

**ENVIRONMENTAL SUSTAINABILITY STRATEGIES AND IMPACTS: A CASE
STUDY IN NORTHPORT, KLANG MALAYSIA**

By

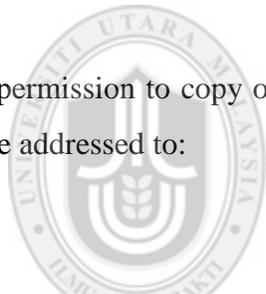


**Thesis submitted to the Ghazali Shafie Graduate School of Government,
Universiti Utara Malaysia
In Fulfillment of the Requirement for the Degree of Master of Science**

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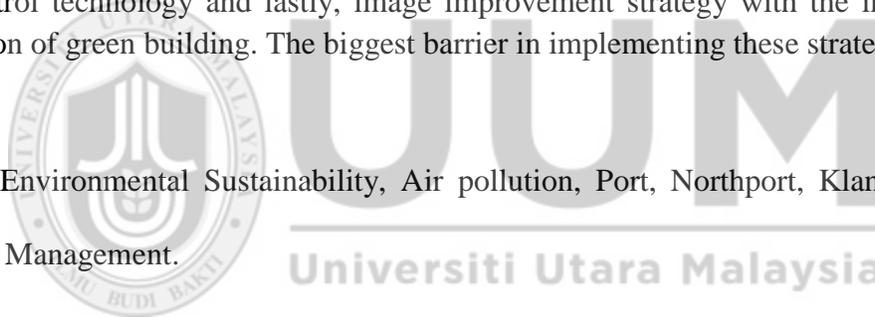
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Abstract

Environmental sustainability, a focal point for the government of Malaysia, is also important in developing business sustainability for businesses including ports. Following this, the research objectives of this study were threefold: 1) investigating the impact of strategies implemented by Northport, Klang in order to be environmentally sustainable, 2) ascertaining the priorities of these strategies and 3) determining the barriers or challenges faced by the port in its efforts of implementing the strategies. Using qualitative research design, data was collected through semi-structured interview with the officers in charge of environment at the Northport, Klang, Malaysia. Findings indicate that strategies implemented by the port have been successful in their efforts to reduce emission and improve air quality, a big step in being environmentally sustainable. Several criteria were used to prioritize the strategies, chief among them being implementation cost and time, maintenance cost and reduction of carbon emission. In terms of priority, the first strategy was operational strategy in terms of vessel speed reduction initiative, followed by infrastructure and equipment strategy with equipment and engine replacement and emission control technology and lastly, image improvement strategy with the initiative of the implementation of green building. The biggest barrier in implementing these strategies was cost.

Key words: Environmental Sustainability, Air pollution, Port, Northport, Klang, Sustainable Supply Chain Management.



Abstrak

Kelestarian persekitaran, adalah tumpuan utama bagi kerajaan Malaysia, di mana ianya adalah penting dalam membangunkan kelestarian perniagaan untuk perniagaan termasuklah di pelabuhan. Berikutan itu, objektif utama kajian ini terbahagi kepada tiga: 1) mengetahui impak terhadap strategi yang telah digunakan di Northport, Klang untuk menjadi persekitaran yang lestari, 2) menentukan keutamaan di dalam setiap strategi dan 3) menentukan halangan dan cabaran yang dihadapi oleh pelabuhan dalam usaha melaksanakan strategi. Dengan menggunakan kaedah kajian kualitatif, maklumat diperolehi melalui temu bual separa berstruktur bersama pegawai yang bertanggungjawab terhadap persekitaran di Northport, Klang, Malaysia. Dapatan kajian menunjukkan bahawa strategi yang dilaksanakan oleh pelabuhan telah berjaya dalam usaha mereka untuk mengurangkan pencemaran dan meningkatkan kualiti udara, ianya adalah satu langkah yang besar di lakukan untuk mendapatkan persekitaran yang lestari. Beberapa kriteria digunakan dalam mengutamakan strategi, yang paling utama adalah kos dan masa pelaksanaan, kos penyelenggaraan dan pengurangan kadar pencemaran. Dari sudut keutaaman, strategi pertama adalah strategi operasi dengan inisiatif mengurangkan had laju kapal, diikuti dengan strategi insfrastuktur dan peralatan melalui penukaran peralatan dan enjin serta menggunakan teknologi mengawal pencemaran dan akhir sekali, strategi peningkatan imej dengan inisiatif melaksanakan bangunan hijau. Kos adalah halangan utama dalam melaksanakan strategi ini.

Kata Kunci: Kelestarian persekitaran, Pencemaran udara, Pelabuhan, Northport, Klang, Pengurusan rantai bekalan yang mampan

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List of Abbreviations

- CO₂** - Carbon dioxide emission
- DOE** - Department of Environment
- HFO** - Heavy fuel oil
- IAPH** - International Association of Ports and Harbours
- ICS** - International Chamber of Shipping
- IMO** - International Maritime Organization
- LNG** - Liquefied natural gas
- LPG** - Liquefied petroleum gas.
- NO_x** - Nitrous Oxide
- PM₁₀** - Particulate Matter
- SO_x** - Sulphur oxides
- TEU** - Twenty - Foot Equivalent Unit
- UNCED** - The United Nations Conference on Environment and Development
- UNCTAD** - United Nation Conference on Trade and Development
- WCED** - World Commission on Environment and Development
- WSSD** - World Summit on Sustainable Development

CHAPTER 1

INTRODUCTION

1.0 Introduction

In the era of globalisation and the rapid expansion of world trade, ports are crucial links in contemporary supply chains and logistics processes, serving as transport hubs with their intermodal transport networks (sea, road, rail and inland shipping) (Pettit & Beresford, 2009). Therefore, seaports have become an essential part of the maritime transport industry and play a key role within integrated transport chains (Cullinane, 2002; UNCTAD, 1996).

It is very important for the port to provide efficient, adequate and competitive services to better service its customers (Okeudo, 2013). Time and cost play an important role especially for the vessel owner because if the port provide inefficient services resulting in cost increase and slow movement at the port, the vessel owner will probably go elsewhere as there are many other ports that can serve their need with better services.

According to International Maritime Organization (IMO) in 2011, there are about 2,814 international ports catering to freight traffic in the world. The movement of goods in the world trade have been increased rapidly, and, based on the Table 1, the amount of vessels that travelled and involved in the world seaborne trade is significant with the total number of vessels estimated around 47,122 vessels. Out of this estimate, 41,215 vessels comes from the world top 35

countries where all types of goods were being transported from port of departure to the port of destination and vice versa (these number of vessels however, excludes fisherman boat and leisure vessels).

Table 1: Total number of vessels in the world

Country or territory of ownership	Number of vessels		
	National Flag	Foreign and international flag	Total
Total top 35 countries	16,606	24,609	41,215
Total of known country of ownership	19,261	27,131	46,392
Others, unknown country of ownership			730
World total			47,122

Sources: UNCTAD (2013)

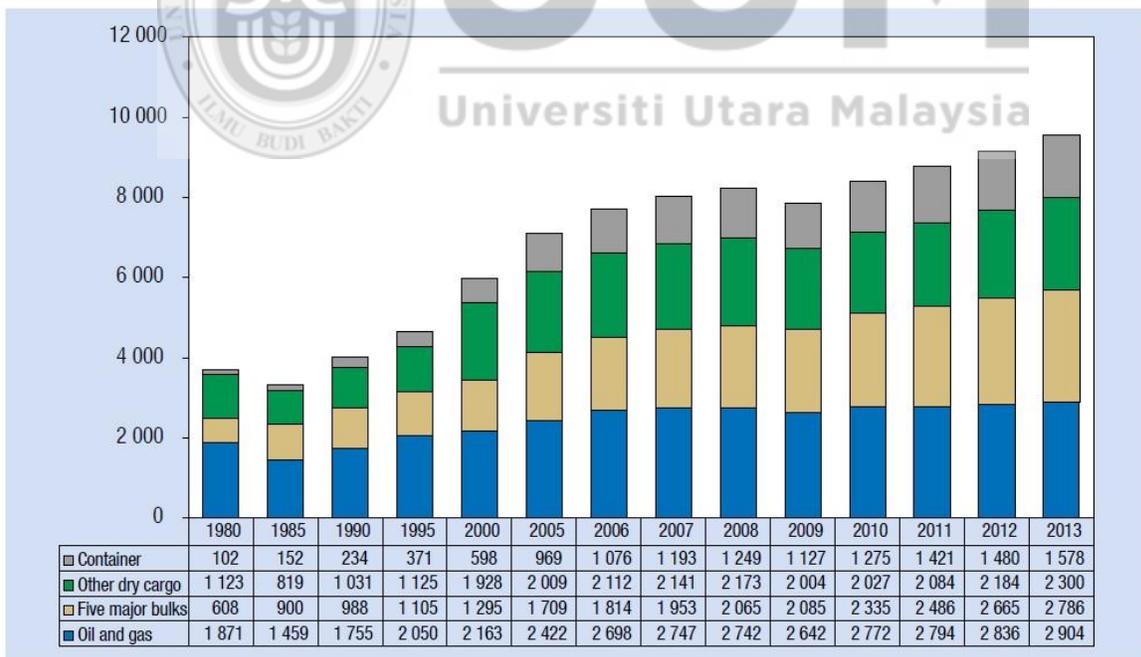
Parallel to the importance of the containerization in the world trade nowadays, container vessels are also increasing their size and capabilities to cater the demand in using container. Maersk Line, for example, took a giant step by introducing their largest container vessel that can carry up to 18,000 TEU in 2013. This improvement on the container vessel is because of the need to gain economies of scale in transporting containers from its port of origin to the destination port (Maersk Line, 2013).

Nowadays, approximately 90 percent of the international trade is carried by sea. In 2012, world seaborne trade exceeded 9.2 billion tons compared to 8 billion tons in 2009, where it were loaded

in port worldwide, with tanker trade which carries crude oil, petroleum products and gas accounting for less than one third of the total trade.

Cargo handling methods keeps improving and with the implementation of containerization, the world trade has shown a significant growth. The rise of containerization method indicates that a port will be moving the container to import and export basis with million TEUs involved annually (UNCTAD, 2002). However, as shown in Figure 1, the numbers of containers handled in the world's ports have slowed significantly in 2012 with volumes increasing only by 3.2 per cent, down from 13.1 per cent in 2010 and 7.1 per cent in 2011, but the world seaborne trade is still increasing annually and showing growth (UNCTAD, 2013).

Figure 1: The International seaborne trade, selected years (Millions of tons loaded)



Source: UNCTAD (2013).

Following the initial introduction to the current situation of world port and seaborne trade, the next section presents the background of the country where the fieldwork was conducted and includes a description of Northport on which the study was based.

1.1 Malaysian port overview

Located in the central of the South East Asian region, Malaysia is an oceanic state where the country is being separated by two main seas: South China Sea and Indian Ocean. Since the beginning of the trading era, both of this seas connected the west and the east and vice versa through the straits of Malacca. According to Paw and Diamante (1995), Malacca Straits has been an important route for local and international maritime trade and traffic for centuries. It is also one of the most important thoroughfares in global commerce which carry 40 percent of the world's trade.

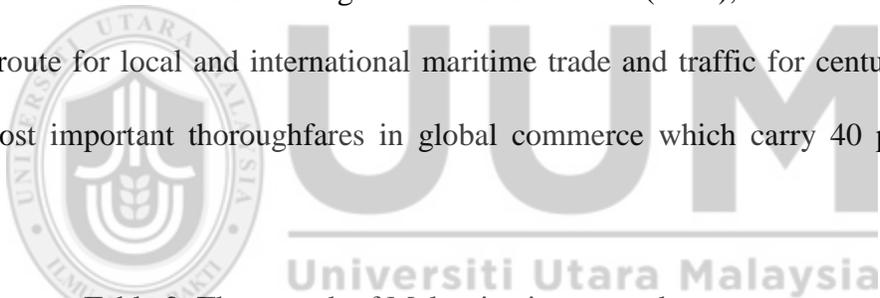


Table 2: The growth of Malaysian import and export

	2012	2013	Country comparison to the world
Export	USD227.7	USD230.7	25
Import	USD186.9	USD192.9	27

Source: CIA Factbook (2014)

Base on Table 2, in terms of current economic growth, the estimation of Malaysian export in 2013 was USD230.7 billion while import was around USD192.9 billion. Both this number showed that there was an increase in trading growth rates if compared to the previous year where in 2012 the export and import, both was USD227.7 billion and 186.9 billion respectively.

With major trading partners such as Singapore, China, Japan, USA, Thailand, Hong Kong, India, Australia, China, Singapore, Japan, US, Thailand, Indonesia, South Korea, the economic growth in Malaysia projected to further increase in the future (CIA Factbook, 2014). Beside the advantageous geography that Malaysia have, which is located at the centre of the important route in maritime trading industry, these growth give the opportunities for Malaysian ports to not only serve as transshipment hubs but also as an attractive port for vessel to berth not only in the short run but also in the long run.

Table 3: Total Container Throughput

No	Port		First Quarter (TEU)	Second Quarter (TEU)	Third Quarter (TEU)
1	Klang	Export	428,671	472,638	477,011
		Import	434,981	494,661	489,197
		Trans-shipment	1,541,816	1,651,233	1,693,727
		Total	2,405,468	2,618,532	2,659,935
	Grand total	Export	842,359	913,683	919,466
		Import	810,145	901,166	899,209
		Trans-shipment	3,352,896	3,434,775	3,493,794
		Total	5,005,401	5,249,624	5,312,469

Source: All Ports and Marine Department (2014)

Note: TEU = Twenty - Foot Equivalent Unit

Department of Statistics Malaysia reported that in 2012, the grand total of container throughput in ten major ports in Malaysia is 5,174,398 TEU. However, based on Table 3 in only the third quarter of the 2013, the total of container throughput increased to the 5,312,469 TEU. Port Klang is the busiest port among all others in Malaysia as the port handles the most containers in Malaysia for about a total of 2,659,935 TEU which include export, import or transshipment container.

Port is a very important industry in Malaysia and the former Malaysian Prime Minister, Tun Dr Mahathir Mohamed in the IAPH's World Port Conference in Kuala Lumpur in May 1999, where he stated that the port sector has always played a major role in the development of a country's economy and this contribution is expected to increase in the future. A well-developed port infrastructure is a vital part of an efficient trading system and network. The most efficient and cheapest method of moving goods is still by sea transport. He also added that no matter how information technology advances, the world trade cannot materialize without ports. This is valuable assets and therefore every country needs to develop much more advanced and efficient ports for its prosperity. The next section provides a description of Northport, Klang, where this study is based on.

1.2 Northport, Klang, Malaysia

Northport, situated at Port Klang Malaysia is owned and corporated by Northport (Malaysia) Bhd, a fully Malaysian-owned and one of the largest private port operating companies in the region. The parent company of Northport (Malaysia) Bhd, (NMB) is NCB Holdings Berhad

(NCB), a transport conglomerate listed on the local bourse, also owns the largest container road haulage company in Malaysia (Northport, 2013).

Northport is one of the largest multi-purpose ports of its kind in the national ports system offering dedicated facilities and services to handle wide variety of cargoes ranging from containers to cars, break bulk cargoes as well as capacity to handle liquid and dry bulk cargoes of all types and shipment sizes. Its facilities are located at two locations which is in Northport, Southpoint for conventional cargo handling and in Northport where the state-of-the-art container handling facilities are located. Northport logistics further adds value to the business entity (Northport, 2013).



The central role played by Northport has been strengthened by its ability to offer the most extensive global shipping connectivity compared with any other ports in the country. This has appropriately earned Northport the reputation as Malaysia's "World Port". The premier world-class port is now linked to many ports worldwide which are served by major shipping lines including several world-ranking container liner operators offering one of the most comprehensive range of shipping services in the region (Northport, 2013).

1.3 Problem statement

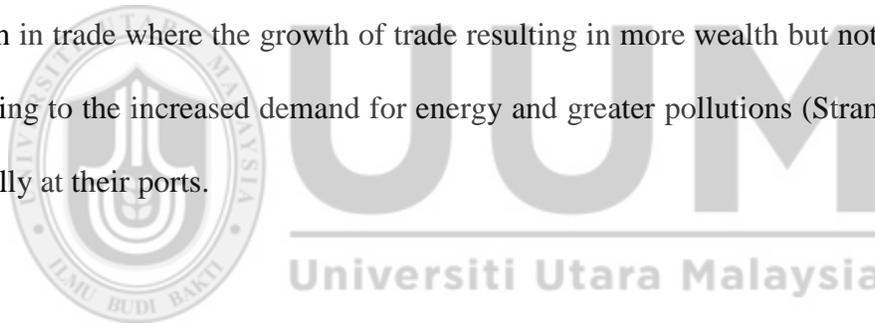
As presented earlier, ports are important as busy commercial, industrial and transport nodes playing a key role in the economic development countries and regions. Malaysian ports are not only seen as a medium for gaining profits but in order to compete and survive in the future, port should now turn to new strategies. Among those strategy is sustainability development. The widely accepted definition for sustainability development was provided by Gro Harlem Brundtland, former prime minister of Norway in the report "Our Common Future", also known as the Brundtland Report in which he defined sustainability as:

“Development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987).

According to sustainability's triple bottom line which are the economic, social and environment, companies (ports included), have always focused on the economic side and there has been less concern on social and environmental issues. However, companies are starting to realize the importance of focusing on environmental and social side for many reasons, chief among them being governmental pressure and survivability. For example, Malaysia, one of the Member State of the International Maritime Organization (IMO), are involved in international efforts as the pressure grows to make the maritime sector more eco-friendly (Khalid and Tang, 2010). With Malaysia's strategic location along the Straits of Malacca, making it important for international navigation and global trade, it is more significant to apply and implement good environmental or green practices. As a consequence, in 2009, Prime Minister Dato' Seri Najib Tun Razak announced Malaysian commitment to reduce 40% of its carbon emissions by 2020 at the Copenhagen Conference.

As a result of the rapid growth either in vessel development and the world seaborne trade, port will entertain bigger container vessel with more containers needs to be handle at the port and the container terminal. However, the concentration of shipping, land transport, port operation and development activities in a relatively small area represents serious safety hazards and risks of environmental deterioration.

Structural, operational or accidental pollution of water, soil and air may result from vessel accidents, bunkering, cargo handling and storage, port maintenance, port industrialization and port development. For example, in emerging countries such as China and India who undergoing a rapid growth in trade where the growth of trade resulting in more wealth but not only that, it is also contributing to the increased demand for energy and greater pollutions (Strange and Bailey, 2008) especially at their ports.



One of the major environmental impacts generated by ports is air pollution. There are several studies which specifically addressed the air pollution generated at ports (Bailey and Solomon, 2004; Cannon, 2009; Corbett and Koehler, 2003) and these researches have shown that transportation plays a major role in contributing to environmental problems especially air pollution around the world with highest concentration in the seaports. According to International Chamber of Shipping (ICS) in 2013, transportation such as airplane, truck and cargo vessels with different sizes emits certain amount of Carbon Dioxide (CO₂) that contributes to the environmental pollution problems. The maritime trade and port industry are not exceptional as shipping mode also part of the contributor.

The problem of pollution is still under a lot of debate. The issue of climate change has become seriously important and the players in maritime and shipping industry have started to play their part in efforts to reduce carbon emissions. Nations worldwide have agreed to combat climate changes through various treaties and conferences such as the famous Kyoto Protocol Treaty and Copenhagen Conference. Society especially the government have started to be concern about the environmental and social effects that had been felt by society such as resources depletion, climate change and pollution which are beginning to occur more frequently.

Being environmentally sustainable is one of the most popular strategy in business industries especially in port and maritime industry as it consist lots of major players that contributes to emissions in the port. As a result of the increasing use of shipping mode, land transportation focusing at the ports (truck, van and rail) and equipment used in cargo handling at port, the enhanced appreciation of the need for sustainable development in port is important (Hiranandani, 2012), especially in the environmental issues (Breitling, 2010; I2S2, 2013; Lam and Voorde, 2012; MPC, 2010; Kolk and Van Der Veen, 2002; UNEP, 2012).

As with other ports around the world, Northport, Klang handles wide range of activities such as loading and unloading, storage, warehousing and cargo containers cargo services. All these activities require the use of heavy duty equipments that are associated with high smoke emissions that contributes to the air pollution. The emission from the equipment poses health risk to the employees, contractors, port users and community living around the port.

From the environmental assessment and data collected in 2013, Northport, Klang was found to be emitting huge amount of carbon emissions staggering a total of 40,723,931 or 40.72 million kg CO₂ per year thus contribute air pollution from its business activities (Northport, 2013). Merk (2014) also stated that besides the port of Singapore, Hong Kong and Tianjin in China, Malaysia Port Klang is one of the ports with the largest absolute emission levels in the world. Based on this environmental assessment and in line with Malaysian government commitment in Kyoto protocol and Copenhagen Conference 2009, the port started developing environmental strategies in reducing the carbon emissions in its vicinity.

However, there is very little research that has been done specifically to identify the impacts of the initiatives taken by ports in reducing its pollution problem and the effectiveness of the initiatives. Nor are there much knowledge known on potential barriers that port may face in its efforts to reduce pollution. Hence, there exist knowledge gaps in this area, where this study intend to start to fulfil.

1.4 Research Questions and Objectives

From the initial investigation, the researcher know that in order to contest the problems of huge carbon emission (as evidenced in the environmental assessment and data collected in 2013), Northport, Klang has devised a Green Master plan with which was used as a guideline to implement their environmental sustainability initiatives (these initiatives will be presented in

much detail in Chapter Four). What we don't know is how effective are these strategies in achieving the environmentally sustainable objectives that the port is aiming for. Do the strategies or initiatives implemented by the port reduce the environmental problems faced by the port? What are the impacts of these strategies or initiatives on their environmental sustainability efforts? Therefore, the first objective of this study is to ascertain the impact of the strategies implemented by the Northport in their efforts to be environmentally sustainable.

Once the effectiveness of the strategies is ascertained, the next question would be which one of those strategies are most effective and which are least? All businesses including ports have limited amount of resources and they need to know which strategies are most effective so that they can concentrate more on these strategies and make the most out of their investment. So far, there have been little efforts in ranking or prioritising these strategies based on their efficiency in efforts to be environmentally sustainable. Therefore, the second objective of this study would be to determine the ranking of the strategies based on its impact on environmental sustainability.

While implementing these strategies, have the port encounter any barriers or challenges that could hamper the successful implementation of the strategies? Knowledge of barriers or challenges in implementing any strategies is always useful as it would help in determining a more successful implementation plan for the future. Therefore, the third objective of this study is to examine the challenges or barriers that Northport, Klang's administration faced in undertaking and implementing its environmentally sustainable strategies.

1.5 Scope and Significance of the Study

This study aims to look into the aspects of impacts of the strategies that the port have implemented in order to achieve environmental sustainability. The impacts of the port environmental sustainable development strategy would lead to the improvement of the port development especially in its operation and performance in Northport, Port Klang. A clear view on the sustainable development in the long term would assist the port to become more sustainable, profitable, efficient and attractive in the future. This study also contributed to the better understanding about the impact of the sustainable strategies, ranking of effectiveness among the strategies as well as better understanding of the barriers and challenges faced by the port in the course of implementation of the environmentally sustainable strategies.

1.6 Structure of the dissertation

This dissertation is divided into five chapters. The present Chapter One provides an introduction and context to this study.

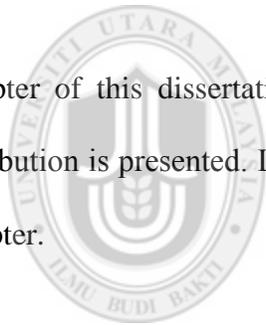
Chapter Two deals with literature review and analysis to provide a general overview of the main topic studied in this research. Definitions as well as past studies are reviewed and analysed to provide the foundation to this topic.

In Chapter Three, the study's research design and methodology are presented. The research design section discusses the study design, sampling design and research instrument (interview

questions). The data collection method section details how data was collected through interviews. Lastly, this chapter discusses how data collected during interviews were prepared and analysed.

Chapter Four presents results and discussion of the investigation on impact of the strategies implemented by the port in order to be environmentally sustainable as well as the ranking of the strategies in its order of effectiveness. It goes on to present findings on the barriers or challenges for the uptake of strategies for environmental sustainability.

The last chapter of this dissertation, Chapter Five, is where conclusions are drawn and the study's contribution is presented. Limitations and future research directions are also presented in this final chapter.



CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

The objective of this chapter is to review and analyse the literature associated with the topic of this study in order to provide a general overview and understanding of the relevant fields involved in this research – environmental sustainability and sustainable developments with focus on the port sector. A general discussion on the environmental issue will also be provided to understand the linkage of these fields and to prepare for a more specific discussion environmental issue of air pollution.



2.1 Sustainable development

First concern and awareness about the environmental perspective arise in the 1972 Stockholm Conference on the Human Environment, when they were the one who first acknowledge the conflicts between environment and development. In 1980 World Conservation Strategy of the International Union for the Conservation of Nature also stressed that conservation of the nature and environment is a means to assist development.

The starting turnaround in using sustainable development is when the World Commission in Environmental and Development was initiated by the General Assembly of the United Nation in

1982 where then later in 1987 in its report “Our Common Future’ chaired by former Prime Minister of Norway, Gro Harlem Brundtland defining the sustainable development that were acceptable by all. In the report which also known as “Brundtland Commission”, brief definition of sustainable development can be defined as:

“Ability to make development sustainable—to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs”.

Since then, major international meeting was held as an effort to attain sustainable development especially to solve the environmental issues and problems. The United Nations Conference on Environment and Development (UNCED) in Rio De Janeiro in 1992 which also known as the ‘Earth Summit’ issues a declaration of principles, a detailed Agenda 21 of desired actions, international agreement on climate change, biodiversity and forest. World Summit on Sustainable Development (WSSD) in Johannesburg, South Africa, was then held in 2002 to reaffirm the commitment towards sustainable development (Kates, Parris and Leiserowitz, 2005).

There are also other researchers that define sustainability development in their own ways where they believe that their definition reflect the true meaning of sustainability development. According to Harris (2000), sustainability development can be defined as business strategies and

activities that meet the current and future needs of the port and its stakeholders, while protecting and sustaining human and natural resources. The President's of the Council on Sustainability Development (1996) stated that, sustainability development can be defined as an economic growth that will benefit the present and future generations without detrimentally affecting the resources or biological systems of the planet. Besides that, even though the definition of sustainability development differs from one another based on researcher perspectives, the main goal for sustainable development is not change which is to sustain and to protect for certain period of time especially in the -long-term basis (UNCTAD, 2013).

Now, it already over two decades since sustainable development first acknowledge throughout the world in 1987. Industries, governments, policy makers and even societies gain a lot of knowledge throughout the years as the researchers continuously researching about the sustainable development. In term of how to achieve sustainability development, Patel (2011) highlighted that stakeholder and market orientation is the key players in developing sustainable competitive advantage and creates long term value where it can improve firm performance.

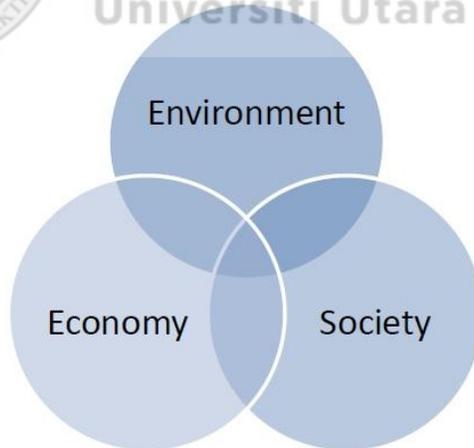
Perrini and Tencati (2006) also stated that corporate sustainability, that is the capacity of a firm to continue operating over a long period of time, depends on the sustainability of its stakeholder relationships. Wagner (2011) concluded that other than stakeholder and customers pressure, there is evidence that sustainability goals and corporate strategy helps to integrate sustainability into what the organization does. This is also shared by Steurer et. al. (2005) in his study where it

was found that sustainable development can be achieved through stakeholder relations management in which it is very important to care about the respective stakeholder claims.

Malaysian Productivity Corporation (MPC, 2010) believed that sustainability can be achieved by developing a sense of citizenship in the sustainable development process through the delivery of quality education, a reappraisal of its core values systems and the empowerment of communities to make their own decision on the future. The initiatives can come from the efforts of the individuals itself or the efforts of the organizational as both of them play an important role in achieving sustainable development.

2.2 The three pillar of sustainability

Figure 2: Past and current consideration on Sustainability development



Source: Elkington (1994)

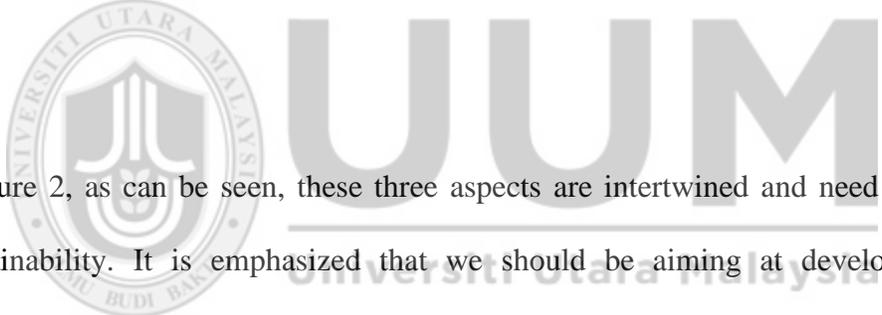
According to Elkington (1994) which was later further developed by Carter and Rogers (2008), the three pillars of sustainability consist of economy, environment and social. Defining the pillars is crucial in understanding the sustainability development.

(a) The social sustainability which requires that the cohesion of society and its ability to work towards common goals be maintained. Individual needs, such as those for health and well-being, nutrition, shelter, education and cultural expression should be met (Gilbert et al, 1996). The processes that generate social health and well-being now and in the future, and those social institutions that facilitate environmental and economic sustainability now and for the future (Dillard et al., 2009). Problems like war, endemic poverty, widespread injustice, and low education rates are symptoms a system is socially unsustainable



(b) The economic sustainability is using the resources that the organization has in both efficient and responsible ways so that the business not only making a profit but the operation and also that it did not creating environmental concerns that could cause harm to the balance of the local ecology. It occurs when development, which moves towards social and environmental sustainability, is financially feasible (Gilbert et al, 1996). Thwink.org (2014) defined economic sustainability is the ability of an economy to support a defined level of economic production indefinitely. Since 2008 this is the world's biggest apparent problem, which endangers progress on the environmental sustainability development.

(c) The environmental sustainability is defined as “meeting human needs without compromising the health of ecosystems” in the “Our Common Future” report by Brundtland Commission. Morelli (2011) then defined it as a condition of balance, resilience, and interconnectedness that allows human society to satisfy its needs while neither exceeding the capacity of its supporting ecosystems to continue to regenerate the services necessary to meet those needs nor by our actions diminishing biological diversity. Besides that, the ability of the environment to support a defined level of environmental quality and natural resource extraction rates indefinitely. This is the world's biggest actual problem, though since the consequences of not solving the problem now are delayed, the problem receives too low a priority to solve (Thwink.org, 2014).

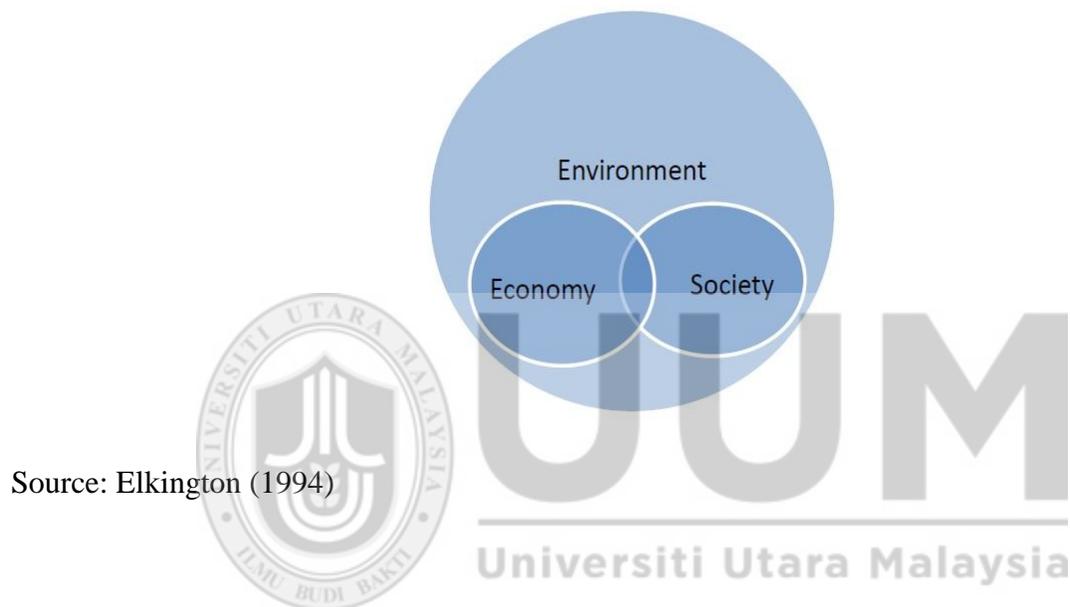


Based on Figure 2, as can be seen, these three aspects are intertwined and need each other to achieve sustainability. It is emphasized that we should be aiming at development which combines economic, social, and environmental aims, not at development which compromises between them (Anderson, 2011).

The main objective of sustainability is developing and implementing the proper methods to balance the three pillars which is the economic, social and environment allowing prosperity for now and future generations and the benefits to business for adopting greener and resource efficient practices are obvious, and the consequences to business of ecosystem collapse are disastrous. However, it is reported that significant barriers remain, most notably the deep-seated

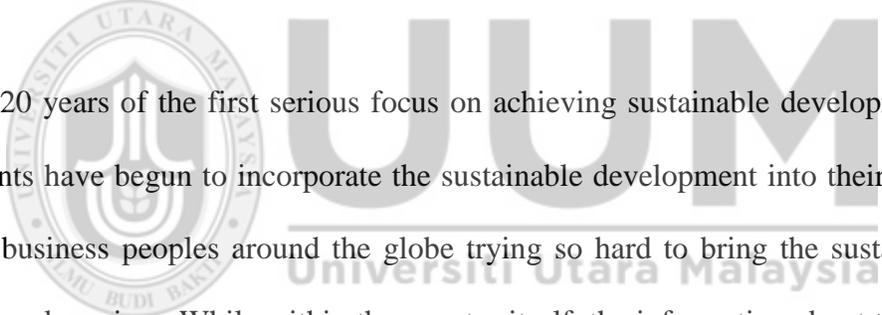
financial short-termism that exists in businesses, markets and governments are the factors that restraining the achievement of sustainability.

Figure 3: Protecting the environmental the main idea for sustainability



Even though there are various definition of sustainability development, based on the three pillars of sustainability, based on Figure 3, the environmental sustainability strategy has become very important and popular among the firms who are trying to establish the sustainability development for their firm and the most crucial aspect that they will focus is on protecting the environmental as it is the main idea for sustainability (Breitling, 2010, I2S2, 2013, Lam and Voorde, 2012, MPC, 2010, Kolk and Van Der Veen, 2002, UNEP, 2012).

After that, the economic and social component comes into places. In the past, human has only focus towards profit maximization and without thinking about the impact of their eagerness to gain profit will damage the environment in the future. This is exactly what we have seen in time when a lot of trouble causes by greed of the past such as climate change, air pollution, water pollution and many more other negative environmental issues arise. This leads to the conclusion that just finding a balance between giving sufficient attention to the three pillars of sustainability is insufficient. The balance should be found in the outcomes of these pillars, which means that support for environmental sustainability needs to be beefed up. Otherwise it stands to lose out (Coninck, 2011).



Over the last 20 years of the first serious focus on achieving sustainable development, most of the governments have begun to incorporate the sustainable development into their planning and policies. The business peoples around the globe trying so hard to bring the sustainability into their products and services. While within the country itself, the information about the advantages and importance of sustainable development continuously being informed to the citizens and societies as an initiative locally (Strange and Bailey, 2008).

Because of that, nowadays, there are lots of drivers that push for the implementation of the sustainability development such as supporting mission of the organization, relationship with the key stakeholders, resource limitation and cost increases and to see a return on investment in sustainability, motivations for going green must be in line with stakeholder or customer requirements (Harris, 2000). Increasing consumer awareness nowadays have made business

players to adjust and change their ways of operating by putting sustainability into their businesses to meet the expectation of the investors which in the economic perspectives can give value to the firm back but at the same time have to put the long term impact that the operations have on the community and the environment to ensure stability between them (Prokesch, 2010).

In a survey of a large 3PL firms found that there are five important reasons for the firms in establishing the sustainability in the firm which identified as the desire to do the right thing, pressure from customers, desire to enhance company image, desire to attract green customers and competitive resources (Lieb and Lieb, 2010). According to Taneja et. al. (2012), they listed five crucial drivers for sustainability which are the concern over availability of natural resources, the growing pollution, global warming, climate change and increasing awareness among the society. These reasons to have very strong evidence that the environmental aspect is mostly why every player in every industry, the governments and the policy makers focusing on right now as it will impact the future in overall.

The most influence driver is the compliance with the environmental regulations which drives ports to incorporate environmental considerations into their activities and plans. It is a non-negotiable aspect of operations and the decision to go beyond compliance has become parts of ports' long term business planning. Examples for integrating environmental initiatives, economic benefits and community is by making a commitment to ISO 14001 where Port of Corpus Christi⁴ and Virginia⁵ are the example of ports that shows its commitment towards achieving the environmental sustainability.

2.3 Environmental issue of air pollution

As one of the major pollution problems, air pollution plays significant role in the development of the strategies in the maritime industry. In port, before developing strategies to reduce the air pollution issue, the sources of the pollution at the port need to be identified first. Based on Table 4, focusing on air quality in which it have an impact on human health, the potential sources of environmental impact at port is on the operational activities of the vessels and port operations (GHD, 2013).

The emission of the vessels or it can be called the ocean going vessels and port operations, contribute to the emissions of nitrogen oxides (NO_x), sulphur oxides (SO_x), and particulate matter (PM) (Corbett and Fishbeck, 1997; Bailey et al. 2004; Harrison, 2007), in which this type of pollutions have been proven to affect the human health which include increased risk of premature death from heart and pulmonary diseases and worsened respiratory disease (Friedrich et al., 2007).

Table 4: Potential source of impact and risk in operational activities on air quality

Environmental impact or risk	Description	Potential sources of impact or risk: operational activities
Air quality	Air quality may have an impact on human health and come from emissions from vessels and port equipment	<ul style="list-style-type: none">• Emissions from port operations (diesel particulate matter, Sulphur and nitrogen oxides etc)• Emissions from vessels (diesel particulate matter, sulphur and nitrogen oxides etc)

Source: GHD (2013)

This is supported by Miola (2009) who stated that port operations and the activities in the port are one of the sources of air emission at the port. From the summary in Table 5, from manoeuvring, loading and unloading/ operations on terminals, hotelling (lighting, heating, refrigeration, ventilation, etc.), dredging, land traffic (heavy vehicle, railway), waste disposal/illegal dumping, port expansion/ infrastructures construction and maintenance, bulk handling and goods movement to industrial activities is the contributor to the total emissions of air pollution in port. Thus, in general, all vessel activities in port lead to air pollutant emissions (Trozzi, 2003).

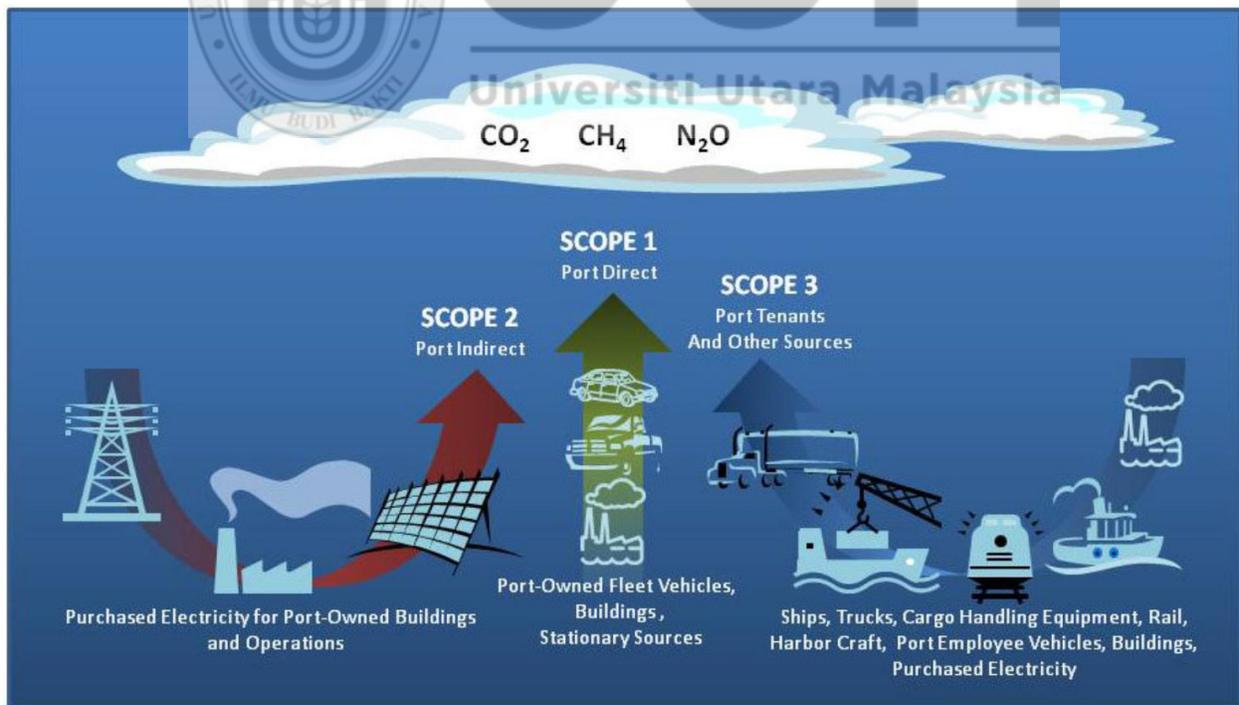
Table 5: Activities in port that impact local air pollution.

Activities In Port/ Impacts	Air Quality
Manoeuvring	Local Air Pollution (NO_x, SO₂, CO₂, CO, VOC, PM)
Loading and Unloading/ Operations on terminals	
Hotelling (lighting, heating, refrigeration, ventilation, etc.)	
Dredging	
Land traffic (heavy vehicle, railway)	
Waste disposal/illegal dumping	
Port expansion/ Infrastructures construction and maintenance	
Bulk handling and Goods movement	
Industrial activities	

Source: Miola et al. (2009).

According to Figure 4, the sources of pollution which has been organized by World Port Climate Initiative (WPCI) and International Association of Port and Harbour (IAPH) can be divided into three categories. The emissions for an organization like ports are often categorized in terms of “scopes” that indicate how directly or indirectly the emissions are generated. This scope will be the element for emissions models and different protocols which will result in different ways on implementing strategies for each scope. Scope 1 can be explained as the emissions that includes all direct Greenhouse gases emissions from a port’s directly controlled stationary and mobile sources. In this scope it includes the port owned fleet vehicles and port employees commute vehicles, stationary generators and building as the source of the emissions.

Figure 4: Port related emission sources



Source: Anderson and Carlock (2010)

The second scope indicates that the source of pollution includes the indirect emissions associated with the consumption of the electricity by a port. It includes the electricity used for port owned building and operations which indirectly are the emission contributors even though it can be control by port. Scope three, however likely account for the vast majority of the port emissions as it include the port tenants' direct emissions from mobile sources especially the vessels and harbour crafts. However, the actual scope of emissions at individual ports will differ significantly based on a wide variety of governance and operational models (Anderson and Carlock, 2010).

It is because that each port, no matter where it is located, has a unique set of geographic, political, community, operational, regulatory and financial circumstances that shape and define its environmental and sustainability initiatives. Therefore, each port has taken a slightly different approach to environmental initiatives, based on their unique circumstances. However, port that incorporated and developing environmental strategies usually started in implementing strategies that related to the direct source to the port (Environmental Initiatives, 2013; Ramani et. al, 2008). It is because, the direct sources which are scope 1 are directly related to the port and easy to be control.

Han (2010) explained that air pollution is not just about problems to the air quality of local and regional areas but also a concern because of the impacts to the public health and the greenhouse gas emission. The exposure to unhealthy air quality will resulted in cancer, heart and respiratory diseases and also includes the premature death. The port communities are burdened with responsibilities in reducing the emission in and around the port vicinity. It is because the

emission from port related activities significantly affect the health not only the port workers but also the society nearby the port area.

2.3.1 Strategy in reducing air pollution

Various studies have shown that there exist significant impacts when the port implementing the environmental strategies which will result in environmental sustainability. First most important thing that needs to be highlighted is that beside the environmental legislation enforcement, the fact that from a survey showed that 82 percent of businesses are willing to increase spending on green marketing. As a result of that, there are lots of strategies exist and appear nowadays in reducing the environmental issues especially the air pollution at the port. Those who manage to implement the best strategies at the port which translating the strategy into competitive advantage back to the port will surely gain not only the increase in profit but also in the performance of the port (Lam and Voorde, 2012).

The strategies in reducing the air pollution in the port can be categorized based on the type of implementation required which are the base on the operational, fuel-based, image improvement and infrastructure. In operational strategy, port can implemented the vessel speed reduction. This strategy can be taken to reduce the pollution sources of ocean going vessel (OGV). This strategy aims in reducing the emission of NO_x and PM₁₀ from ship which is calling in or out of the port. The speed reduction of the vessel must be around 12 knots which equal to 22.22 km per hour. The implementation of this strategy will not require the vessel to perform any changes but only changes the limits speed of the vessel. Besides that, the ports just need to have an updated radar

and communication device to ensure that the vessel speed reduction strategies will be efficient. The good manoeuvring management of the vessel upon arrival at the port gives positive impacts to the port. Rigot-Muller and Gibbs (2011) found that managing the arrival of the vessel by decreasing the speed of the vessel when approaching the port, able to reduce the emissions because it can reduce the waiting time and decrease the health and safety issues especially when the port have a high density of traffics. They also stated that, when the vessels at berth, in the hotelling phase, providing shore-side electricity is a good approach. It can reduce the emissions of NO_x and particulate matter (PM) by more than 95%.

When determining the emissions activities that contributed to the pollution concentrated at and around the port, the focus is on the manoeuvring and hotelling activity as it contributes to the large amount of pollution during this phase (Biona, 2013). Approximately 80 percent of the worldwide vessel is either harboured (55 percent of the time) or near a coast (25 percent of the time). This means most vessels spend only about 20 percent of the time at sea and far from land (Balkanski, 2010; Corbett et al. 1999). International Association of Ports and Harbours (IAPH) define hotelling as the period during which a vessel is secured at berth and the cargo from the vessel being loaded and unloaded at the port. While manoeuvring means the operation of vessels from a safety perspective, and covers the operation when leaving from or arriving to a port, vessel yard or anchorage area and navigation through narrow channels (Evirgen and Kilic, 2012).

Various researches have been presented within both academic and industry fields proven that vessel emissions comes from the manoeuvring and hotelling activity. Van der Meer (2012)

investigated the shipping emissions in ports of Delfzijl and Eemshaven. The author concluded that maximum concentration of pollution within 5km x 5km area around the port was resulted from the shipping maximum concentrated at the area. Besides that, the vessel that is berthed which is in the hotelling stage is the major source contributing to the emissions at the port. Fernandez and Perez (2012) showed that the air emissions by types of vessel in 2008 at Port of Barcelona, also stated that vessel at the port contributed to the large amount of NO_x and PM₁₀ in the manoeuvring and hotelling phases.

Other than that, Saracoglu et al. (2013) studied the emissions from vessels calling in Izmir Port, Turkey where the total emissions based on bottom up approach from shipping activity in the port is estimated as 1923 ton for NO_x, 1405 ton for SO₂, 82753 ton for CO₂, and 165 ton for PM in which most of the emissions released during the manoeuvring and hotelling phases. Thus, resulting to the critical health effects on people living close by.

Gore (2004) and Cross (2010) identified four basic reasons the idle reduction is important in order to reduce the air emission from the vessel which includes:

- i) High fuel costs: in where the longer it takes for the engine to operates, the more consumption of fuels needed which will particularly increase the need for more fuels.
- ii) Higher maintenance costs: Idling will lead to more rapid engine oil contamination, due to increased residue in the engine, resulting in an incomplete combustion cycle and condensation of unburned fuel on cylinder walls.

- iii) Increased emissions: while the vessel is in idle mode, still the engine operates and it emits pollutant into the air which can create environmental issues such as global warming and smog.
- iv) Health risks: when vessel in idle modes, the emission from the vessels that emits to the air around the port makes the air quality at the and around the port become unhealthy and this, in consequence, can create health problem not only to the workers at the port but also the communities around the port.

In the fuel based category, suggested that instead of using the heavy duty fuel switching it to cleaner fuels. In this category, the fuel plays an important role as it is the requirement and major aspects in all the contributor of the pollution sources. The fuels are required in ocean going vessels, cargo handling equipment, heavy duty vehicles, locomotive and construction equipment. Almost all the activities at port rely on fuel to generate its energy and as a result, port faced increasing issues of greenhouse gas emissions.

Each vessel required fuel to operate. It is the important element for vessel and approximately 67% of the world fleet use four stroke diesel engines for propulsion (Corbett, 2003). Usually the fuel types that been used by the international fleet nowadays are the heavy fuel oil (HFO) which contains residues from refineries processing of crude oil (Winnes, 2010). This type of fuel is characterised as high sulphur content and emit high sulphur emissions. However, fuels differ according to the need of vessel. Mostly, large vessels use bunker fuel which also known as crude

oil and others use the diesel oil. And nowadays, there are vessels that operate using the nuclear fuels.

Other than that, the reason vessel using different fuel is because vessels have a high fuel demand because of the continuous use of the main engine for propulsion and auxiliary engines and boilers for electricity and heat production while in port. Van der Meer (2012) stated that the commonly used fuel for the vessel is the residual fuel oil which has high sulphur and nitrogen contents compared to other types of fuels. As a result of that, IMO (2009) started to develop a legislation concerning fuel efficiency and emission reduction measures for the shipping industry.

The types of the emission and air quality are depending on the content and type of the fuel. Townsend (2008) listed the major types of marine fuel in use which is:

1. Heavy Fuel Oil (HFO) – it is the least expensive fuel in marine transportation industry and it used on many world's largest commercial vessels. However, because of the cost of the fuel is low, there are lot of disadvantages using this type of fuel. It is not only need lot of maintenance but also with the emission standard becoming tighter, the use of this type of fuel seem to be impractical.
2. Marine diesel fuel/marine gas oil – is a fuel that is blend of distilled fuel combined with small amount of HFO. This type of fuel has a low level of sulphur content however these fuels have become quite expensive.

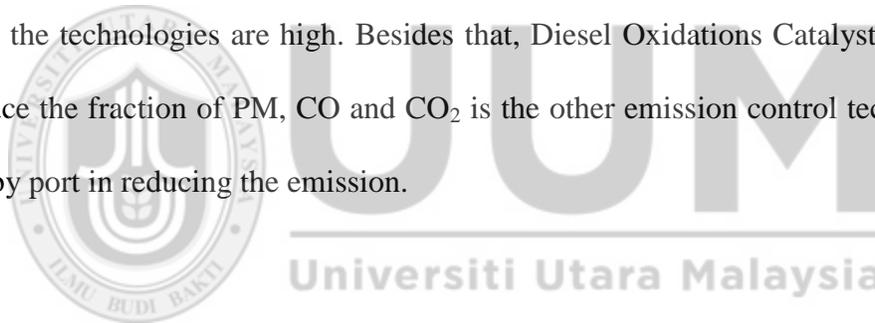
3. Natural gas – also known as marine propulsion on LNG vessels where it is the popular types of fuel of choice. It is because of the clean burning that allow low level of emission. However the natural gas must be stored as a liquid under pressure which makes it disadvantages.
4. Nuclear fuel – is for marine propulsion where it usually used for military vessels.
5. Biodiesel – is a clean burning alternative fuel for maritime industry. This type of fuel burn cleaner than conventional diesel distillates and environmental friendly.

There are lot of changes in regulatory and environmental changes which makes the fuel that the vessel used becoming more important matter to bring forward as it can give challenges and disadvantages to the vessels in the future. So, the types of fuel where it can also affect the amount of emission emit to the air because different types of fuel reflects different amount of emission. The types of fuels also can reduce the amount of air pollution in and around the port and create an environmental sustainability port operation.

The strategy that related to infrastructure and equipment is the third category that port implemented to reduce the pollutions. In doing so, firstly looking into the first strategy in the infrastructure and equipment category is the equipment and engine replacement. This is when the ports switch and replacing the old engines or equipment with new ones to aim in improving the environmental efficiency. In using this strategy, the most affected mostly related contributor are

the cargo handling equipment, heavy and light duty vehicles, locomotive and construction equipment.

Besides that, the emission control technologies also one of the ways in reducing the emission that comes from the pollution sources such as cargo handling equipment, heavy and light duty vehicles, locomotive and construction equipment. Ports worldwide have implemented various emission control technologies in their port. Some of the technologies that efficient in reducing the air pollution are the Diesel Particulate Filter (DPF) which is the most effective technologies that reducing the amount of particulate matter (PM) up to 90 percent. However, the costs of implementing the technologies are high. Besides that, Diesel Oxidations Catalyst (DOC) which aim is to reduce the fraction of PM, CO and CO₂ is the other emission control technologies that usually used by port in reducing the emission.



Swaine and Hatic (2008) stated that the port can achieve the environmental sustainability by switching to cleaner low or ultra-low sulphur diesel fuels in providing emissions reduction at the port. However, the cleaner the fuel, the higher is the cost compared to heavy duty fuel. In strategy related to technology, the port can use the retrofit, repower or rebuild the equipment strategies in reducing the emissions. Besides that, also in reducing the emission at the port, suggested that the port used the infrastructure and replacement strategy as the initiative to achieve environmental sustainability.

2.3.2 Strategic Assessment

In assessing the strategic initiatives in ports, criteria that need to be looks into are the cost of the implementation as it is the main criteria as the cost is the key concern of any businesses. In port, each cost of the operations leads to the decrease of the profit. It means that, the port and the port decision makers need to determine the environmental feasibility and calculating the expected cost and benefits of the strategies implemented. In doing so, port can adopt the most cost effective and bring the most environmental impacts to the port air emission quality (Lam and Voorde, 2012).

Besides that, maintenance costs also play an important role in determining the best criteria that the port used in selecting the initiatives in reducing the air pollution. It is because, the cost to maintain the strategies in the future and in the long run are most important and if the initiatives not being maintain well, the strategy will become useless in the future and resulting in the losses either money or the port properties (Gore, 2004; Cross , 2010). The implementation time needed in implementing the strategies is also part of the criteria in selecting the strategies in reducing the air pollution.

This means that, the time needed to set up the strategies to ensure that the strategies properly running and functional. Technicality of the strategies also plays an important role in creating the best initiatives in reducing the air pollution. It is because as more complex the strategies are, the more difficult it will be as it will not only takes times for the implementation but also perhaps will affected the operation of the ports.

2.4 Summary

In this chapter, the definition of sustainable development was provided and the importance of environmental sustainability discussed. Environmental issues with particular focus on air pollution were also presented. Other than that, previous studies on strategies that have been implemented including the criteria for strategic assessment in ranking the strategies other ports were reviewed and presented. The next chapter presents the research design and methodology employed to answer this study's research questions and fulfil its related research aims.



CHAPTER 3

METHODOLOGY

3.0 Introduction

This study was conducted in the context of Northport, Klang in Malaysia with environmental sustainability as the main framework. The research objectives of this study are threefold. The first is to examine the impact of environmental sustainability strategies implemented by the port. The second is to prioritise the impact of the strategies and the third is to ascertain the barriers or challenges faced by the port in its efforts to be environmentally sustainable. This chapter presents a detailed description of how the present research was designed and conducted. It will cover sampling design, research instrument, and the data collection and analysis method.

3.1 The research design

3.1.1 Study design

As the main purpose of this study is to explore and identify the impacts of the sustainable development practices that the port operations implemented, then a qualitative research approach design was employed. An inductive approach is used during the process. The inductive approach helped the authors to condense a pile of raw data (data reduction), to link up the summary from the data with the research objectives. Based on this design, the main reason to use qualitative approach is to have a better understanding about the practices that the port uses which allows the researcher to analyse and compare the findings and possibly knowing the best method which

reflect the most favourable environmental sustainable development initiatives that the port uses for their long term development programme.

Differentiating the qualitative and quantitative is the best first steps in understanding the differences which either will give advantages to the flow and process of the research or it will be disadvantages to the researcher. According to Ranjit Kumar (2013), if the researcher want to strive and be specific and attempt to narrow the magnitude of the study, the quantitative approach will be chosen. But, to maintain the flexibility, openness and freedom to include any new ideas and to understanding in depth about the research study, the study should choose the qualitative approach.



Other than that, the qualitative study is categorized by emphasis on describing, understanding and exploring the phenomena where there is no specific need to build and test the hypothesis as in the quantitative approach. The goals between qualitative and quantitative research design differ from each other's where in qualitative, the goal is to gain insight, explore in depth about the phenomena whereas in quantitative, the goal is to test the relationships, describe, examine cause and effect relationship of the study topic.

Most important aspects in choosing the qualitative approach is because of the way in collecting the data which need to be flexible and dynamic with time, space and scope of the research. In efforts to be more accurate and gaining quality information, information was gathered from the

persons who are inside the organisation within which we want to study in order to have their view and experiences on the topic under study (Noraini Idris, 2010 and Ranjit Kumar, 2013).

3.1.2 Research design

There are several specific qualitative research approaches that can be used to further the research. Case study, ethnography, grounded theory, historical research, experimental research or action research can be selected to be conducted as the qualitative approach.

In this study, the researcher utilised the case study type design. There are several reasons for this decision. By selecting the case study design, the researcher is able to describe in depth the experience of the person in the institutions where the method in doing so is by using direct observation and interaction with the subject. Case study is also useful because by due to its ability to explore any area where little is known. Lastly, the researcher can also use it in cases where there is a need to have a holistic understanding of the situation, phenomenon, episode, site, group or community and also institution or organization is the general purpose of the study (Ranjit Kumar, 2013).

3.1.3 Sampling design

The research population for this study is the ports in Malaysia and as the study is using case study approach, the sample for this research is Northport, Klang, Malaysia. Purposive sampling method was employed where as stated by Ranjit Kumar (2013), by using the purposive sampling, the researcher can choose their respondent in where the researcher thinks that the respondent can best answer the research question and achieve the objective of the research. Besides that, Northport, Klang was chosen because of the limitation of time and cost in this study. By using this sampling method, the researcher can go to the people that are likely to have the required information and willing to share the information. The information gathered and obtained could be accurately described in order to answer the research questions.

3.2 Data collection and analysis method

3.2.1 Data collection method

In a qualitative research design, there are several methods that can be used to collect data. Observation, field research and interviewing are some of the method of collecting data using primary sources. In this study, data was collected using semi-structured interview.

Firstly, primary data which is the information about the study was collected through an interview using semi-structured interview questions that has been develop beforehand to ensure that the question that will be asked will not be going out of topic of the discussion. The interview

question is a written list of questions and prepared for the use by the interviewer in a person-to-person interaction.

The differences between structured and semi structured is that in semi structured interview, the mode of interaction is more flexible where there are freedom of asking question which are not in the questionnaire. It is because, by doing so, the questions that are not in the questionnaire that comes up in the middle of the interview session can be inserted into the report of the research study.

The reason why interview is selected is because it is commonly used method of collecting information from people and using interaction between the interviewer and interviewee to gather data. In using this method, the researcher have the freedom to ask question and decide the format, content and the order of the question because of the flexibility in using this method.

In conducting interviews in this research, the researcher follows the guideline from Noraini Idris (2010) in implementing the interview process. Data collection procedure for this study is firstly, the researcher develop and construct relevant questions that need to be asked to the respondents in the interview session. Then, a request for the permission of interview session and explanation of the purpose of the study were sent via email to get the approval from the respective department in the Northport, Klang Authority with the application letter that issued by the Ghazali Shafie Graduate School of Government, Universiti Utara Malaysia.

After gaining the approval of the respected department which is the Health, Safety and Environment department (HSE), the date of appointment was set where the person interviewed was the Environment Executive of the HSE department and the Marine Superintendent of the Marine Services department. These two persons were chosen as the respondents of the study because only certain people in Northport, Klang are involved directly with environmental sustainability strategies' implementation and therefore have the right knowledge, understanding and can respond well towards the objectives of this study.

3.2.2 Secondary sources

The secondary data used in this research was obtained from local and international journals regarding the research topic, the related books, articles and website in the internet and also reports from Northport, Klang. This method of data gathering is used because the secondary data are usually the past studies or research that other researchers had done and will help in further understanding of the topic under study.

3.2.3 Data analysis

The interview data was analysed by reviewing the tape recorded and notes that were taken during the interview session. Besides that, the narrative recording method was used where the researcher records the description in the researcher words. This method is used by making a brief notes while observing the interaction and then soon after completing the observation of the interview session makes detailed note in narrative form.

In term of interpreting the data collected, after going through descriptive responses given by respondent to each question from the interview, based on the main theme in the study which is the strategies implemented in Northport, Klang, the impacts and challenges, the response given by the respondents can be classify under this category. After identifying and categorising the responses based on their themes, the researcher then integrated the themes and responses into the report in order to achieve the objective of the research.

Overall, even though there are many ways in interpreting the data, the researcher followed the suggestions of Ranjit Kumar (2013) who suggested that the way in writing the finding is:

- i) Identifying the main themes that emerge from the transcription of the in depth interview

Using this method, content analysis is needed where to be able to analyse the whole content, the researcher needs to record all the respondent response either by taking notes or taping the interview session. It means that the researcher needs to analyse the transcription of the interview to identify the main themes that emerge in responses to the

answer given by the respondents. The process in doing so involves a number of steps which is:

Step 1 – Identifying the main themes where the researcher interpret the answer that the respondents give to each question to understand the meaning behind the answer. After going through the data that have been interpreted, the researcher comes out with a set of themes that reflects the meaning of the answer given. Even though the answer given differ from the understanding of the researcher, the researcher need to select the best accurate word to indicates the themes so that the answer given by the respondent are accurately in the right theme.

Step 2 – Assign codes to the main themes is the second step in the content analysis where the researcher need to code the answer that the respondent give in order to ensure that the answer that occurred in the transcription are not redundant. In this process, the researcher can eliminate and choose the right coding for each themes and get a clearer view on the overall content of the analysis that have been done.

Step 3 – Classifying the responses under the main themes. After that, the coding that has been done in the previous step, the researcher can classify the answers that have been coded based on the themes.

Step 4 – **Integrate themes and responses into the report.** Finally, after all the answer and the themes have been identified, the researcher can integrate which means that the theme and the answer of the content analysis can be put under the finding. Besides that, the best way to express the finding answer is to use verbatim responses where it ensure that it maintain the feel of the responses.

3.3 Summary

This chapter has presented an overview, description and justification for the chosen method of the research design and methodology used for this study. Qualitative method has been employed in the data collection and analysis in order to achieve the specified aims, and answer the research questions. Qualitative techniques were employed to understand more the phenomena under study, and to illustrate and further validate quantitative findings.

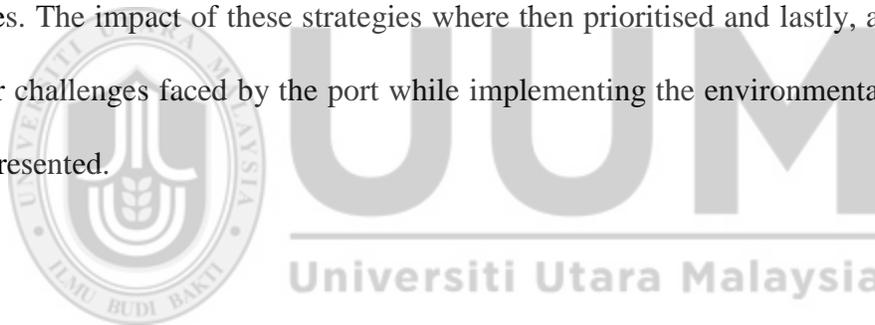
The next chapter will present the results of the environmental sustainability efforts of the respondent port. This will include the port's overview of the strategies implemented. In addition, the chapter will highlight the impact of strategies taken and barriers or challenges faced by the port in the course of implementing those strategies.

CHAPTER 4

FINDINGS AND DISCUSSIONS

4.0 Introduction

This chapter will present and discuss findings of this study and is organised based on the study's research objectives starting with a presentation on the environmental issues and the view of the port in terms of environmental sustainability. It is then followed by discussion on the strategies implemented by the port in their efforts to reduce environmental pollution and the impact of these strategies. The impact of these strategies were then prioritised and lastly, a discussion on the barriers or challenges faced by the port while implementing the environmentally sustainable strategies is presented.

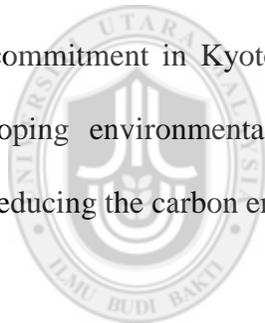


4.1 The environmental issues and view on environmental sustainability in Northport, Klang

Northport, Klang offers various services and facilities, i.e. handling wide variety of cargoes ranging from containers to cars, break bulk cargoes as well as have the capacity to handle liquid and dry bulk cargoes of all types and shipment sizes. With state-of-the-art container handling facilities, the port should be able to sustain itself in the industry for a long period of time.

However, there are several negative effects to the environment that is a consequence of the various activities in Northport, Klang that could lead to unstable environmental sustainability. In

recent years, Northport, Klang has started to be concern about the environmental issues related to the port activities and operations. Port activities that use heavy and large machineries and equipment consume huge energy sources. Currently, the fossil fuel and electricity is the two major types of energy used at Northport, Klang. These resources released carbon dioxide (CO₂) which is one of the greenhouse gases (GHG) that contribute to regional and global warming and eventually leads to extreme climate change. As stated earlier in the problem statement section in Chapter One, from the environmental assessment and data collected in 2013, Northport, Klang was found to be emitting huge amount of carbon emissions staggering a total of 40,723,931 or 40.72 million kg CO₂ per year thus contribute air pollution from its business activities (Northport, 2013). Based on this environmental assessment and in line with Malaysian government commitment in Kyoto protocol and Copenhagen Conference 2009, the port have started developing environmental management plan (using short and long term strategic planning) in reducing the carbon emissions in its vicinity.

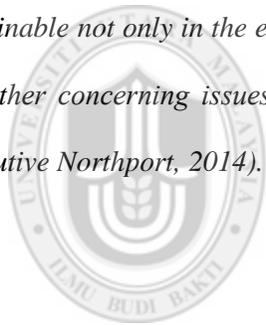


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Northport, Klang formulated its environmental management plan based on the guidelines set up by World Port Climate Initiative (WPCI) and from the International Association of Port and Harbour toolbox, with focus on reducing the air emission from Scope 1 which is the direct pollution that occurs in port and which the port can control. The department that was put in charge of overseeing this environmental management plan is the Health, Safety and Environment (HSE) department in Northport, Klang.

In general, Northport, Klang believes that the environment is the essential part in their business operations. Because of that, there are continuous strategies, initiatives and awareness programs conducted to ensure that the port not only gaining economic sustainability but also conserving the flora and fauna in each and every operation they have. They want to ensure that their operations do not cause negative implications in relations to the environmental issues which in return will give a very good image towards Northport, Klang. This is partly evidenced by a statement by a representative at the HSE department:

“We (Northport, Klang) have implemented initiatives in being environmental sustainable not only in the environmental issues of air pollution at the port but also in the other concerning issues of water, noise, and other pollutions”. (Environmental Executive Northport, 2014).



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The next section will discuss the impact specific strategies that the port has implemented to overcome the environmental issues that related to reduce the air pollutions.

4.2 Strategies implemented and its impact on environmental sustainability

4.2.1 Strategies implemented by Northport, Klang on environmental sustainability

With the focus on achieving better port performance, enhanced employee relations, building stronger relationships with communities, promoting favourable reputation and branding, improving risk management and also relations with the investment community, the port have

taken initiatives in the environmental aspects based on the Northport Green Master plan involving long term strategies in reducing the overall pollution at the port. Based on Table 6, the strategies and initiatives that have been implemented by Northport were:

Table 6: Northport, Klang Environmental Emission Reduction Strategies

Strategy	Specifics
Infrastructure and Equipment strategy	Emission control technology
	Equipment and engine replacement
Operational strategy	Vessel speed reduction
Image improvement	Green building

Sources: Executive Environment, Northport (2014)

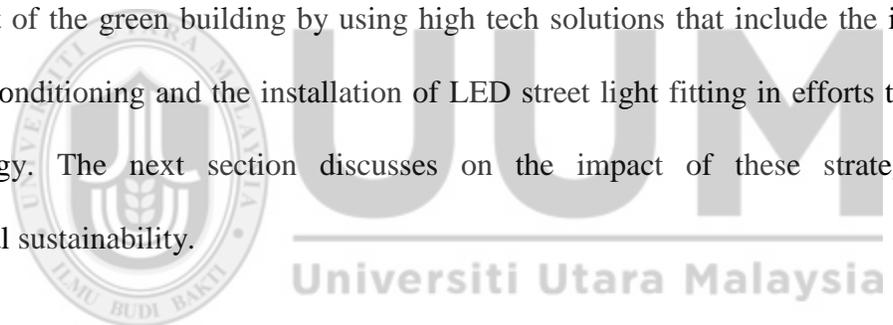
Basically, under the port’s Green Master plan, the strategies falls under three categories: 1) Infrastructure and equipment, 2) Operational, and 3) Image Improvement.

The first category, under the infrastructure and equipment strategy, the first initiatives that the port have implemented was on equipment and engine replacement where the port had already implemented the Euro 4 emission standards requirement of their ninety two new units of “Terberg” Terminal Tractor fleet that is used to handle and move containers in the container

yard. The second initiative is the emission control technology where the port installed micro clean filter for their rubber tyre gantry (RTG) hydraulic system.

The second category, under the operational strategy, the port has implemented vessel speed reduction initiative for any calling vessels entering the port. This initiative aims to reduce the emission from ships that are coming or going out of the port by reducing the speed of the vessels.

The third category, under the image improvement strategy, the port has taken the initiative in establishment of the green building by using high tech solutions that include the installation of inverted air conditioning and the installation of LED street light fitting in efforts to minimizing use of energy. The next section discusses on the impact of these strategies towards environmental sustainability.



4.2.2 Impact of each strategies in sustaining the environment

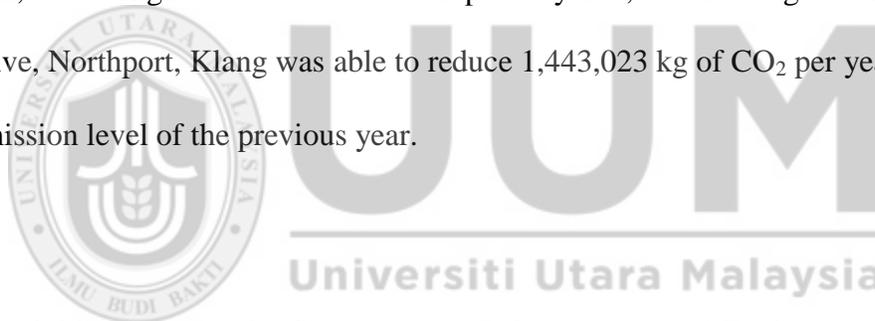
4.2.2.1 First Category: Infrastructure and Equipment strategy

For the first category which is the modification or replacement of the infrastructure and equipment strategy, the port have successfully implemented and incorporated the Euro 4 emission standards requirements for their new 92 units “Terberg” Terminal Tractors Fleet with the objective of improving the air quality at the port. “Terberg” Terminal tractor is used to handle container cargo in and around the port where the tractor is playing major role in moving the containers from one container terminals to another around the

container yards. With the implementation of the emission standards, the tractors now emit the exhaust emission which is parallel to the European standard.

This means that, the emission are reduce and the reduction is better if compared to average Malaysian emission standard as the standard that the European used (which the port has used as its benchmark) is lower than the standard that the Malaysian used.

This implementation was successfully completed in January 2011 which resulted in saving fuel consumption rate of 43, 617 litres in comparison between 2011 against 2008. In 2012, the saving reduces in fuel consumption by 214, 044 litres against 2008. With this initiative, Northport, Klang was able to reduce 1,443,023 kg of CO₂ per year compared to the emission level of the previous year.

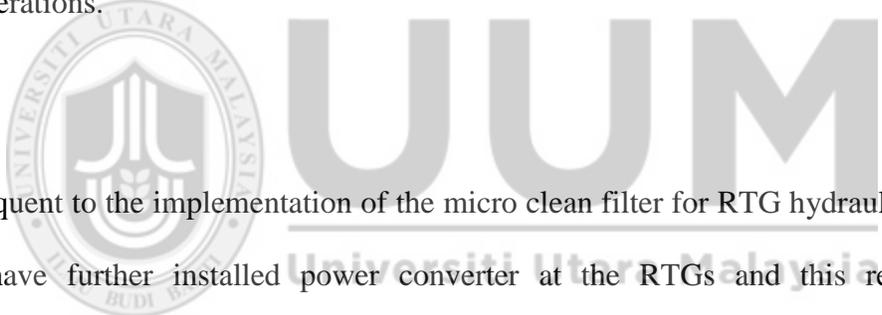


Another initiative under the first category (Infrastructure and Equipment strategy) is the installation of micro clean filter for rubber tyre gantry (RTG) hydraulic system at the port (which also doubles as one of the initiative in improving the waste management system that Northport, Klang), which is also resulting in the improvement of air quality.

Micro clean filter is a product that effectively minimise the waste oil disposal up to 90% from the standard practice of waste oil disposal in the market. This micro clean filter also gives the port the benefit of reducing the downtime losses through lesser and effective

repair and maintenance resulting in the cost reduction of maintenance that the port have to coves.

With the implementation of micro clean filter to their 22 RTG, a sum of RM150,800.00 worth in cost reductions for three years was achieved besides the reduction emission that from the RTG for about 21,669.83 kg of CO₂ per year. Not only that, the cost related to changing the hydraulic oil was reduced to RM24,780.00 in 2012 compared to RM41,592.50 in 2011. This reduction cost made for about 59.6% of the hydraulic systems maintenance shows some evidence that the initiative that the port made was effective and efficient not only in reducing the pollution but also in reducing the cost of the operations.



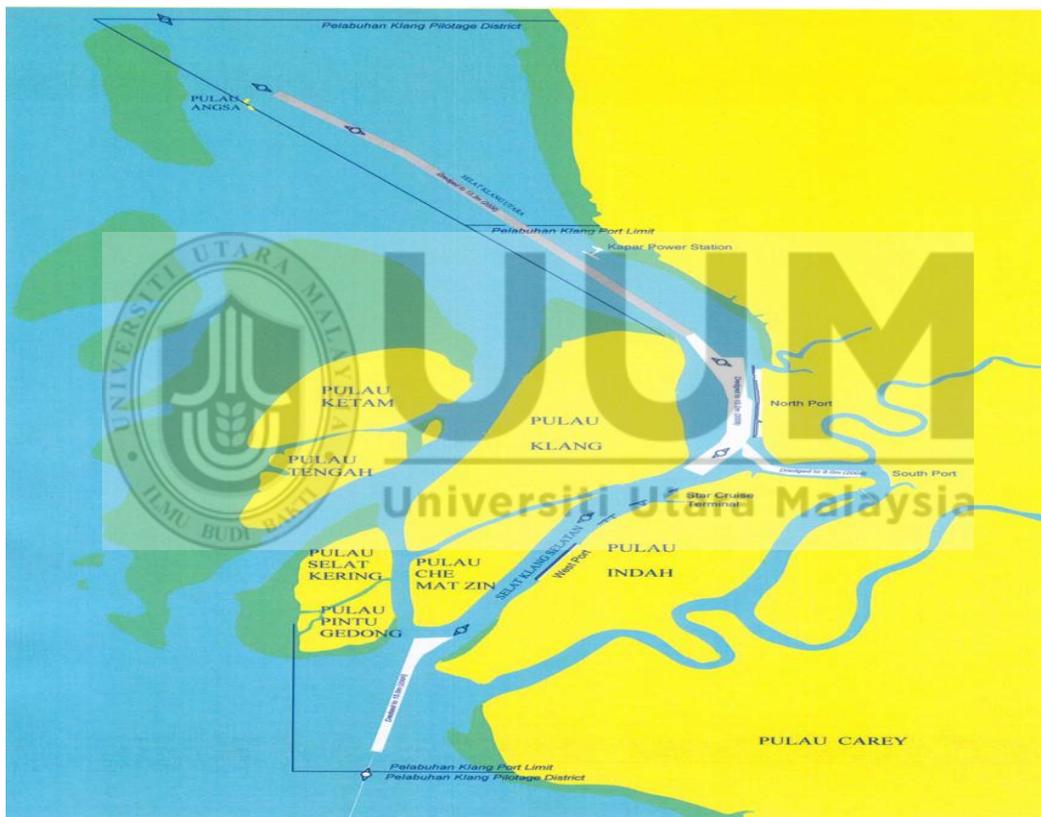
Subsequent to the implementation of the micro clean filter for RTG hydraulic system, the port have further installed power converter at the RTGs and this results in fuel consumption reduction by 10 percent. This installation was made on all their 22 RTG units after a trial run at one of their RTG unit for five months. The result of the trial run was fuel saving of 9.36% equivalent to 20,592 litres per month.

Based on the trial run on this initiative, the port believes that it can achieve cost reductions of RM520, 800.00 per month with the reduction of 4,160kg of CO₂ emission per year. The completion of the project was in December 2011. However, there is no performance monitoring assessment on the effectiveness of the installation of the power

converter was made after the installation and it only based on the monitoring result of the five months trial run.

4.2.2.2 The Second Category: Operational Strategy

Figure 5: The Southern and Northern approach channels



Source: Pilot Superintendent, Northport (2014)

On the operational strategy, Northport, Klang has taken vessel speed reduction initiative to reduce carbon emissions from the vessels. As presented in Figure 5, Northport can be approached via the southern or northern entrances. Vessels approaching from the north

can use the Northern Pulau Angsa Approach which lies between the mainland in the east and vast area of mudflats and sandbanks known as Angsa Bank on the west. The approaches are marked by two major lighthouses, Kuala Selangor and Pulau Angsa with the additional numbers of beacons and buoy to help the vessel navigate through the approach. On the other hand, using the Southern Pintu Gedung approach lies off the adjacent North Bound Lane of the Malacca Straits Traffic Separation Scheme. The approach is well marked by Bukit Jugra Lighthouse, Tg. Rhu Lt. Beacon and South Fairway Buoy.

Vessels are prohibited to navigate by themselves into the port. In the North Channel, the vessel are recommended to anchor while waiting for the harbour pilot at 0.5 nautical miles east of the pilot boarding ground where depth of between 15 meter – 22 meter are available. If coming from south, the Southern Channel, vessels that are waiting for the berthing instruction can anchor at the South Fairway Buoy but not within 1 nautical miles of the buoy.

Safe speed shall be observed throughout the passage plan where the speed limits will be consistent to the safe navigation with regards to harbour regulations, prevailing circumstances and conditions including the capabilities and limitations of the piloted vessel. Thus, all the vessels need to be navigated at a safe speed which not exceeding 12 knots. Furthermore, vessels navigating within 300 meters of the wharves or other mooring structure shall not exceed the speed limit of 8 knots. With the implementation of

the vessel speed reduction initiative, Northport, Klang have succeeded in reducing approximately 55% of the amount of CO₂ emissions coming from the vessels and improve the air quality at the port.

4.2.2.3 Third Category: Image Improvement Strategy

In the image improvement strategy, the port has taken the initiative establishing the green building. An example of green building initiative that the port has taken is the installation of the inverted air conditioning in the operator cabin resulting in the low consumption of energy, is environmentally friendly and safer to human health. This initiative was completed in August 2001 where 10 units of inverted air conditioning technology using cleaner refrigerated gas was installed at the Northport, Klang in 10 units of its quay cranes. The saving that Northport achieved was a total cost reduction was RM 874.63.00 for six month using the inverted technology.

Besides the installation of inverted air conditioning technology, the port has also installed LED street light fitting. With this initiative, the port was able to achieved 70% energy efficiency after the installation. Northport, Klang was also able to reduce 250 kg of CO₂ emissions per month. Other than that, the port has also replaced 40 air condition units using the green gas. This implementation was completed in 2011 and enabled the port to achieve 29% of energy efficiency and reducing approximately 24,178.56 kg of CO₂ emission per year.

Overall, besides implementing strategies and initiatives in and around the port as discussed earlier, Northport, Klang has also conducted their own ambient air pollution study. The study was made at the main critical operation areas in the port with the objective of improving air quality. This measure was taken as compliance to the Environmental Quality Regulation (Clean Air) 1978, EQA 1974, Usechh regulation 2000 and OSHA 1994.

The sample taken were analysed in a certified laboratory and the result was compared to Recommended Malaysian Air Quality Guidelines (RMAQG) by Department of Environment (DOE). From the assessment, the result showed that all pollutants levels are not at dangerous levels and passed the minimum requirement of DOE. This indicates that the ambient air quality in Northport's vicinity is good. It also shows that the strategies that the port have implemented was successful in which it allows the port to have a good air quality. However, even though the level of air quality at the port is good, the port through either its port operation or shipping activities, can still contribute to the huge amount of emission throughout the year. The initiatives need to be continuously implemented to ensure that the environmental sustainability can be maintained.

4.3 Prioritizing the strategies

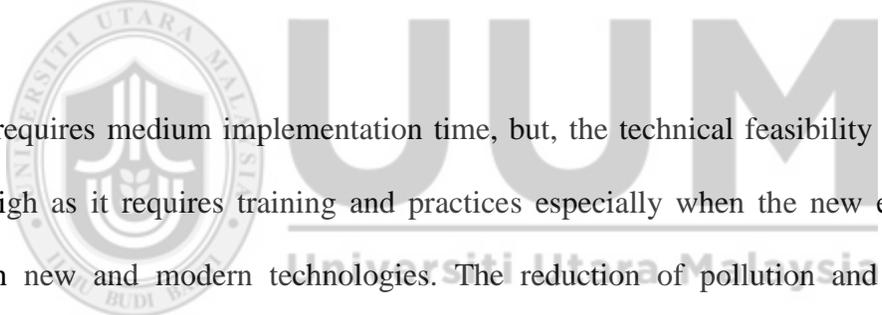
4.3.1 Ranking of each strategy based on importance and impact on environment to Northport, Klang

In prioritizing the strategies, based on the interview conducted, the port uses several criteria: a) implementation cost of the strategy, b) the maintenance cost, c) the time needed for the strategy implementation, d) technical feasibility of the strategy and e) the reduction of emissions from the strategy.

The operational strategy in terms of vessel speed reduction initiative was selected as the first priority because of very low implementation cost needed for this initiative. Besides that, very low maintenance cost required as the port need only to monitor the speed of the vessels when the vessels coming and going out from the port. Very short implementation time and technical feasibility needed as this initiative will be monitored by the harbor pilot that will come to the vessel upon arrival. This initiative in reducing the amount of pollution only in the medium level because the vessels keep emitting the pollutions and the initiative is made between the port and the vessel owner. The contributor of the pollution which is the vessel emission is not control by the port.

The infrastructure and equipment strategy with equipment and engine replacement was selected as the second priority, because, by having a new and modern equipment and engine, it will help significantly in reducing the emission problems. The implementation cost of this strategy is at the medium level. However, the maintenance cost of this initiative is high as the machine and equipment requires proper maintenance to operate especially in the long term.

It is the same for emission control technology where this strategy require medium level of implementation cost, and short implementation time because the emission control technology such as the installation of micro clean filter and power converter that the Northport have implemented at their equipment will be ready to be used after the installation. However, the maintenance cost is high as it requires the port to maintain the technologies were installed in all the equipments at the port. The On the other hand, this implementation results in high reduction of emission because it directly solves one of the main contributors of emissions at the port which is the exhaust that emit to the air by the equipment and the machine.



The strategy requires medium implementation time, but, the technical feasibility in having this initiative is high as it requires training and practices especially when the new equipment are provided with new and modern technologies. The reduction of pollution and emission are medium as it only reflect the amount of the reduction of the emission from the machine or equipment that have been replace with new equipment or engine.

The image improvement strategy with the initiative of the implementation of green building is selected as the third priority. This practice requires high cost because of the need to have high levels of technology in having the green building. This means that the building that the port constructs is free from any kind of pollution and not only focus on air pollution. Even though the port have benefited in terms of lowering the energy used, good water disposal management, lower operation and maintenance cost, this strategy needs a long time to implementation to make

successfully green building. At the moment, the port could only implement inverted air conditioning installation of LED lights in its streets.

The next section presents and discusses barriers or challenges that the port faced in implementing environmentally sustainable strategies.

4.4 Barriers and challenges faced in implementing the environmental sustainability strategy

One of the major barriers in implementing the environmental initiatives is cost. Each strategy requires substantial investment and the port need to thoroughly consider whether the environmental efforts are worthy for its implementation. An example is the application of onshore power supply which can be used for wide variety of vessels to reduce emission. This application requires a huge cost of infrastructure development including cables, powering sources, power cables and complex handling systems along with transformers, switchgears and converters.

Due to this, even though there are plenty of study that have found out that the method of turning off completely the ship pollution engine and change it with the electrical power source by the port resulting as the easiest way in emission reduction, the port operators need to have a thorough financial research to identify either the initiative would bring profitable benefits or not in the future.

Besides that, the port also wants something back such as incentive for tax reduction for environmental efforts that they have implemented and will implement in the future. Thus, in order to make the port comply with the regulation for environmental protection, the Malaysian government also need to play a proactive role in ensuring that the port will get back the investment that they have put towards achieving the Malaysian government target in the commitment to solve the environmental issues. Other than that, the government could also provide other incentives that will encourage the maritime industry especially the port operators to “go green”.

4.5 Summary

The study of environmental sustainability at the port shows that there are benefits in implementing various environmentally-related strategies as evidenced in reduction of carbon emissions, cost and better air quality. This study has also shown that although all the strategies play a role in sustaining the environment, the port does have a system in prioritising the implementation of each strategy using several criteria such as implementation time, cost and maintenance costs as well specific benefits that can be achieved. The biggest barrier or challenge faced by the port would be the cost of implementing these strategies as substantial investments are needed to make the strategies into reality.

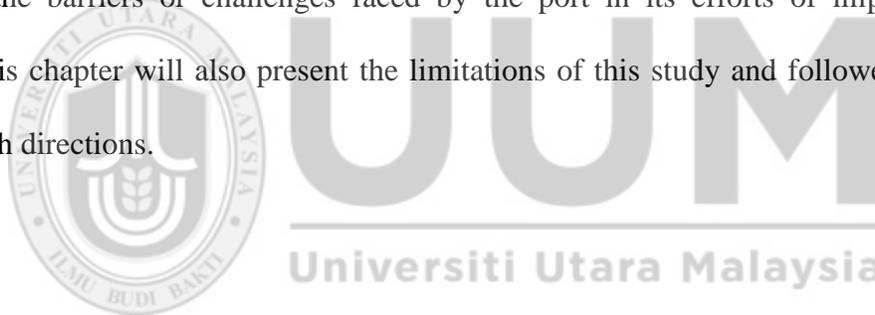
The next chapter, which is the final chapter of this dissertation, the conclusion will present the concluding synopsis of this study. In addition, the researcher will provide recommendations for future research and limitations of the study.

CHAPTER 5

CONCLUSION

5.0 Introduction

The objective of this chapter is to present the conclusions drawn from the results and findings of this study in the order of the research objectives. The research objectives of this study are threefold: 1) investigating the impact of strategies implemented by Northport, Klang in order to be environmentally sustainable, 2) ascertaining the priorities of these strategies and 3) determining the barriers or challenges faced by the port in its efforts of implementing the strategies. This chapter will also present the limitations of this study and followed, lastly, with future research directions.



5.1 Impact of the environmental strategies on Northport, Klang

Based on the first research question, the objective is to investigate the impact of strategies implemented by Northport, Klang in order to be environmentally sustainable. The result shows that Northport, Klang has successfully implemented three categories of strategies based on their Green Master Plan (GMP) which are the infrastructure and equipment strategy, operational strategy and image improvement strategy. Northport, Klang has strived to ensure that the strategies that they implemented were a successfully especially in terms of reduction of emissions and therefore improve air quality in the port.

All the strategies that the Northport, Klang have implemented were successful in enabling the port towards its goal of becoming environmentally sustainable. This is evidenced by the improved air quality in the Northport, Klang vicinity as assessed by the credible contractor with the cooperation of Department of Environment, Malaysia who makes the assessment on the level of air quality in and around the port.

5.2 Prioritizing the strategies

With regards to prioritizing the strategies implemented towards environmental sustainability, this study has found that the port has used several criteria such as implementation cost, maintenance cost, technical feasibility and reduction of emissions. In the order of priorities from first to last, the priorities of the strategies are: operational strategy in terms of vessel speed reduction initiative, followed by infrastructure and equipment strategy with equipment and engine replacement and emission control technology and lastly, image improvement strategy with the initiative of the implementation of green building.

5.3 Barriers and challenges to be environmental sustainable

In determining the barriers and challenges that the port faced in their efforts to be environmentally sustainable, the biggest barrier of challenge was cost both in terms of implementation and maintenance. This is shown by the fact that the most favourable initiative at the port in reducing the air pollution at Northport are the vessel speed reduction strategy as this

initiative does not required lot of investment. Moreover, this initiative can reduce the highest contributor of pollution at the port which is the vessels that come and going out of the port.

In the perspective of the Northport, Klang, incentives from the government for taking steps to sustain the environment is preferable at least in the form of tax incentives. This can further drive the port to implement other strategies in the future to sustain the environment.

5.4 Limitations

The main limitation of this study is the number of company (port) interviewed to get data. This effectively limits the generalizability of the findings. However, an in-depth interview does provide a certain element of richness in data that a large scale survey could provide. Environmental sustainability in Malaysia is still a new field of study and one of the best ways to investigate a new phenomenon is by conducting an in-depth case study, with which this study has strived to do.

5.5 Future research directions

For future research directions, the next research should consider more than one port in Malaysia in order to see the pattern and impact that other port have implemented to be environmentally sustainable.

Future research could also look into alternative strategies that port can implement and how these strategies impact not only the environmental sustainability performance but also the performance of the port socially and economically, thereby completing the three pillars of sustainability proposed by Elkington (1994) and later further developed by Carter and Rogers (2008).



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