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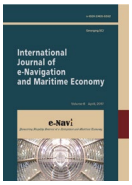

Original article

Green Environmental Friendly Challenges towards Malaysia Port ☆

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Abstract

Malaysia announced to reduce emission during the 15th Conference of Parties in Copenhagen 2009 by 6th Malaysia Prime Minister YAB Dato' Sri Mohd Najib Tun Abdul Razak. While, one of the major energy consumption and emission producers are port systems. Therefore, port must minimise emission and pollution, to become green and environmental friendly. Thus, this study looked for the external environmental factors that influencing port become green. The external environmental factors determined using PESTEL analysis; there are political, economic, social, technology, environment, and legal. Next, the priority dominant external environmental for main factors and sub-factors identified using AHP analysis (Analytic Hierarchy Process). Questionnaires used to collect data from expert, and generated from literature review and pilot test. The initial results showed that the first priority main factor is economic, the second priority main factor is technology, and the third priority main factor is environment. At the same time, the results also highlighted that the first priority sub-factor is economic growth, the second priority sub-factor is reduce pollution, and the third priority sub-factor is research and development. The CR (Consistency Ratio) value is less than 0.1 and indicated that the data is considered acceptable. The advance and green technology and system revolution require financial support, and the Environmental Kuznets Curve (EKC) highlighted that people will looking for environmental protection while economic output per capita achieving certain turning point. Thus, the economic growth is significant contributed and influenced Malaysia Port to become green and environmental friendly.

Keywords: Port, Green and Environmental Friendly, External Environmental factors, PESTEL, AHP

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1. Introduction

Globalization encourages international trade and 90% of cargoes carry by sea (Won and Yong, 1999). The high demand of international trade stimulates shipping evolution. The growth of trade and shipping evolution are forcing ports continuous upgrade their systems and expand the territory. Thus, it leads to destruction of the environment surrounding port areas.

Therefore, green and environmental friendly initiative had be proposed. It's also called green port or eco-port. Green and advanced technology and equipment had develop to reduce pollution and emission.

Meanwhile, the 6th Malaysia Prime Minister YAB Dato' Sri Mohd Najib Tun Abdul Razak agreed to reduce 40% of emission by the year 2020 compared to 2005, during the 15th Conference of Parties (COP) in Copenhagen (Loo, 2015). Therefore, as one of the energy consumption and emission producers, port should reduce emission and pollution.

Consequently, this paper scanned through the external environmental factors that influenced Malaysia Port toward green and environmental friendly. Thereafter, the priority dominant external environmental factors identified using AHP (Analytic Hierarchy Process) analysis.

2. Review Study

Green initiative is current issue and executes in port industry. Because of its significant and sustainable development is essential for next generation (Ying and Yijun, 2011). Green port also called ecological port or eco-port. Green port has some characteristics; there are reducing waste from port operation, maximizing long-term economic benefits, balancing in within environment, economic and social, improving water quality, maximizing energy efficiency, and reducing air emissions (Tanzer and Neslihan, 2018).

To become green and safe for next generation, Malaysia Port looks forward to become green port. Thus, PESTLE analysis used to determine the external environment factors that affected port towards green; there are political, economic, social, technology, environment, and legal (Mohammad et al., 2018).

Political factors are government involvement, government stability, and different ideology. Government involvement is important to support business practices and operations. Such as, Hong Kong government established Maritime Industry Council to develop Hong Kong as an international shipping hub (Roh et al., 2016). According to Tanzer and Neslihan (2018), government stability encourages the cooperation between public and private operators, to transform port to become modern and advanced terminal. Besides, different group of people and individuals hold different beliefs and values. The beliefs and values set a culture that transmitted from generation to generation, and it's formed an ideology (Facchini and Melki, 2011). So, different political parties had different ideology that affected the business circumstance.

For economic factors, port development, economic crisis and economic growth were affected port become green. Notteboom and Rodrigue (2005) highlighted that port development related to port competitiveness, and inland accessibility will increasing the port competitiveness. Other than that, economic crisis can reduced port throughput and influenced port to become green in future (Wang, 2014). Besides, shipping and industries would expanded during economic growth (Gaunaris, 2017). Thus, the growing economic would support port operators invest in advance and green technology.

For social factors, emission produced by industry influencing climate, air quality, ecosystems, and it's affecting population health surrounding port areas (Eyring et al., 2010). In addition, people are educated for a wide range of environmental awareness and sustainable development (Lucie, 1996). The availability of information supply was resulting people knew the pollution of environment affected population health. Therefore, people are desiring to eliminate pollution and concern about green and environmental friendly. Hence, community surrounding port areas are looking for the green practices for the port activities. They are starting to request seaport to reduce pollution and the seaport also responds to their requirements. For example, Port of Szczecin controlled the negative environmental impacts through technical solutions, cargo transport processes and transport systems, to

meet the population of the city of Szczecin requirements (Montwill, 2016). Moreover, culture shape individuals behaviors, beliefs, values, and attitudes (Hofstede, 2001). For example, globalization culture is a trend and it is happening in industries (Seo & Buchanan, 2015). Whereas, emerging of mega carrier in the world is stimulating port industry to upgrade their facilities and equipment.

Technology factors including research and development, innovation, and green ship. Research and development is a stimulator for economic growth, it is an essential input for technology growth, and giving positive returns to industries and societies (Birdsall and Rhee, 1993). In addition, innovation of advanced and green equipment had used to reduce emission eg. electric rubber-tyred gantry crane (Rowen and Dhiren, 2015). Furthermore, Environment Protection Committee advised new construction vessels should complying with energy efficiency standard and protect environment (UNCTAD, 2017).

Environment factors consist of green shipping practice, reduce pollution, and ballast water control. According to Roh et al. (2016), green shipping practice is encouraged, likes counting carbon footprints for shipping routes and using alternative transportation method. For example, feeder vessel used to carry domestic cargoes, which can carrying high volume of cargoes and reducing carbon emission. Besides, shipping industry should minimises pollution e.g. installing scrubbers and using liquefied natural gas and other low sulphur fuels (UNCTAD, 2017). In addition, Ballast Water Management Convention 2004 stated that ship should releases and exchanges ballast water before entering port, to reduce public health-related and environmental and economic impacts (UNCTAD, 2017)

For legal factors, green shipping policy, safety and health policy, and government laws are influencing green practices in port. Legal affected business environment and practices; likes such as green shipping policy where the larger ship can reducing the emission of CO^2 (Lu et al., 2014), implementing of safety and health working conditions in ports (Antao et al., 2016), and government has the right in regulating laws and policies that would benefit them from time to time (Rosario, 2000).

Table 1 shows the summary of PESTLE variables. Each variables had three sub-variables and each sub-variables had identified through review study and verified by pilot study.

3. Methodology

Kuantan Port is selected as case study and the respondents are chose from Kuantan Port. The respondents picked out from head of department and they had more than 5 year industry experience. Ten respondents selected and they are from research & development, commercial, traffic & marine services, new deep water terminal (civil), marine service, health, safety & environment, governance, risk & compliance, new deep sea terminal (mechanical), free zone, and information technology departments, whereas they are involved in greening practices. Interview and questionnaire are used to collect data. Questionnaire is determined through literature review and verified by pilot study.

Table 1: Summary of PESTLE

Factors	Sub-factors	Source
Political	- Government involvement	- Wong, 2009
	- Government stability	- Tanzer and Neslihan, 2018
	- Different ideology	- Facchini and Melki, 2011
Economic	- Port development	- Notteboom and Rodrigue, 2005
	- Economic crisis	- Wang, 2014
	- Economic growth	- Gaunaris, 2017
Social	- Population health	- Eyring et.al., 2010
	- Education	- Lucie, 1996
	- Culture	- Hofstede, 2001
Technology	- Research and Development	- Johor Port Authority, 2017
	- Innovation	- Rowen and Dhiren, 2015
	- Green ship	- UNCTAD, 2017
Environment	- Green shipping practice	- Wong et.al., 2009
	- Reduce pollution	- UNCTAD, 2017
	- Ballast water management	- UNCTAD, 2017
Legal	- Green shipping policy	- Lu et.al., 2014
	- Safety and health policy	- Antao et.al., 2016
	- government laws	- Rosario, 2000

Figure 1 shows the research framework formulation based on the research variables selection toward challenges of Malaysia Port to green environmental friendly. To become green port, Malaysia Port facing some external environmental challenges, and the variables identified using PESTEL analysis (political, economic, social, technology, environment, and legal). Thereafter, external environmental scanning had be carried out to determine the sub-variables for each variables.

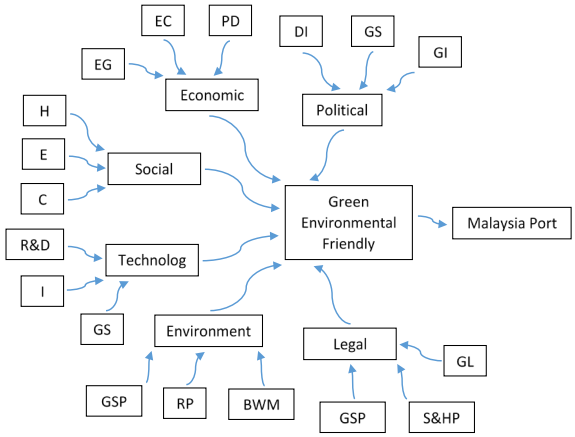

Figure 1: Challenges of Malaysia Port to Green Environmental Friendly

Whereas,

GI – Government involvement

GS – Government stability

DI – Different ideology

PD – Port development

EC – Economic crisis

EG – Economic growth

H – Health

E – Education

C – Culture

R&D – Research and Development

I – Innovation

GS – Green ship

GSP – Green shipping practice

RP –Reduce pollution

BWM – Ballast water management

GSP – Green shipping policy

S&HP – Safety and health policy

GL – Government laws

Subsequently, the data analysed by AHP analysis to determine the dominant priority factors and sub-factors. Based on the respondents' point of view, they are compared the importance between two factors, eg. political and economic. Next, a Geometric mean (GM) (equation 1) used to get the value between political and economic factors, to calculate the importance between each criteria.

$$GM_{IJ} = [e_{ij}1, e_{ij}2, e_{ij}3 \dots e_{ij}k]\frac{1}{k} \quad (1)$$

Whereas,

K – number of experts

$e_{ij}k$ – experts opinion for relative importance of the I criterion to the criterion

Next, each value is inserted into the comparison matrix (equation 2).

$$A = (a_{ij}) = \begin{pmatrix} 1 & a_{12} & \dots & a_{1n} \\ \frac{a}{a_{12}} & 1 & \dots & a_{2n} \\ . & . & \dots & . \\ \frac{a}{a_{1n}} & \frac{a}{a_{2n}} & \dots & 1 \end{pmatrix} \quad (2)$$

The relative importance of one alternative over another computed using matrix (Muriel and Jan, 2012). Where the element $a_{ij} = 1/a_{ij}$ and when I = j, $a_{ij} = 1$. The value of wi ranges from 1 to 9 and 1/1 indicated 'equally important', while 9/1 indicated 'absolutely more important'.

Based on comparison matrix, equation 3 used to calculate the weight for the factor and it is demonstrated as follow:

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

Next, Consistency Ratio (CR) of pair wise comparisons used to calculate the value.

$$CR = \frac{CI}{RI} \quad (4)$$

CR designed in such a way that a value greater than

0.10 indicated as inconsistency in pair-wise comparison. If CR is 0.10 or less, the consistency of the pair-wise comparison considered reasonable (Saaty, 1980).

Whereas, the equation for CI and λmax are as follow:

$$CI = \frac{\lambda_{max} - n}{n - 1} \quad (5)$$

$$\lambda max = \frac{\sum_{j=1}^{n} \frac{\sum_{k=1}^{n} w_k a_{jk}}{w_j}}{n} \quad (6)$$

Whereas, Random Consistency Ration (RI) stated in table 2. The RI identified based on the total factors (n). The total number of factors for this study is 6, so the RI value is 1.24.

Table 2: Radom Consistency Ratio (RI)

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

4. Result and Discussion

PESTLE analysis had six main factors; likes political economic, social, technology, environment, and legal. Next, the priority dominant main factors calculated using AHP analysis.

The pair-wise comparisons were using to identify the priority external environmental factors that contributed to Malaysia Port towards green environmental friendly. The scales of important are demonstrated in table 3. Respondents compared the two main factor (e.g. political and economic) by using scales of important.

Table 3: Scales of Important

Scale	Level of Important
1	Equally important
3	Weakly important to left or right criteria
5	Strongly important to left or right criteria
7	Very strongly important to left of right criteria
9	Extremely important to left or right criteria
2,4,6,8	Intermediate values of important

Then, the pair-wise comparisons result for main factors are listed in table 4. Table 4 shows that most of the respondents are perceived economic (EM), technology (T), and environment (EN) are important than political (P). But, political is important than social (S). Besides, they considered economic is important than social, technology, environment, and legal (L). Moreover, they felt that technology, environment, and legal are important than social. In addition, they also considered technology is important than environment and legal. Last but not least, they agreed the environment is important than legal.

Thereafter, the weight and CR for each factors are expressed in table 5. The first priority dominant factor is economic (0.3541), the second dominant factor is technology (0.2227), the third dominant factor is environment (0.1778), the fourth dominant factor is legal (0.1051), and the fifth dominant factor is political (0.0738), and the last dominant factor is social (0.0666). These external environment factors is the challenge factors facing by Malaysia Port toward green environmental friendly. The CR value is 0.0238. It is less than 0.1, so the judgement on the data analysis is considered acceptable (Saaty, 1980).

Table 4: Pair-Wise Comparisons Result for Main Factors

LF	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	RF
P								1					4		2	1	2	EM
P							2	4	2	1	1							S
P								1			5	1	3					T
P									1	1	4	3	1					EN
P								4	2	1	3							L
EM				1	7		1									1		S
EM					1	1	5		3									T
EM					1	1	4	1	1	1				1				EN
EM					2	1	6		1									L
S						1				1	4	3				1		T
S									1		7	1				1		EN
S							1		1	4	3					1		L
T							8		1			1						EN
T					1	1	4	2	1			1						L
EN							2	5	3									L

Table 5: Priority Dominant Ranking for Main Factors

Ranks	Criterion	Weight	CR
1	Economic	0.3541	0.0238
2	Technology	0.2227	
3	Environmental	0.1778	
4	Legal	0.1051	
5	Political	0.0738	
6	Social	0.0666	

Hereafter, the sub-factors for each of the main factors are calculated and described in table 6. The result shows that the first dominant priority factor is economic growth (0.5165), the second priority factor is reduce pollution

(0.4783), the third priority factor is research and development (0.4633). The subsequent priority factors are government involvement (0.4547), safety and health policy (0.4510), health (0.4188), port development (0.3886), education (0.3855), government stability (0.3227), innovation (0.2843), government laws (0.2835), ballast water management (0.2704), green shipping policy (0.2655), green ship (0.2523), green shipping practices (0.2513), different ideology (0.2226), culture (0.1957), and economic crisis (0.0949). The CR value for the entire sub-factors are less than 0.1, so the judgement on the data analysis is considered acceptable (Saaty, 1980).

Table 6: Priority Dominant Ranking for Sub-Factors

Ranks	Criterion	Weight	CR
1	Economic growth	0.5165	0.0014
2	Reduce pollution	0.4783	0
3	Research & development	0.4633	0.0004
4	Government involvement	0.4547	0.0003
5	Safety and health policy	0.451	0
6	Health	0.4188	0.0008
7	Port development	0.3886	0.0014
8	Education	0.3855	0.0008
9	Government stability	0.3227	0.0003
10	Innovation	0.2843	0.0004
11	government laws	0.2835	0
12	Ballast water management	0.2704	0
13	Green shipping policy	0.2655	0
14	Green ship	0.2523	0.0004
15	Green shipping practices	0.2513	0
16	Different ideology	0.2226	0.0003
17	Globalization culture	0.1957	0.0008
18	Economic crisis	0.0949	0.0014

The top three priority sub-factors are economic growth, reduce pollution, and research and development. Economic growth is the first priority sub-factor that challenges Malaysia Port towards green environmental friendly. The development of seaport and advance and green technology need strong financial support. During economic growth, the revenue and profit of seaport has dramatically increase and it's good for transformation of seaports. David (2015) defined that economic growth is the process which the buying power for the same amount of product or service increase over time, for an individual/group with the same amount of workload. However, Jouili and Allouche (2016) stressed the investment of government in seaport has positive relationship with economic growth. Therefore, economic growth and seaport development have significant relationship to each other.

Next, the second priority sub-factor is reduce pollution. Bailey and Solomon (2004) highlighted that seaports caused environmental pollution in coastal urban areas due to seaport's activity. They also stated that marine vessels, trucks, locomotives, off-road equipment lead to air pollution at seaports. It caused environmental health impacts, e.g. asthma, respiratory diseases, cardiovascular disease, lung cancer, and premature mortality to local communities. It's also affected children's health, e.g. asthma, bronchitis, missed school days, and emergency room visits. To reduce air pollution and ensure cleaner air, some suggestions had provided by Bailey and Solomon (2004). They suggested restrict truck idling, use low sulphur diesel fuel, shore-side power for docked ships, alternative fuels, reduce marine traffic, greener design for new terminals, and state-of-the art approaches to emissions control.

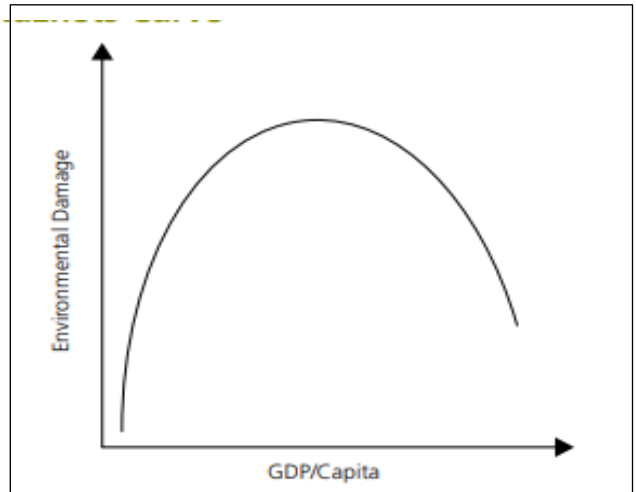

Figure 2: Environmental Kuznets Curve

Source: Economic Growth and The Environment (Everett et. al., 2010)

The economic growth and reduce pollution are top two criterions toward green environmental friendly. The relationship between economic growth, reduce pollution and environmental quality is proved further by Environmental Kuznets Curve (EKC). The EKC highlighted that economic output per capita rise up will leading to environmental degradation, it is due to human

aim to meet their basic consumptions at lower income. But, at certain point of economic output per capita, people will starting to look for environmental quality, trade-offs between economic and environment. While, that will has a turning point, where environment will be improving once the economic output per capita or gross domestic product (GDP) is achieving at certain point (Everett et al., 2010). Figure 2 shows the relationship between economic income per capita and environmental damage. Therefore, economic growth will encouraging people to invest in green environmental technology and reduce pollution.

Beyene and Kotosz (2019) used EKC theory to do study case at East African countries. Burundi, Comoros, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, Sudan, Tanzania, and Uganda were selected as case studies from 1990 to 2013. The results are proved that the relationship between economic output per capita and CO_2 emissions is bell shaped, which be in line with EKC theory.

Thereafter, the third priority sub-factor is research and development. To support the transformation become green port, Malaysia Port needs more research and development activities, to fulfil local circumstances and needs. For example, collaboration between seaports, research institutions and universities to develop new software or technology. Collaboration of Johor Port Authority (JPA) and Universiti Teknologi Malaysia (UTM) in research and development program, to develop Ship Emission Management Systems (SEMS) to calculate and analyse emission (Johor Port Authority, 2017). Gao et al. (2018) used China's foreign direct investment (FDI) to study the effect of reverse technology towards green innovation efficiency. While, his study found that reverse technology can improve green innovation. Matsuoka (2009) also related the research and development strategies toward green environment, whereas the study focused on reducing CO_2 emission and sustainable society establishment. Hence, various institutes and countries had doing research and development activities to enhance their green innovation towards green environmental friendly.

5. Conclusions

Various external environmental factors will affecting seaports become green. Thus, environmental scanning being able to identify the potential factors and allow seaports to respond quickly to the changes in their operating system and making informed decision in organization's strategic planning. Malaysia Port is facing challenges to become green port. There are several external environmental factors that affected Malaysia Port towards green environmental friendly. The top three priority external environmental factors are economic, technology, and environmental. In addition, the top three priority external environmental sub-factors also came from these three groups (economic, technology, and environmental); there are economic growth, reduce pollution and research and development. The subsequent sub-factors are government involvement, safety and health policy, health, port development, education, government stability, innovation, government laws, ballast water management, green shipping policy, green ship, green shipping practices, different ideology, culture, and economic crisis.

Environmental Kuznets Curve (EKC) theory highlighted that economic growth will resulting people to look for environmental protection, and leads to pollution reducing and green innovation exploitation. Awareness and conscious of public raising green initiative, to preserve and conserve environment. Consequently, public demand for environmental safeguards and remedies. A number of laws and legislations addressed to environment protection. Hence, government and seaport are forced to impose green strategy and increase financial investment in green environmental projects.

The port operators and government need to pay attention to the top three sub-factors during the transformation of seaports become green ports. However, how should the government help the port operators facing environmental challenges against economic growth, reduce pollution and research and development? How should the port operators adjust their investment towards green strategies? The limitations of the study are suggested to further clarify.

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