

A Conceptual Model for Sustainable Green Port Practices: A Case Study of Northport (Malaysia) Berhad

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Abstract: This paper aims to propose a conceptual model for sustainable green port practices. The port industry is the main gateway of trade around the world. Nowadays, ports do not only focus on business purposes but also non-business purposes specifically environmental concerns surrounding the ports. As the public becomes more engaged with the risks of climate change and the composition of port shareholders changes, the philosophy towards port business has evolved too. The environment has become an in-thing for ports to emphasize the sustainability of their business. It is also the regulation that is implemented by the International Maritime Organization (IMO) to protect the environment and community because ports are also the source contributing to pollution. Thus, the introduction of Green Port Initiatives (GPIs) is the best way and resolution to highlight the importance of keeping a safe environment for the future. The study presents the conceptual framework portraying the elements concerning the sustainability of GPIs from the Northport perspective. Firstly, examining the level of awareness of GPIs among the port community; secondly mapping the port GPIs to the six key areas of Green Port Concepts; thirdly, understanding the initial key areas of initiatives which port community is interested in practicing; and fourthly, comparison GPIs at Northport with other port for benchmarking. The findings will provide ideas on the best strategies to implement and sustain the GPIs at Northport (Malaysia) Berhad towards their operation and more significantly meeting the United Nation's 17 SDGs.

Keywords: *GPIs, Sustainability, Green Port Practices Awareness, Green Port Concepts, Conceptual model, Northport (M) Berhad.*

1. Introduction and Background

Trading and port operations began via sea and ocean a very long time ago, mostly for economic reasons. A new age of trading patterns has been created by globalization and the shifting structure of the global economy. Ports become crucial links in the supply chain and logistic process, serving as transport hubs with intermodal networks such as sea, road, rail, and inland shipping. According to the Review of Maritime Transport 2021, the total number of commercial vessels in the world in 2020 is 2,134,640 vessels. It is shown that the seaport industry is the main key to economic contribution. Therefore, the success of seaports around the world no longer stands on their exclusive performance. The achievement of success is not measured on their own core competencies, qualifications and performance but also depends on their external factors such as the networking surrounding the port. Environmental issues are mostly highlighted in each community of the shipping industry and become worse if no action is taken to prevent them. The port and shipping industries are also the factors that contribute the environmental pollution.

Due to the port's basic resources, particularly the lack of land, limited increase space and water surfaces have become an asset. All these issues create continual social and environmental pressure, posing a challenge to the seaport's economic activities. As a result, seaport competitiveness is impacted not by business growth but by non-business conditions, which are influenced by good human interrelationships and surroundings. Almost every seaport in the world is expanding with new development by expanding their shore or coastal region. Managing and maintaining a high level of safety, health, and the environment has become a greater task for all those involved in port operations as a result of these developments. Due to global issues such as climate change, pollution, and energy consumption, there has been an increasing interest in the environmental impact of port operations and expansion in recent years. The issue arises when a seaport expands its port area, resulting in increased pollution discharge. The seaport is also known to be the primary source of pollution in the environment due to maritime industry activities. The port's wastewater, noise pollution, dust, and other pollution all came from the coast. Since the early 1980s, the environment has been a

hot topic of conversation among port officials.

Sustainable development is described by the Brundtland Report (1986) of the World Commission on Environment and Development as balancing human needs without jeopardizing future generations' ability to meet their own needs. There has been a change of emphasis over time in the focus of international enforcement with the current issue of environmental sustainability management. For example, MARPOL now started to introduce the regulation for prevention of pollution from oil chemicals and other hazardous substances, ballast water, treatment, reduction in the use of harmful paints, reduction in emission from ships and port operations according to (Saeyon et al., 2016). Regarding (Ricked et al., 2019) mention in their research on green ports in theory and practice mention in April 2018, the IMO announced a commitment of the shipping sector to reduce emissions by 50% by 2050. Establishing a target for the first time is certainly a positive step but history shows that such ambitions do not always translate into action. The long timeframe allows the possibility of delay and further modification of the deadline. Therefore, without clear and strong global regulations, the sustainability of GPIs cannot meet the main objective.

Accidents, oil spills, and water contamination from ballast water are among the main environmental concerns at sea. According to Europe Maritime Shipping Agency EMSA (2016), there were 3,296 occurrences involving 3,669 ships in just one year, with 36 ships lost and 115 people killed. 278 of these occurrences resulted in water pollution due to the leakage of bunker fuel and other residual oils and lubricants, which was attributed to human error in 62% of the cases. Another crucial issue that has taken decades to resolve is ballast water. Microorganisms can be transported around the world in ballast water, resulting in massive damage to local species. Based on (David et al., 2015), the IMO ballast water management convention, which came into force 13 years after its ratification and reflects the challenges of global environmental governance, took decades of labor by many organizations. Finally, the concept emphasizes that human greed in mining scarce environmental resources must be controlled. The difficult issue for seaports is to execute business plans that address not only current but also future port needs. Seaports must also maintain a balance of corporate expansion while minimizing environmental effects. The strategic plan should be created in such a way that the environmental impact is minimized. A new fight will erupt between seaports, stakeholders, and ship owners. They need to come up with a fresh approach to develop a long-term port business.

So, the introduction of a Green Port Policy will help to ensure a long-term port operation while also decreasing environmental impact. Green Port is a sustainable and environmentally friendly port that meets all environmental requirements (Satir et al., 2018). Green Port Policy is being implemented to protect marine life, minimize air pollution, and keep the port clean and safe for port users. For example, the Port of Long Beach has implemented the Green Port Policy since 2005, which monitors all aspects of the environment. One key environmental issue addressed by the port is the reduction of air pollution within its premises. The port has funded technologies that enable large cargo ships to switch off their diesel engines while berthed, and it has introduced hybrid diesel-electric tugboats in the harbor to reduce emissions. These initiatives serve as an example to other ports worldwide and contribute to cleaner air in the Long Beach area. Additionally, the Port is now focusing on reducing greenhouse gas emissions over the next 60 years as part of its efforts to mitigate climate change. As a result, at the 32nd Asian Freight and Supply Chain Awards held in Shanghai in 2018, the Long Beach Port was recognized as the "Best Green Seaport" in the world for its GPIs. This prestigious award was the result of an annual survey involving thousands of professionals in the freight transportation industry who acknowledged the port's exceptional Green Port Policy (Lam et al., 2019).

Although the Green Port Idea has been introduced for decades in Western developing countries, it was only recently, brought to the Malaysian Port community around 10 years ago. In research by (Hairul et al., 2020), most of the Malaysian Port community is still unfamiliar with the concept of Green Port and its benefits for their daily lifestyle and environment several challenges would be faced when undertaking the initiative to become a green port. The environmental, economic, and social challenges that ports encounter include the increase in maritime traffic volumes, the increasing size of ships, and the cost of upgrading port capacity, the volatile energy prices, the transition to alternative fuels and stricter limits on Sulphur emissions principally. The latter is stimulated strongly and even imposed by the IMO regulations. In addition, the impact on maritime operators also needs to be considered. Indeed, in parallel to the heavy challenges, there is even increasing pressure from shippers, who demand green supply chains, over and above any international

regulations. There is also port state control and local port fines given in case of non-compliance with local regulations.

In 2021, Northport (Malaysia) Berhad was awarded the APEC Port Services Network (APSN) GREEN PORT 2020. The mission of the APSN is to strengthen economic cooperation, capacity building, and information and personnel exchange among port and port-related industries and services in the Asia-Pacific region to achieve the common prosperity of the APEC member economies. This is done by promoting the liberalization and facilitation of trade and investment as well as improving supply chain security. This achievement was made possible through the efforts of Northport (Malaysia) Berhad whereby various green initiative programs were implemented related to alternate energy viz solar energy, conservation, including replacement of conventional lighting with LED lighting, investment in more energy-efficient and environmentally friendly cargo handling fleets, monitoring carbon emissions from port equipment and vehicles, marine water quality monitoring and treatment before being released into port waters, paperless transaction, establishing waste management standard operating procedures and other ongoing green initiatives.

Although GPIs have been used for years in Western developing countries, they were just recently introduced to Malaysia's port sector, roughly ten years ago. Therefore, most of Malaysia's port industry is still concerned about how to adapt to the concepts of Green Ports and its advantages for their daily lifestyle and environment and not focusing more on sustaining the GPIs. While some studies have looked at the initial implementation of GPIs, there is limited information on how to sustain and make these initiatives effective over the long term. The lack of established practices and comprehensive data on sustaining GPIs makes it challenging to identify the best strategies for sustainable green port practices in ports (Lim et al., 2019). However, the critical issue of concern is how the port can sustain its green initiative programs. Moreover, all the ports must face three main challenges to implement green port initiatives including Northport. Northport needs to sustain its recognition for its award of Green Port 2017 and 2020.

Firstly, the effectiveness of the GPIs implementation at Northport. Northport needs to trace the effectiveness of GPIs since their location and infrastructure are different as they have two terminals which are Northport and South Point. They also must ensure that GPIs should be fully implemented in both terminals. So, it will become a major issue on how they could the GPIs to ensure sustainability and effectiveness. According to research (Notteboom, 2020) in his research on the role of seaports in green supply chain management: initiatives, attitudes, and perspectives in Rotterdam, Antwerp, North Sea Port, And Zeebrugge, the author mentions that implementation of initiatives was easier to monitor if the target location was centralized. A part from that, the different facilities and services among the two terminals also should be the focus for the sustainability of GPIs because The Northport provides the services of container and conventional services while the South point provides only the conventional services. Both terminals serve as important hubs that facilitate goods movements. The distribution of freight such as raw materials, parts and finished consumer products by water transportation mode has created rampant economic activities for local communities and the worldwide market.

Secondly, awareness among the port community in the implementation of GPIs. Although GPIs have already been implemented for a certain period, there a less study about awareness for GPIs whether the level of awareness is low or high among the port community. It is important because the researcher wants to know that the port community already adopted the implementation of initiatives. The GPIs maker should ensure that the port community is aware of the GPIs and should have a model of facilities for information between the GPIs maker and the port community that affects sustainability (Simoni et al., 2020). Every individual in the port industry has their role to live and work more to sustainability, but when it comes to improving sustainability in green port initiatives, some people are in a unique position that will affect the changes according to the awareness. The current issue is that not enough companies have yet figured out how to link their employees' awareness of green port initiatives sustainability with employees' daily work and companies' operations.

Thirdly, the investment cost for implementing GPIs. Although in particular data centers can have a tremendous positive effect by implementing GPIs and going green makes good financial sense for the future the hidden cost of implementing the initiatives cannot be avoided. The cost of every GPIs implementation will

rise for training for the port community. The training aims to make the port community understand what are the GPIs and how to ensure they support and practice the initiatives that will be implemented in the future. Some of the investment cannot be avoided and actually, it is worth the initial expense. For example, Northport already implemented initiatives by replacing light bulbs for using energy efficiency with LED bulbs. Apart from that, new technology for example Electric Rubber Tyre Granty (ERTG) for container operation also raises the cost because they need to replace the new equipment and vehicles to support the green port initiatives. Ports have been trying to become "greener" by introducing new technology, upgrading their infrastructure, and decreasing their energy use. According to the research by (Beleya et al., 2020), the authors mention that, from financial institutions and investors' view in providing financing services, they normally assess the revenue projections and major risks of a business.

The quantity, timing, cost, and availability of financing will all be directly impacted by how well this risk-return analysis is done. The cost of implementation of GPIs also directly drives toward sustainability. Good GPIs practices can improve business performance and reduce business costs by cutting the use of raw materials, energy, water and resources. Saving energy is the easiest way for the port to save money in daily operations. In doing so, ports can reduce the carbon footprint of their business. Changing employee behaviors, using more efficient equipment and designing more efficient processes are the best ways port can lower their cost for operation in the long term (Iris et al., 2019). Investments not only need to be shown to be reliable; they must also be flexible and scalable to produce predicted profits if Malaysian ports are to get specific grants from financial organizations. Port also needs to conduct training for their employee on how to handle the new equipment and vehicle. As a result, the effectiveness of GPIs, awareness among the port community in the implementation of green port practices and the investment cost for implementing GPIs need to be considered for long-term sustainability.

2. Literature Review

Concept of Green Port: The concept of "Green Port" development is the integration of the environmentally-friendly method of port activities, operation, and management. There are several ways to define measures for the sustainability of "Green Port" implementation such as the implementation of relevant policies for the reduction of emissions into the atmosphere, the use of renewable energy port operations and activities, recycling and reuse of materials. According to (Badurina et al., 2017), one of the main measures for the application of the concept of "Green Port" development is the enhancement of the term "Green" growth in the further development of the port systems and establishment of environmental planning within the mentioned areas.

The environmental concern regarding the port systems is very diverse. They can arise from maritime activities such as internal port operations, transshipments of transport activities within the port area, and warehousing activities. Therefore, the impact of the increase in transport activities also CO2 emissions and produces potential threats to serious environmental pollution. In recent years, the priority has been to minimize the harmful impact of port operations on the environment. Seaports are trying to achieve a "green" title by introducing new technologies and renewal systems for energy production in the port infrastructure (Othman et al., 2022). Therefore, the model of "Green Port" development is an important concept for the development and operation of the port companies to prevent environmental destruction, loss of biodiversity life and sustainable use of natural resources. Apart from that, the port and port authorities will benefit greatly from adopting a green operation because green is typically connected with energy efficiency. The advantage can further enhance all operational and economic aspects while also reducing operating costs over the long run for the participating port (Nazry, 2019). The earlier concern and awareness about the environment arose in 1972 at the Stockholm Conference on the Human Environment when the community of the conference acknowledged the conflict between environment and development. The starting turnaround in using sustainable development is when the World Commission on Environmental and Development was initiated by the General Assembly of the United Nations in 1982 1987 in its report "Our Common Future" chaired by former Prime Minister of Norway, Gro Harlem Brundtland defining the sustainable development that was acceptable by all. In the "Brundtland Commission" Report, a brief of sustainable development can be defined as the ability to make the development sustainable to ensure that it meets the requirements of the present without compromising the ability of future generations to meet their own need.

Sustainable Green operation refers to the 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. According to research by (Ashok, 2019) stated that sustainable development is not a new idea It simply means living safely with nature in full recognition of the needs of all other species. This is not just 'survival of the fittest', humans must protect even the weakest of the species to survive because each species has a role to play in ability that is ultimately beneficial to the earth and all its human population. Apart from that, Sustainable development should be seen as a subset of green growth rather than as a replacement for it, and revealed by (Moon et al., 2018). It is more focused and involves an operational policy agenda that can assist in making real, observable advancements where the economy and the environment converge. It focuses on creating a clean environment, investment, and innovation that can result in fresh avenues for economic growth that are compatible with a robust ecosystem. Ports around the world have begun to run the new idea of sustainable "Green Growth". The green growth operation focuses on innovations to decrease airborne emissions that are harmful to all business locations inside the port. Embracing the green operation will bring a lot of advantages to the port and port authorities as green is normally associated with the efficiency of using energy. The benefit can further improve all economics and operational activities, as well as reduce operating costs in the long-term period for the participating port research (Nazri, 2019). The sustainability of GPIs depends on the various green port policies and tools adopted by port or public authorities. Different ports may adopt different policies considering the local regulatory, geographical, economic and political background. Various policies and tools are classified into three main categories for example costing, monitoring and measuring environmental standard regulation (Ren et al., 2018).

Various multinational initiatives are paving the way to a greener future. In 2008, the International Association of Ports and Harbours (IAPH) asked its Port Environment Committee to develop a framework to help ports in combating climate change in partnership with regional port organizations. As a result, the C40 World Ports Climate Declaration was adopted in 2008, resulting in the World Port Climate Initiative (WPCI), which now includes 55 ports around the world that pursue various green initiatives such as offering discounts to vessels that score above a certain threshold on the Environmental Ship Index (ESI). With the advent of the World Ports Sustainability Program in 2018, this effort has grown (WPSP). The International Association of Ports and Harbours (IAPH), the American Association of Port Authorities (AAPA), the European Sea Ports Organization (ESPO), the Worldwide Network of Port Cities (AIVP), and the World Association for Waterborne Transport Infrastructure (WAWI) are working together on this initiative (PIANC). The program is designed to adhere to the United Nations' 17 Sustainable Development Goals. Resistant infrastructure, climate and energy, community outreach and port-city communication, safety and security, governance, and ethics are the five core themes. While initiatives like this that focus emphasis on better environmental practices at ports through sharing best practices and emission reduction commitments are good, the voluntary nature of such schemes means that major emission reductions are still delayed.

Awareness and Port Community's Engagement towards Sustainable Green Port Practices: The introduction of GPIs will protect the port community and environment as this policy will also have an impact on the community. Community engagement is essential for the GPIs to run smoothly. Apart from that, GPIs are very important to ensure the sustainability of port community safety. According to (Roh, 2016), the implementation of employee safety, development of working conditions, and support for community projects may increase the social performance and reputation of the company. According to the Corporate Social Responsibility (CSR) report, connections with the local community to promote a positive image and build trust should be implemented. After the implementation of GPIs, it should have a monitoring action by the initiative's maker for the long-term period. They should educate and make the port community understand the impact of the initiatives. It will increase their performance at work and become more productive. According to research about the environment (Imtiaz et al., 2020) the owner's awareness should be considered on how to promote initiatives with relevant stakeholders to increase proactiveness. The level of concern and awareness for the initiatives will increase from the education and knowledge. Numerous studies have demonstrated that education and training may improve people's awareness of sustainable green technology awareness. According to the research (Fadhilur Rahim, 2018), organizations should raise employee awareness of green port practises and ensure they have a basic knowledge about that. However, implementing green practices become more expensive due to the number of learning and training to ensure the initiatives can be implemented smoothly. As a result, the success of the organization's training courses

will enhance the sustainability of green port practices by employees, contractors, and port users.

GPIs by International and Local Port: The example country that is interested in implementing the “Green Port” is Turkey due to the establishment of a sustainable environmental policy at the port and the application of this implementation to all operations of the port facilities on the grounds of adoption by all business owners and stakeholders voluntarily. In the “Green Port” implementation, they have seven strategies which are the preservation of natural life, air policy, water policy, land and sediment policy, education policy and energy policy. To show that they are interested in implementing this concept, the Turkish Transportation, Communication and Maritime Ministry and Turkish Standard Institution initiated the “Green Port Project in December 2014. This idea encourages Turkey’s Ports to be environmentally friendly ports or Green Ports. To achieve this accreditation, the port must fulfill some responsibilities before requesting a Green Port Certificate. These are to improve the seven strategies in Green Port and improve the working conditions. After the port had implemented the all strategies and policies, the Turkish Standard Institution awarded a certificate to the port. Now, three ports (Asyaport, Marport and Port Akdeniz) are Green Ports in Turkey. In this manuscript, Marport and Asyaport were selected and assessed.

Meanwhile, the Port of Long Beach also known as Long Beach’s Harbor Department, is the second busiest container port in the United States, after the Port of Los Angeles. This port established a reduced speed zone in 2006, which rewarded vessel operators for slowing vessels within 20 nautical miles (nm) of the port, the zone was extended to 40nm in 2010. This program cut the CO₂ pollution from ships by an estimated 26,700 tons in 2007. The Port’s annual Air Emissions Inventory confirms its ongoing progress. The study, which isn’t released until it’s reviewed by regional, state, and federal regulatory agencies, shows in its most recent update that, years ahead of schedule, the Port reached and surpassed its third and final 2023 target for slashing ground-level air pollution from port-related operations. To do its part, the Port is moving forward with measures to transition off-road cargo handling equipment to zero-emissions vehicles by 2030 and the truck fleet to zero-emissions vehicles by 2035. The challenge involves accelerating the development, deployment, and commercialization of machines powered by clean energy.

To minimize the environmental impact and maintain sustainable operation in the long period, several initiatives regarding the port operators have been introduced in a very timely manner at both national and international levels. In Malaysia, for example, the Green Port Policy was introduced by Lembaga Pelabuhan Johor (LPJ) in 2010. This policy, incorporated environmental issues into the port core strategies for port development and operations to be both environmentally friendly and commercially profitable. The implementation of this policy indicates recognition of port sustainability development as a key driver in port development in the future. As the regulatory authority, PA has oversight over all development within the waters of Pasir Gudang Port (PGP) and the Port of Tanjung Pelepas (PTP). This includes ensuring the safety of port development and operation as well as ensuring any port development has minimal impact on the environment. Their Green Port policy guideline also mentions encouraging positive impacts beyond economic benefits to the surrounding community and maintaining a balance between the environment, society and economy in any port planning, development, and operation. The JPA Green Port Policy will drive port operation and development in Johor that is based on the ethics of sustainability and greater responsibility towards the environment and the community.

Port Klang is currently being developed as the National Load Centre with several load centering and hubbing strategies pursued since 1993, the facilities and services in Port Klang are now synonymous to those of World class ports and monitored by Lembaga Pelabuhan Klang as the port authority. The port has trade connections with over 120 countries and dealings with more than 500 ports around the world. Its ideal geographical location makes it the first port of call for ships on the eastbound leg and the last port of call on the westbound leg of the Far East-Europe trade route. Port Klang aims to be Malaysia’s premier maritime hub leveraging sustainable port development in line with the National Transport Policy. The Port Authority will continue to work closely with Northport, Westport, and other stakeholders to ensure that the environment surrounding their ports is protected and preserved for future generations to come.

Westport is committed to running its business in a responsible, environmentally sound, and sustainable manner. They recognize that the services offered to their clients have both direct and indirect environmental

impacts. Efficient ports are important for the economic development of their surrounding areas. However, the related ship traffic, the handling of cargo in ports, and hinterland distribution can result in several negative environmental impacts on operations and the impact on the sea and land. In 2020, Westport its commitment by introducing a Green Port Policy and complementing the existing Environmental and Sustainability Policy, Their Green Port Policy covers all aspects of port operations including energy management, wastewater management and reduction best practices, scheduled waste, water consumption, noise pollution, and climate change. This policy is to reduce the impact group operation has on the environment through green initiatives. The main goal is to promote sustainability and environmental awareness at all levels of their staff.

Northport (Malaysia) Bhd awarded APEC Port Services Network (APSN) GREEN PORT 2020 unification for the second time since 2017. The port took the initiative in 2013 by buying 13 units of Electric Rubber Tyre Gantry Cranes (E-RTG) for energy saving and reducing emissions. Apart from that, this type of crane a good environmentally friendly because it uses electric supply power. Based on their Chief Executive Officer, Dato Hj Rubani Dikon at that time said using this E-RTG can save the cost of operation due to using only 35% more electric energy than diesel. This is a part of their concern to implement the Green Port policy toward the port sustainability.

Green port concepts, in the port business, can be a comprehensive attempt to handle environmental issues from a port operation, considering all factors given in the green port concept. To become the port of the future, Malaysia's ports must undergo a transformation that is well-planned and coordinated, as well as great in terms of operational efficiency, environmental protection, green economic growth, and societal endeavors. This transformation concept can begin with regulatory compliance, followed by aggressive action to address all environmental issues, optimization on a proactive strategy to accomplish sustainable goals, and finally transformation into a fully Green Port.

Now, it is already over three decades since the term sustainable development approach to the world in 1987. Port communities, governments, policymakers, and even societies have gained a lot of knowledge throughout the years as researchers continuously review sustainable development. In term of achieving sustainable development, (Patel, 2012) highlighted that stakeholder and market orientation is the key players in developing sustainable competitive advantage and creating long-term value that can improve firm performance.

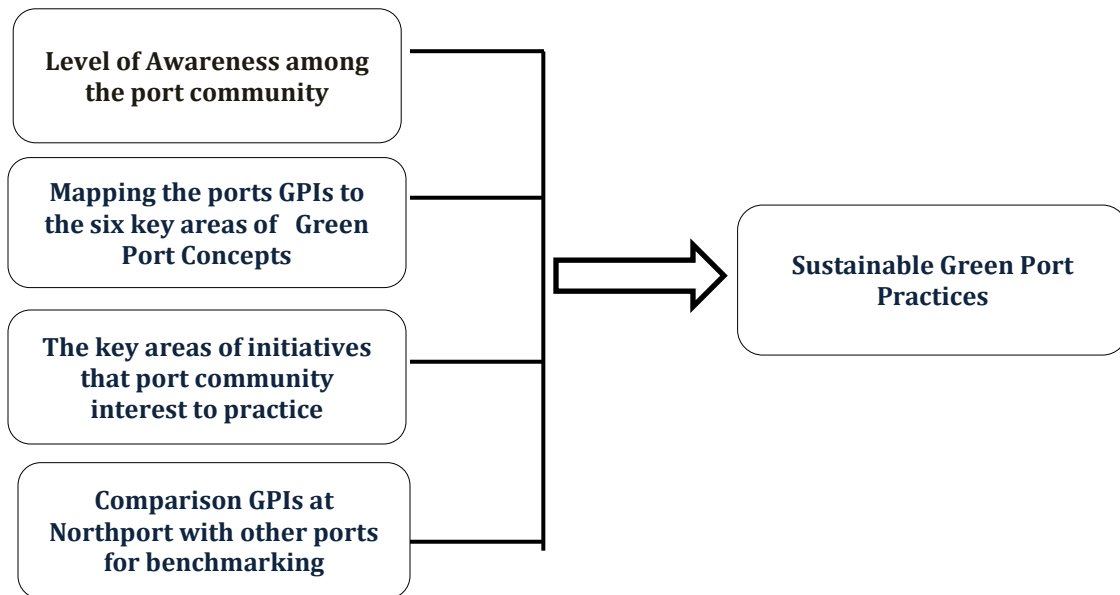
The Importance of Benchmarking for Sustainable Green Port Practices: The objective of sustainable green port practices is to find benchmarking for the sustainability performance of ports and identify the chances for improvement based on research (Adegoke, 2018). Sustainability focuses on the long-term preventing the destruction of environments and saving energy. In the business sector, sustainability is linked to an organization's all-encompassing strategy that considers everything from internal and external factors. Sustainability benchmarks are a method of systematically determining the success of standards, certifications, organizations, businesses and factors that have a beneficial effect. By identifying a sustainability standard, they can adopt the other company policies or initiatives that already bring benefit for their company too. In research (Ferrari, 2019), the author summarizes that benchmarking is a continuous learning process that compares an organization's operational practices to other organizations in the same or related industry. By applying a variety of indicators, benchmarking is a great way to enhance performance that makes the organization successful in that field. Benchmarking provides concepts on how to improve performance. As a result, the main goals of benchmarking are to identify areas for improvement and encourage change for good. Therefore, benchmarking is a useful technique for finding a solution by discovering other initiatives and policies. It also serves as a basis of comparison for analysis and develops something entirely new. Therefore, the objective of benchmarking is to implement changes and create continuous improvements to business operations, goods, and services. Therefore, benchmarking procedures aid in understanding the person who created the program. When an organization benchmarks, it has accessibility to external references and practice guidelines on which to construct its analyses and construct its operating procedures.

3. Conceptual Model of Sustainable Green Port Practices

According to the literature review, some factors influence the conceptual model of sustainable green port practices such as the level of awareness among the port community, mapping the ports' GPIs to the six key areas of Green Port Concepts, the key areas of initiatives which port community interest to practice and comparison GPIs at Northport with other port for benchmarking. The concept of Green Port development focuses on integrating environmentally friendly methods into port activities, operations, and management. This involves implementing policies for emissions reduction, utilizing renewable energy sources, promoting recycling and reuse, and preserving natural resources. Ports are increasingly aware of the environmental impact of their operations and are striving to achieve "Green" status by adopting new technologies and sustainable practices.

Initiatives such as the C40 World Ports Climate Declaration and the World Ports Sustainability Program demonstrate multinational efforts to combat climate change and promote environmental stewardship in the port industry. Local port authorities in countries like Turkey and Malaysia have taken proactive steps to implement Green Port policies, leading to the development of environmentally friendly port systems. By embracing sustainability, ports can safeguard the environment, support economic growth, and create a greener future for generations to come. Achieving sustainable development requires the active involvement of stakeholders, market orientation, and a commitment to continuous improvement in all aspects of port operations. With the knowledge and experience gained over the years, the port community is moving towards a fully Green Port transformation to ensure long-term value and success. These factors need to be considered to make sure that sustainable green port practices will be achieved and discussed in the following sections. The figure below shows the conceptual model for sustainability practices of GPIs and this conceptual model the outcome from the literature review.

Figure 1: Conceptual Model of Sustainable Green Port Practices



Level of Awareness among the Port Community: The first factor is to examine the level of awareness among the port community who are from Northport employees, contractors, and port users about GPIs. Northport already implemented the GPI starting from the year 2017 until now and has already been awarded APEC Port Services Network (APSN) GREEN PORT 2020. So, the first action is to analyze the level of awareness because can be used as a tool measurement to see if it can be sustained for a long-term period. Aside from that, information about their understanding of GPIs can be detected, and how they practice the GPIs that are implemented by Northport. The different backgrounds of the port community such as culture and education also influence the level of awareness. Awareness of any program or initiative should be considered as a parameter to ensure the program's objective can be achieved. Awareness not only comes

from the target community but also the initiative’s marker. After the implementation of green port initiatives, it should have a monitoring plan by the initiative’s maker for the long-term period. They should educate and make the port community understand the initiatives’ impact. It will increase their performance at work and become more productive. According to research by (Imtiaz et al., 2020) about the environment, the owner’s awareness should be considered in how to promote initiatives with relevant stakeholders to increase proactiveness. Another author also mentioned that the focus of employee awareness is to ensure the alignment of the employee with the organizational goals or mission and to go beyond what is expected (Osborne et al., 2017). All organization in the world already set their goal to achieve. To ensure their employee, follow their goal, the organization conducted many pieces of training and advertisement about their goal. So, the role of an employee is very important in each organization to ensure the goal can be achieved. Education and understanding will develop the level of awareness and concern toward the initiatives Nevertheless, it is not easy to achieve the sustainability practices of GPIs but it is not impossible if can raise awareness. The high level of awareness toward sustainable green port practices can be attributed to global environmental concerns, stakeholder expectations, government policies, and knowledge-sharing platforms. These factors combined create a conducive environment for raising awareness and promoting sustainable practices in the maritime industry and objective no one is achieved.

Mapping the Ports GPIs to the Six Key Areas of Green Port Concepts: Hairul et al. (2020) mentioned that the implementation of the Green Port Concept covers six key areas in ports, to achieve the environmental sustainability goals that will benefit the port for their initiatives. Table 1 is derived from a study conducted by (Hairul et al., 2020) and has been customized to suit the requirements of this study. To understand the GPIs in the key area of the Green Port Concept, all the GPIs implemented by Northport have been categorized into six key areas of green port concepts as portrayed in Table 1. Mapping these GPIs to the six key areas of the Green Port Concept is crucial for ensuring the relevance of the initiatives compared to those of other ports. This approach also facilitates the identification of implemented initiatives and those that are still ongoing. It reflects Northport’s commitment to sustainable and environmentally responsible practices within the port industry.

Table 1: Mapping the GPIs to the key Area of Green Port Concept

Key Area	Initiatives
Energy Consumption	-Implementing solar panel system -Utilization of Northport's 13 units of Electrified Rubber Tyred Gantry -Cold ironing (shore power)
Sustainable Social and Environment Development	- Launched a Landscape Competition between divisions - Conservation of mangroves surrounding the port - Promotion campaign twice yearly through the 3R (reduce, reuse and recycle) - initiated energy saving awareness to encourage staff to turn off lights when not in use and fix air conditioning temperature to 25°C
Water Quality	- Marine water quality monitoring and treatment before being released into port waters - Effluent waste water monitoring which also includes vessel-generated pre-wash/waste water.
Waste Management	-Integrated Waste Management Centre - Recollection of spilled cargo by consignee.
Air Quality	-monitoring carbon emissions from port equipment and vehicles, - Air pollution prevention
Sustainable Business Practices	-Conducted Sustainable Port Development which includes ensuring sustainable design in new projects and developments as well as building

climate resilience into terminal developments and redesign.

-Explore opportunities with suppliers for environmental-friendly equipment and biodegradable products

Generally, major ports in the world starting to introduce and implement the GPIs in their ports. The GPIs provide benefits that could further improve all economics and operational activities, including reducing operating costs in the long-term period via their participation in port research (Nazri, 2019). The efforts of Northport (Malaysia) Berhad can be seen whereby various green initiative programs implemented related to alternate energy viz solar energy, conservation, including replacement of conventional lighting with LED lighting, investing in more energy-efficient and environmentally friendly cargo handling fleets, monitoring carbon emissions from port equipment and vehicles, marine water quality monitoring and treatment before being released into port waters, paperless transaction, establishing waste management standard operating procedures and other ongoing green initiatives.

The Green Port Concept is a holistic and sustainable approach to port operations that revolves around six fundamental areas. The first area, energy consumption, aims to minimize the environmental impact of ports by reducing overall energy use. Ports are energy-intensive facilities, and by adopting energy-efficient technologies, embracing renewable energy sources, and implementing conservation measures, they can significantly decrease their carbon emissions and contribute to a greener future. Since air quality is a major concern, the Green Port Concept emphasizes measures to reduce air pollutants, such as adopting cleaner fuels, using electric-powered equipment, and implementing emission reduction strategies to improve air quality and public health in the port vicinity. Waste management is another critical pillar of sustainable port operations since ports generate a significant amount of waste, including solid waste from cargo handling and hazardous waste from various industrial processes. By implementing effective waste management practices, including recycling and proper disposal, ports can minimize their environmental impact and reduce the strain on local waste management systems.

The second area, sustainable development, underscores the importance of balancing economic growth with environmental and social responsibilities. Ports play a vital role in trade and commerce, but sustainable development ensures that their expansion and activities are carried out in harmony with the environment and local communities. This approach encourages the preservation of natural habitats, biodiversity, and cultural heritage while fostering economic growth. Water quality is another crucial aspect of the Green Port Concept. Ports are often located near sensitive marine ecosystems, making water quality preservation essential. By implementing stringent pollution control measures, treating wastewater, and mitigating runoff, ports can help maintain the health and cleanliness of surrounding water bodies, benefiting both marine life and nearby communities.

4. The Key Areas of Initiatives That Port Community Interests in Practice

The information on key areas of initiatives that the port community is interested in practicing can be gained after the process of analyzing the level of awareness among the port community about GPIs. The port community that is concerned and understands the concept of GPIs will practice the initiatives because they realize the outcomes from GPIs have a positive impact on them. Employee performance toward the GPIs is an action or behavior of employees at work to produce an output of goods or services. Moreover, attitudes are formed from the process of understanding (cognition) to stimuli such as organizational policy, then born affection feelings like or dislike, continued intention to do, and end the process in the form of action or behaviors. This shows that if employees understand or perceive work or policy, they will be satisfied and increase their performance of employees by research (Ariffin et al., 2019). Green port initiatives gave a lot of benefits not only for the short term but also for the long-term period. In this case, making the port community a part of the GPIs team also will drive them directly to the objective of the sustainability of GPIs. In addition, the implementation of new environmentally friendly technology should be introduced to the port community in the port operation.

So, Northport needs to invest more cost for new technology and training for the port community to conduct the new technology. Based on (Prashanth et al., 2020), mention that all new implementation needs to consider the costs and financial management. The cost of implementation of GPIs also directly drives toward sustainability. Good GPIs practices can improve business performance and reduce business costs by cutting the use of raw materials, energy, water and resources. Saving energy is the easiest way for the port to save money in daily operations. In doing so, ports can reduce the carbon footprint of their business. Any action to make or buy new pricing policies has to be considered to encourage sustainable and environmentally friendly practices. Hence, we need to identify the initiatives that port community interest to practice and contribute their support for GPIs. So, Northport should give more attention to those initiatives and monitor them all the time for the sustainability of GPIs. In addition, when they identified the key area that the port community is interested more in practices, they adopted a culture of continuous improvement and innovation within the port. Encourage employees, stakeholders, and port users to propose and implement new ideas, technologies, and practices that can further enhance sustainability. Embrace emerging technologies and trends in the field of sustainability to stay at the forefront of green port initiatives.

Comparison of GPIs at Northport with other Ports for Benchmarking: Comparison of GPIs at Northport with other ports that already implemented the full GPIs is very important as a benchmarking. For example, Long Beach Port was awarded the “Best Green Seaport” in the world at the 32nd annual Asian Freight and Supply Chain Award, which was held in Shanghai in 2018. The award reflects the annual polling of thousands of freight transportation professionals who recognized the port’s Green Port Policy which has led to major improvements in air and water quality through initiatives within the Clean Air Action Plan and the Technology Advancement Program. This study also will identify the other port initiatives and make a comparison with Northport initiatives. As a result, the comparison of the Northport GPIs with other ports will assist Northport in implementing the new initiatives that other ports already implemented to bring new benefits to Northport. There are several benefits of benchmarking with other ports. Performing the regular benchmarks contributes to a company’s overall effectiveness and efficiency by allowing it to identify potential areas of improvement for GPIs by looking at the most effective and efficient ports within Northport. By exchanging knowledge and experiences with other ports, Northport can learn from successful practices adopted elsewhere and adapt them at their port.

To benchmark their GPIs, Northport has established the ESG (Environmental, Social, and Governance) committee to review and monitor their GPIs. Another reason benchmarking for GPIs is important is because it gives a way to discover opportunities for increased growth and success. According to (Lee et al., 2017), performing benchmarks allows for identifying areas for improvement to get the company on par with the growth and success of other GPIs in the port industry. Assessing what other companies are doing successfully is an opportunity that develop a plan to boost performance and take advantage of opportunities. As a benchmark, Northport has successfully implemented all the GPIs associated with the Green Port Concept. Some of the initiatives implemented by Northport, such as solar energy utilization, wastewater management, shore supply current, and energy-saving practices, have also been adopted by other ports. This demonstrates that Northport has established itself as a benchmark for sustainability and has been recognized with two GPAS awards. Northport can serve as a model for other ports in terms of benchmarking and maintaining sustainable green port practices.

5. Conclusion

In conclusion, the biggest challenge in embarking on any green initiatives and practices is that creating and sustaining them is more significant than having to bear the higher cost of investing in sustainable solutions like renewable energy. Additionally, the initiators need to focus on their initiatives to ensure that the impact of GPIs will lower the operation cost and bring profit in the future. An important aspect to consider, terminating activities that pollute or are not sufficiently energy-efficient does not imply green practices, more essential is that the initiators must focus on continuous monitoring of GPIs’ progress for sustainability. A good suggestion provided by (Latip et al., 2022) is to introduce CO₂ absorption ability by the local authority as one of the policies to improve the air quality level in the surroundings. To ensure the conceptual model of sustainable green port practices can be implemented, the effort from all parties should be engaged to enhance the quality of life, safeguard ecology, and protect natural resources for future generations. The high level of

awareness towards the sustainability of green port initiatives can be attributed to global environmental concerns, stakeholder expectations, government policies, and knowledge-sharing platforms. These factors combined would create a conducive environment for raising awareness and promoting sustainable practices in the maritime industry an objective no one has achieved. In the business world, sustainability is linked to an organization's all-encompassing strategy from manufacturing to logistics to customer service.

Northport's decision on new projects, operations at the wharf, and cargo handling services should consider the GPIs sustainability goals to ensure any new unfriendly environmental activities from taking place and replace older unfriendly environmental activities with sustainable ones to balance business growth and environmental sustainability. The study by (Siron et al., 2023) in their findings confirms that employee participation in environmental management and environmental practices is essential in an organization or facility. Although Northport demonstrates a strong commitment to sustainable practices through the implementation of GPIs, further details regarding the specific key areas and their impact on its port sustainability would provide a more comprehensive understanding.

Northport has achieved commendable success in its sustainability practices for Green Port Initiatives. The port's commitment to environmental responsibility, resource conservation, community engagement, and continuous improvement has positioned it as a leader in sustainable port operations. The successful sustainability of GPIs requires adherence to guidelines and best practices, effective monitoring systems, top management commitment, continuous training, benchmarking, and financial assistance. Ports and the shipping industry must overcome organizational and economic barriers to achieve sustainable GPIs. The findings of this research contribute valuable insights and serve as a benchmark for other ports seeking to enhance their sustainability practices and contribute to a greener maritime industry.

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