wagtmann & Poulsen (2009); Osnin (2004)

3. Research Methodology

In pursuance of the aim and the objective of this study, this section explains the outline of the research design and the approach employed. In this paper, Analytical Hierarchy Process (AHP) technique has been used. AHP is one of the most popular technique of decision making under Multiple-Attribute Decision Making (MADM) approach (Kahraman, 2008). The focal point of the AHP approach is to determine the priorities among various criteria through the judgement of experts using a set of scales depicting absolute judgements (M. Hanafiah, 2017). As shown in Figure 1, firstly, the assessment process began by determining the factors that confronted by Malaysian Maritime Industry to remain sustainable in global trade. This process will be gained from the literature review and further discussion with domain experts which involved with the filtration process. As a result, the influence factors as listed in Table 1 are used for further steps.

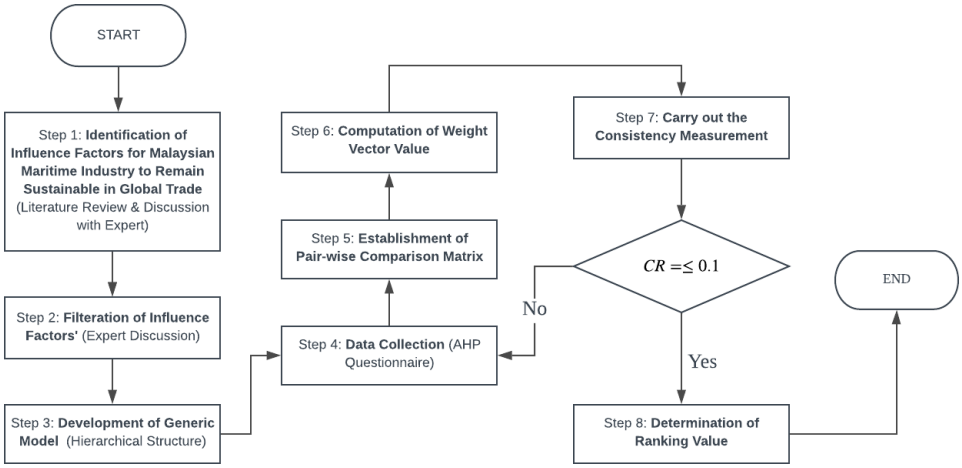

Figure 1: Research Methodology

Secondly, after the influence factors have been identified, revised and filtered, a systematic hierarchical model is developed. A hierarchy refers to a structure that is used in a sequential manner to represent the simplest component of a system (Saaty, 1994). Figure 2 exemplifies a hierarchy in order to rank the most influence factor that confronted by Malaysian Maritime Industry to remain sustainable in global trade.

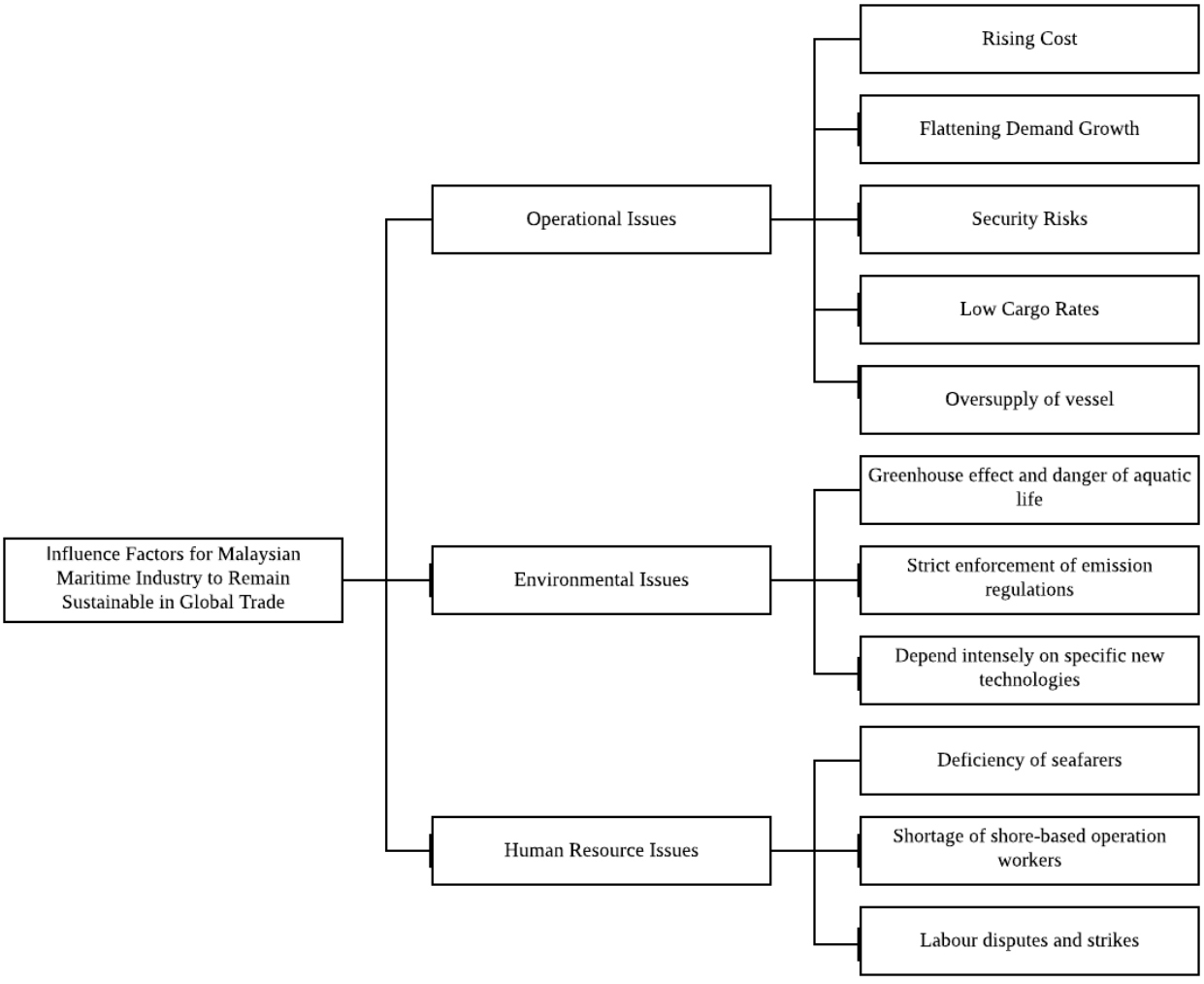

Figure 2: Generic Model Development

Thirdly, by using Analytic Hierarchy Process (AHP) method, the weight assignment for each factor will be calculated. At this stage, a set of AHP questionnaires was developed and presented to the selected experts in order to derive at the weight value for each criterion and sub-criterion. For that purposes, five experts were involved in this data collection process. These experts were selected based on their experiences spanning between 10 and 20 years in the shipping industry, as well as their knowledge, skills, and ability to offer judgements and professional opinions. The background details of these experts are as follows:

Table 2: Background Details of Experts

Expert	Position	Years of Experience
1	Director General	>20
2	CEO of Insurance and Indemnity Malaysia	>20
3	Assistant Manager	>20
4	Marine Officer	>20
5	Associate Professor/ Researcher	>20

These selected experts were required to make comparison on an individual criterion with the rest, one-by-one at the same level of a decision hierarchy (Saaty, 2008). Subsequently, by using the ratio scale of measurement, as shown in Table 3, these experts were required to select the more important factor in order to achieve the goal of each part. For example, between rising cost and flattening demand growth, which factor is more influence Malaysian maritime industry to remain sustainable in global trade?

Table 3: Ratio Scale for Pair-Wise Comparison

Intensity of Importance	Definition
1	Equal importance
3	Moderately important
5	Strongly important
7	Very Strongly important
9	Extremely importance
2,4,6,8	Intermediate values

(Source: Saaty, 1990)

Also, in this step, a construction of pair-wise comparison matrix $(n \times n)$ that shows the preference of one criterion A_i over the other $A_j$is built using scale in Table 3 (Saaty, 2008). The a_{ij} entries are defined by rules as follows:

- Rule 1 : if $a_{ij} = \alpha, 1/\alpha, \alpha \neq 0$
- Rule 2 : if A_i is judge to be of equal number of equal relative number as A_j, then $\alpha_{ij} = a_{ji} = 1$

Then, the above rules of matrix D is shown as follows:

$$D = a_{ij} = \begin{bmatrix} 1 & a_n & \cdots & a_{1n} \\ 1/a_n & 1 & \cdots & a_{2n} \\ 1/a_{1n} & 1/a_{2n} & \cdots & 1 \end{bmatrix} \quad (1)$$

Next, in order to determine the priorities of each criteria or also known as weight vector value (W_k), the value of each comparison is calculated by using Equation 2 as follows:

$$W_k = \frac{1}{n}\sum_{j=1}^{n}\left(\frac{a_{kj}}{\sum_{j=1}^{n} a_{ij}}\right) (k = 1,2,3,\cdots,n) \quad (2)$$

where a_{ij} stands for the entry of row i and column j in a comparison matrix of order n.

Fourthly, Consistency Ratio (CR) will be calculated in order to ensure the judgement made by the experts are consistent. The equation of the CR is expressed in Equation 3-5 as follows:

$$\mathrm{CR} = \frac{\mathrm{CI}}{\mathrm{RI}} \quad (3)$$

$$\mathrm{CI} = \frac{\lambda_{\max} - \mathrm{n}}{\mathrm{n} - 1} \quad (4)$$

$$\lambda_{max} = \frac{\sum_{j=1}^{n}\left[\frac{\sum_{k=1}^{n} W_k a_{jk}}{W_j}\right]}{n} \quad (5)$$

where Random Index (RI) refers to the value of average random index (Table 4).

Table 4: Value of Average Random Index

n	RI
1	0
2	0
3	0.52
4	0.89
5	0.11
6	1.25
7	1.35
8	1.4
9	1.45
10	1.49

(Source: Saaty, 2013)

The value of CR should be less than or equal 0.1. Nevertheless, if the CR value is more than 0.1, the experts would be required to revise the pair-wise comparison that is logically inconsistent. Finally, calculation of global weight for each factor will be perform to gain a single result of the most influence factor that confronted by Malaysian maritime industry (Step 8). In this step, the local weight of each sub-factor is multiplied with the weight of its main factor in order to determine the most influence factor.

4. Result and Discussion

On the basis of this research, the main issues faced by Malaysia maritime industry is determined. To ensure sustainability of the industry, three main issues were investigated: operational, human resources and environmental. Equation 1-5 is employed to compute the weight of each factors and subfactors of this research.

Table 5 presents the weight value of main issues studied. Operational issues demonstrated the highest important (0.4875), followed by the human resource issues (0.3503) and environmental issues (0.1622).

Table 5: Weights (Important Level of Factors) and Consistency Ratio (CR)

Main Indicators	Weights of Main Indicators	Sub-Indicators	Local Weight of Sub-Indicators	Global Weight
Operational Issues	0.4875	Rising Cost	0.2722	**0.1327**
		Flattening Demand Growth	0.1706	0.0832
		Security Risks	0.1186	0.0578
		Low Cargo Rates	0.2492	**0.1215**
		Oversupply of Vessel	0.1893	0.0923
			CR: 0.0080	
Environmental Issues	0.1622	Greenhouse effect and danger of aquatic life	0.2654	0.0430
		Strict enforcement of emission regulations	0.4115	0.0667
		Depend intensely on specific new technologies	0.3232	0.0524
			CR: 0.0036	
Human Resource Issues	0.3503	Deficiency of seafarers	0.2898	0.1015
		Shortage of shore-based operation workers	0.4605	**0.1613**
		Labor disputes and strikes	0.2497	0.0875
			CR: 0.0012	
	CR: 0.0030			

Despite the highest value on operational issues, the sub-factor of human resources: shortage of shore-based operation workers was ranked as the most important sub-factor according to global weightage (Table 6).

Table 6: Ranking Orders of the Sub-Factors

Sub-factors	Global Weight	Rank
Shortage of shore-based operation workers	0.1613	1
Rising cost	0.1327	2
Low cargo rates	0.1215	3
Deficiency of seafarers	0.1015	4
Oversupply of vessel	0.0923	5
Labor disputes and strikes	0.0875	6
Flattening demand growth	0.0832	7
Strict enforcement of emissions regulations	0.0667	8
Security risks	0.0578	9
Depend intensely on specific new technologies	0.0524	10
Greenhouse effect and danger of aquatic life	0.0430	11

The importance that respondents attribute to shortage of shore-based operation workers may be due to lack of skilled personel to fill the positions. This is linked to the fact that maritime industry required high quality labour (Lottum and Zanden, 2014). This supported by Abudu and Sai (2020) that stated in adequate skilled workforce as the challenged faced by one of Ghana maritime industry. In addition, the working environment with high exposure of risk (Menhat et al., 2019) may cause this sector less attractives by potential workers. For instance, if the workers involved in tanker shipping, they have to be very particular with safety precautious as any slip might lead to fire accidents, injury and to some extent, fatality (Othman et. al., 2015).

The finding shows that the rising cost as the second most important subfactor is notable because of the restricted in maritime market arises from the implementation of cabotage policy (Ruslan et al., 2019). However, the Malaysia cabotage policy has been abolished on June 1st 2017 (Hand, 2017). This spark various reponses from industry player. Nonetheless, it is difficult to clearly discuss about the effect of the abolishment of cabotage policy to the maritime industry in general and shipping sector without empirical evidence. Apart from this, it is important to note that there might be other factors attributed to the rising cost such as high handling charges, insufficient inland facilities, inefficient distribution networks, among others. These combined factors, will in turn raised the overall cost (Rochwulaningsih, Sulistiyono, Masruroh, & Maulany, 2019; Lee et al., 2014).

The subsequent sub-factor according to weightage is low cargo rates, which consider as two sides of the same coin with the 2nd sub-factor, rising cost. Both factors are related to monetarial aspects of business operation. The low cargo rates depicted as one of the critical issues in the maritime industry as it will be a disadvantage to the shipping companies in general. High overall cost with low cargo rates will cause a maritime company to lose its profit. Thus, it will eventually make it difficult for them to sustain in the industry.

Environmental issues show the least important among the three issues where its highest subfactor was at 7th ranked with global weight of 0.0667. This evidences that environmental issues have less impact in determining the sustainability of the industry based on the respindents view. The demographic of experts involved in this study mightcontributed to this outcome.

5. Conclusion

This study addresses some of the issues compelling Malaysia in becoming a sustainable maritime industry for global trade. These issues are operational issues, environmental issues and human resource issues. The most critical issues for Malaysia maritime industry were identified through analytical hierarchy process (AHP) involving five maritime experts. Three main factors and eleven sub-factors were ranked in the order of importance to the industry. Operational issues was found to be the most siginifcant factor followed by human resources and environmental issues. However, the most important subfactor is shortage of shore-based workers, which belong to the human resource issues. The subsequent subfactors are rising cost and low cargo rates, which are operational issues factor. The finding of this study is significant for the decision maker in devising a strategy to ensure Malaysia maritime industry remain sustainable. Furthermore, it is important to open more training center to prepare well-equipped local workforce to ensure the sustainability of the industry. Apart from this, attractive work benefits can be introduced to attracts more personnel to venture this industry. Owing to the fact that the working environment in the industry is challenging and often requires long hours work, schedule flexibility might attracts more labour to pursue their career in this industry.

More in-depth research is required to investigate the causes that contributed to the issues in this study. Further study can be conducted to identify the causes of shortage of shore-based workers, rising cost and low cargo rates. This information is necessitate to improve Malaysia maritime industry and can be served as guidance for future research in other sectors and regions.

Eventhough the respondents of this research are five, the quality is justified from seniorities and hands on experience over 20 years each of them. However, more expert respondents are welcome in the future research.This research work has certain limitation. First, the quality of the findings would have been higher if the number of experts were more. However, the authors

have ensure that qualified experts were participated in this study, decision makers with more than 20 years experience. The expert judgement on environmental issues are rigorous from the respective environmental authorities and professionals instead of diverse respondents experince. On the other hand, the demarcation of this research required diverse respondents to generalise the outcome. Secondly environmental issues in this study may subjected to bias as it construed mostly industry perspectives and not representing environmental authorities of Malaysia.

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