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Green Port Performance Assessment in the Egyptian Context

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المستخلص:

يهدف هذا البحث إلى اختبار أداء الموانئ قبل وبعد تطبيق استراتيجية الموانئ الخضراء. لذلك استخدمت الباحثة الفلسفة الوضعية في هذه الدراسة والمنهج الاستنتاجي لأنهما أكثر توافقًا مع طبيعة البحث ومع ما يريد الباحث الوصول إليه. كما اتبع المنهج الكمي في جمع البيانات، حيث قام بإعداد استبيان وتوزيعه على 385 بحارا. فتم تحليل البيانات باستخدام طريقة إحصائية مثل عينة اختبار "t" المستقلة. وبذلك أشارت النتائج إلى تحسن أداء الموانئ بعد تطبيق استراتيجية الموانئ الخضراء.

Abstract:

This research aims to test the performance of ports before and after the application of green port. Therefore, the researcher used the positivism philosophy in this study and the deductive approach because they are more compatible with the nature of the research and with what the researcher wants to reach. He also followed a quantitative method in collecting data, as he prepared a questionnaire and distributed it to 385 seafarers. The data is analyzed using statistical method such as independent sample t-test. The results indicated that the performance of ports is better after the application of green ports.

Keywords: Green Port, Performance, Pollution, Energy.

1- Introduction

Ports today play a greater role than simply handling cargo on the quayside. The sources of their competition and the extent of their influence stretch across the sea and deep into the hinterland (Aregall et al., 2018). Their management and operational strategies are entwined with stakeholders on several scales and in many spheres, from local to global and from business to government. The port's role in the transport chain has the potential to shape the social and environmental performance of transportation systems extending across the globe. While many ports choose not to act beyond complying with existing environmental regulations in their city, region or country, in many cases they have exercised their potential for addressing both social and environmental externalities (Bergqvist and Monios, 2019).

While the Kyoto Protocol (adopted in 1997 and entering into force in 2005) introduced legally binding emissions targets, aviation and shipping were not included. Researchers have in recent years analyzed and quantified the emissions from the maritime sector, which may form a potential baseline for future targets. While the primary focus of this book is on the port perspective, attention to emissions in the maritime sector has focused for the most part on the output of vessels while at sea. These emissions can be divided broadly into greenhouse gas (GHG) emissions affecting climate change and local air pollution, primarily sulphur oxides (SOx), nitrogen oxides (NOx) and particulate matter (PM) (Bergqvist and Monios, 2019).

In 2007-2012, shipping accounted for 2.8% of global GHG emissions or double the level produced by air travel. Local pollutants are a more pressing issue in coastal areas due to their impact on human health (Bergqvist and Monios, 2019). The World Health Organization (WHO) considers air pollution a major environmental risk to health, estimating that it results in three million deaths per year (World Health Organisation, 2016).

Shipping contributes a significant amount to this risk, especially in coastal areas. Worldwide, shipping accounts for approximately 15% of NOx and 5-8% of SOx emissions (Zis et al., 2016) which cause serious harm both to human health and to the environment. It was found that emissions from shipping caused about 50,000 premature deaths in Europe alone in 2000 (Bergqvist and Monios, 2019).

When thinking of sustainability in shipping and ports, most of the focus tends to be on air pollution; however, as shown through the diversity of topics covered in this volume, there are many other areas of importance for green ports such as noise, dust, waste and water pollution (Lam and Notteboom, 2014).

Green port management must also include the broader topic of ecosystem protection through port sustainability plans and environmental planning regulations (Schipper et al., 2017). In addition, we also consider the issue of socioeconomic analysis and planning (Dooms et al., 2015) as relevant to a complete understanding of green ports (Bergqvist and Monios, 2019).

2. GREENING POST IMPORTANCE

Maritime transport is the backbone of international trade and a key engine driving globalization. Around 80 percent of global trade by volume and over 70 percent by value are carried by sea and are handled by ports worldwide in 2012 (Dumitrescu, 2014). In 2021, the global trade become over 80 percent of world trade by volume according to UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT (UNCTAD).

These shares are even higher in the case of most developing countries. As transfer traffic continues to grow, this grow of ensuring the long-run sustainability is playing an increasingly important part in the policy debate on globalization, trade and development, environmental sustainability, energy security and climate change (Chiu et al., 2014).

Seaports connect the world through maritime transportation networks, promote international trade, and support global economic growth (Lee et al., 2018). The anthropogenic inputs of environmental pollution can be the checkpoint through maritime transportation activities, which presents new and critical challenges to port managers regarding the provision of efficient port services and utilization of their unique position to curb global environmental problems (Luo and Yip, 2013). The concept of green porting is important to protect the environment, there are many factors affecting the operation of a green port (Chiu et al., 2014).

Ports are important gateways for international trade as about 90 percent of global trade tonnage move by ship through ports (Rodrigue and Notteboom, 2013). Being locations where trade, logistics, and production converge; connecting various points of production and consumption, ports are indispensable nodes in global supply chains. Research has however also shown that increasing shipping, which often requires expanding existing port infrastructure with new quays and deeper channels as well as handling increased volumes of cargo, can be associated with adverse environmental externalities (Lawer, 2019).

These include effects on air quality, water quality, biodiversity, emission of greenhouse gases and problems associated with hazardous ship and port generated waste, oil spills and ballast water discharge. Consequently, ports all over the world are under pressure from both local and international arenas to protect the environment, maintain public health and reduce their impacts on climate change (Lawer, 2019).

Generally acknowledged that achieving (environmental) sustainability including at seaports and along the maritime value chain, requires effective policy, management and governance systems (Notteboom and Rodrigue, 2017). Traditionally, the environmental governance of ports followed a centralized nation-state system where national institutions set and enforce rules or pollution limits and require environmental improvements and compliance from port authorities (Lawer, 2019).

In recent years, however, non-state and sub-national actors including port authorities, port cities, terminal operators, and environmental NGOs are taking up environmental responsibilities and positioning themselves as key actors with agency in environmental governance and policy making through various collaborative environmental initiatives and projects (Barnes-Dabban, 2018), especially those that are directly related to shipping and are trans boundary in nature (Lawer, 2021).

3.TOOLS OF GREENING PORTS

Port authorities around the world are pursuing a greening of port management in view of safeguarding their 'license to operate' and increasing their economic and environmental competitiveness. Port policy charts a port's strategy and development as well as regulates port activities. The government plays an important role as a powerful institution influencing the actions of organizations to improve environmental management (Clemens and Douglas, 2006). However, environmental policies and regulations may impose substantial cost to the extent that such matter becomes a community responsibility rather than just an industry concern (Lam and Notteboom, 2014).

Therefore, how to balance environmental quality and economic feasibility is a key issue. Another challenge in setting environmental policies is the existence of institutional barriers to the integration of such policies with transport and health policies. The barriers include autonomy of government departments, weak connections among the sectors and inefficient procedures in dealing with cross-sectorial issues (Lam and Notteboom, 2014).

The possible tools are; pricing, monitoring and measuring, market access control and environmental standard regulation.

Pricing Strategies can be used to boost a port's competitive position such as lowering charges (port dues or terminal handling charges or both) in order to compete against other ports (Lam, 2016). Ultimately, the pricing scheme should correspond to market conditions and counter competition, stimulate market growth and improve profitability (Yap et al., 2011). In view of the direct relationship between hinterland access and port performance, port pricing should also consider hinterland capacity. It was found that profit-maximizing ports internalize hinterland congestion as far as it affects their customers (Saeed and Larsen, 2010).

Port pricing can promote the efficient use and enhance the utilization rate of the facilities. Another long existing approach is to impose marine pollution penalty. Started in recent years, pricing can also be used as an environmental incentive tool in ports (Lam and Notteboom, 2014).

Access regulation is to control how terminal operators access the facilities they need to compete in the market. It promotes competition among the operators and has lower intervention costs than using price regulation (Defilippi and Flor, 2008). In relation to market access regulation, a terminal concession or a grant by a government or port authority to a (private) operator for providing terminal operation services has become a popular governance tool in the port industry (Notteboom, 2006).

The design of concession agreement, it is regulatory and tariff regimes, as well as the way the concession is awarded are structured to conform to the priorities of public authorities. It was argued that concessions are beneficial to enhancing competition in and between ports only if they are granted to the most efficient port operator. ESPO is in the process of producing a good practice guide, which is primarily aimed to help port authorities improve their contracting methods and instruments in order to gain more value from a governance perspective (Notteboom et al., 2012).

Ports also increasingly implement environmental management system (EMS) which is a systematic approach to manage a port's environmental programmes for pollution prevention, protection and control. t in essence is a documented process that describes a structure for the management of environmental impact processes and continuous improvement (for example, environmental risk assessment and management actions to address those risks) (Du Plessis, 2014).

It was suggested that port and harbor projects should have an environmental management plan, which includes information on the generation and treatment of solid waste, liquid and gaseous effluents, details of safety measures around the project, and details of the safety organization, including key personnel (Lam and Notteboom, 2014).

Monitoring is one of the important aspects in EMS. The UK ports sector responded to environmental legislation with the focus on monitoring mechanism for ports and harbors in maintaining their environmental sustainability (Lam and Notteboom, 2014). Biological indicators such as presence/absence of individual marine species and abundance of dominant species for monitoring purpose were suggested Desrosiers et al., 2013).

The major environmental parameters that ports required to be monitored were marine-related issues, water quality, meteorological parameters, turbidity and sediment processes. Indirect effects such as altered transport patterns and increased energy use due to larger built environment should be taken into account in strategic environmental assessment of transport infrastructure investment (Kusnoputranto et al., 2017).

4. BENEFITS OF GREENING PORTS TO ENVIRONMENT

According to the United Nations, the maritime transport is not isolated from climate changes; the type, range, and extent of impacts vary according to local locations, transportations systems, designs, and policies, as well as the capacity to adapt and minimize the costs. Direct impacts are likely in relation to maritime transport infrastructure, operations, and maintenance (Chiu et al., 2014). The services of maritime transport may also be affected indirectly; as a result of changes in demand, induced by climate change effects on trade, investment decisions, agricultural production, demographics, forests, energy demand, energy exploration and fishing activity (Dellink et al., 2017).

Emissions from commercial shipping have been one of the important subjects under intense security to reduce environmental impacts. There are three main ways to reduce maritime greenhouse gas emissions. Firstly, technical measures include more efficient ship hulls, energy saving engines, more efficient propulsion, use of alternative fuels, such as fuel cells, biofuels, or others, "cold ironing" in ports (providing electrical supply to ships from shore sources), devices to trap exhaust emissions (such as scrubbers), and others, even including the use of sails to reduce power requirements. Secondly, the market based instruments measures are classified into two main categories, emissions trading and carbon levy schemes. Thirdly, there are operational options that mainly involve speed optimization, optimized routing, improved fleet planning, and other logistics based measures (Chiu et al., 2014).

In the context of ship construction and technology, some ships are more environmentally friendly than others by design, as measured by the Energy Efficiency Design Index (EEDI) (Smith, 2012). Newer ships tend to be more energy efficient than older ones as hull and engine designs improve with time, and engines lose efficiency with age and use. Some ports have considered including the EEDI in the determination of port fees, to encourage more energy efficient shipping. Shipping lines now commonly optimize routes with respect to weather and currents to save fuel. Likewise ballast and trim can be optimized to save fuel (Davarzani et al., 2016).

Operationally, in ports, there has been a move to encourage ships to turn off their engines and generators while at berth and connect to a landside electricity supply, a process referred to as "cold ironing" (Zis et al., 2014). Landside electricity may also be used to power cranes and equipment for moving containers, perhaps accompanied by automation. The electrification of cranes opens up the possibility of introducing regenerative technology, enabling electricity to be generated when containers are lowered and reducing crane energy consumption by around 30% (Davarzani et al., 2016).

Research is ongoing on the use of batteries to power vehicles for moving containers horizontally in ports (Chiu et al., 2014). In general, the impact of electrification on emissions and the environment will depend on how and where the electricity is generated. Ports are frequently in windy locations with space available, opening up the possibility of generating electricity in the environmentally friendly ways on site by installing wind turbines or importing and burning biomass. Thus, a spectrum of practical organizational and supply chain arise for the port and maritime transportation greening (Iris and Lam, 2019).

5.COMPARISON BETWEEN PRE AND POST GREENING PORTS

Green ports are related to the long-term strategy for the sustainable development of the port infrastructure in which aims to reduce the greenhouse gas (GHG) emissions (Marzantowicz and Dembińska, 2018). In this section a comparison is done for the situation of ports and environment between pre and post greening.

First comparison point is related to pollution, the environmental pollution could include both air pollution and water pollution. The air pollution considered harmful emissions into the air (not only by shipping companies, but by any type of transport) (Franchi and Vanelslander, 2021). In addition, the water pollution occurs as a result of leaking oil residue from the ships in ports (Deja et al., 2021). This kinds of pollution occurs in the traditional ports, while the greening ports aims to minimize the water and air pollution for the aim of sustainability (Gibbs et al., 2014).

Second point is related to costs; ports and the city are borne very high costs in the traditional ports as a result of ports' detrimental environmental impact. On other hand, the environmentally friendly initiatives and green ports have crucial roles in mitigating the negative footprint of ports on the environment and require a multi aspect and long-term sustainable approach to environmental issues. Such measures would lower external costs (Żukowska, 2020).

Another point of comparison is that green ports work on making balance between the economic demand and the environmental responsibility, while the traditional ports put their main focus on the economic demands (Franchi and Vanelslander, 2021).

Accordingly, converting the traditional ports to green one is much better to the environment, in which help in reaching sustainability as well as decreasing the costs. Finally it is important to refer that there are numerous challenges to overcome when attempting to become a green or sustainable port. The environmental, economic, and social challenges that ports face include, in particular, an increase in maritime traffic volumes, an increase in ship size, the cost of upgrading port capacity, volatile energy prices, the transition to alternative fuels, and limits sulphur emission (Franchi and Vanelslander, 2021).

Many ports over the world starts to convert into greening, for example; Hamad Port in Qatar. According to the Ministry of Transport and Communications (MoTC) in Qatar, Hamad Port is considered the largest eco-friendly project in the region, which is internationally recognized as one of the largest green ports in the world. During the Seatrade Marine Awards Middle East, Indian Subcontinent, and Africa 2016, the Hamad Port Project was named the largest smart and eco-friendly project. All of the port's structures, buildings, and equipment are environmentally friendly. Furthermore, for the project, over 12,000 coral pieces were moved and resettled, as well as over 14,000 square meters of coral reefs. Programs were also put in place to enrich the area with nearly 32,000 mangroves and seedlings in order to provide the food and environment needed for marine life to thrive. As a result, the port was named one of the world's greenest in June 2019.

The positive results of converting to greening in Hamad Port has been appeared in 2021, as the port had gained a gateway to the world and succeeded in achieving an increment of containers witnessed over 9% compared to 2020. Moreover, the port has also registered an increase in arrival of vessels in 2021 as 1,750 vessels called on Hamad Port compared to 1,600 in 2020. Hamad Port is expected to have the capacity to handle 7.5 million TEUs at its three terminals on completion of the development stages and greening transferring.

6. RESEARCH METHODOLOGY

This study aims to examine the performance of ports before and after applying the green port operations. While, the main operations of green port consisted of (Environmental Quality, Use of Energy and Resources, Waste Handling, Habitat Quality and Greenery and Social Participation)

The target population is defined according to the data collection method used. In addition, the study followed a non-random technique of convenience of sampling for the questionnaire designed as it easy to access; a probability sampling method, of experts to be able to generalize research results. In addition, a sample size of 385 seafarer was used in the study to achieve a confidence level of 95%, with respondents' ratio of 77% as the questionnaires were distributed to the sample of 500 seafarers but only 385 of them were returned and accepted.

The operations used in this study can be categorized into five main operations, which are; Environmental Quality, Use of Energy and Resources, Waste Handling, Habitat Quality and Greenery and Social Participation.

Environmental Quality: Water Pollution, Air Pollution, Noise Pollution, Land, and sediments Pollution.

Use of Energy and Resources: Resources (Materials Selection, Water consumption and Energy Usage.

Waste Handling: General Waste Handling and Hazardous Waste Handling.

Habitat Quality and Greenery: Habitat Quality and Port Greenery.

Social Participation: Community promotion and education, and Port staff training.

Figure 1, represents the proposed study model for this research, where the study aimed at the variables

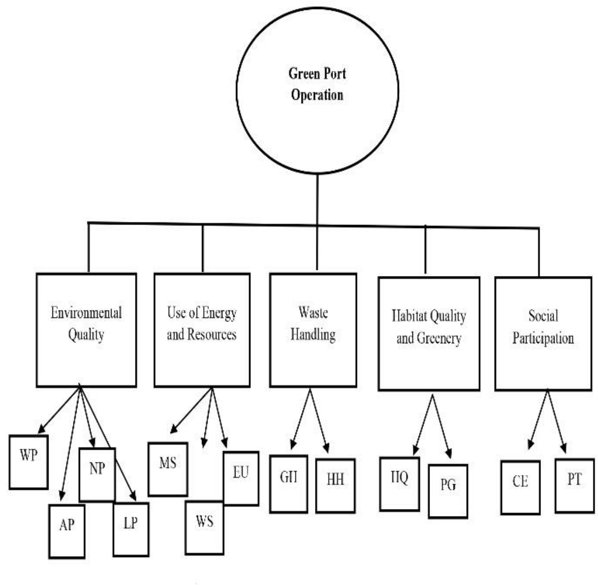

Figure 1: Research Framework

Table 1: Research Variable Operationalization

Variables	Measurements	References
Environmental Quality (Water Pollution) [WP]	Dredge monitoring and assessment.	Chiu et al., (2014)
	Investigate sewage source.	
	Monitor water quality.	
	Handle spill oil emergency.	
	Install palisade on sewage pipe.	
	Manage ballast water.	
	Handle on board sewage.	
	Improve the standard of ship's sanitation equipment.	
Environmental Quality (Air Pollution) [AP]	Set up air quality monitoring system.	Chiu et al., (2014)
	Set up sulfur and nitrogen emissions control area.	
	Provide shore power.	
	Use energy from renewable sources.	
	Use more electric machines/equipment.	
	Use automated gateway system.	
	Install air filter on port machines.	
	Port machines use clean fuel with lower sulfur content.	
	Monitor dust levels.	
	Implement dust and smoke recycle measures.	
	Monitor smoke from vessels.	
	Adjust the type of importing bulk cargo (e.g., replace coal splinter with block coal).	
	Promote environment-friendly transport.	
	Promote port ride share or use shuttle bus.	
	Establish the carbon footprint.	
	Vessel speed reduction in port.	
	Idle control on vehicles and cargo handling equipment.	
	Idle truck parking arrangement.	
	Use lower air pollution truck.	
	Replace or improve the old vehicles.	
	Vehicles and vessels to use clean fuel with lower sulfur content.	
Environmental Quality (Noise Pollution) [NP]	Set high standards of noise limits.	Chiu et al., (2014)
	Monitor noise levels during construction and operation.	
	Require to use lower noise.	
	Install double insulation windows and boards.	
	Use noise reduction machines (forklifts, ships, trucks, and other devices vehicles).	

Variables	Measurements	References
Environmental Quality (Land and sediments Pollution) [LP]	Remediation of contaminated sites.	Chiu et al., (2014)
	Reuse of dredge sediments.	
	Sediments deposited in the separated area.	
Use of energy and resource (Materials selection) [MS]	Adopt LEED standard for green building.	Chiu et al., (2014)
	Procure locally available materials and suppliers.	
	Use reusable materials for building/facility.	
	Encourage using environment-friendly materials.	
	Port landscaping to use local native species.	
Use of energy and resource (Water consumption) [WS]	Reduce waste of drinking water and irrigation.	Chiu et al., (2014)
	Monitor water usage and leakage.	
	On-site water treatment and reuse.	
Use of energy and resource (Energy Usage) [EU]	Use new environment-friendly energy in office and port area (e.g., solar power).	Chiu et al., (2014)
	Microclimate design.	
	Use energy efficient control system.	
	Use “heat stop” paint to coat the refrigerated containers.	
	E-document program.	
	Use energy efficient light in port area.	
Waste Handling (General Waste Handling) [GH]	Recycle publications or office waste.	Chiu et al., (2014)
	Reduce packaging use and choice fewer packaging use supplier.	
	Provide a dedicated storage area for recycling.	
	Reuse the construction waste materials.	
	Garbage classification in port area.	
	Vessel waste classification.	
Waste Handling (Hazardous Waste Handling) [HH]	Separate hazardous goods and poisons during construction and operation.	Chiu et al., (2014)
	Employ licensed contractor to handle hazardous waste.	
	Sterilizing and burning of cargoes coming from epidemic area.	
Habitat Quality and Greenery (Habitat Quality) [HQ]	Establish indicators of habitat quality.	Chiu et al., (2014)
	Ecological monitoring in port area.	
	Establish compensation area or alternative area.	
	Expansion of tidal areas for habitat restoration.	
Habitat Quality (Port Greenery) [PG]	Grow flowers or trees in port area.	Chiu et al., (2014)
	Use biological spectrum lighting.	
	Use nonchemical composition of pesticide and fertilizer.	

Variables	Measurements	References
Social Participation (Community promotion and education) [CE]	Allow public to have port tour.	Chiu et al., (2014)
	Provide job opportunity.	
	Encourage public participating in port planning.	
	Provide green port web site.	
	Promote green port concept for the community.	
	Public opinion survey.	
Social Participation (Port staff training) [PT]	Hold green port seminar.	Chiu et al., (2014)
	Provide green facilities/building guide and training.	
	Implement an accredited Environmental Management System.	
	Provide green port training.	

7.SEARCH ANALYSIS AND FINDINGS

The researcher in this section tests the results of the data of the research. First, the study starts with Validity and Reliability Tests. Second, descriptive analysis is used to data. Third, the independent sample t-test.

Data Testing using Validity and Reliability for the Research Variables

In this section, the validity for the statements used to measure the main variable of the research. The main concept of the research is the Green Port Operation, which includes Environmental Quality (Water Pollution, Air Pollution, Noise Pollution and Land and sediments Pollution), Use of Energy and Resources (Materials Selection, Water consumption and Energy Usage), Waste Handling (General Waste Handling and Hazardous Waste Handling), Habitat Quality and Greenery (Habitat Quality and Port Greenery) and Social Participation (Community promotion and education, and Port staff training).

Validity analysis implies the extent to which an instrument measures or estimates what it supposes to quantify effectively and measure correctly. Convergent validity tests the data utilizing factor analysis (multivariate technique), where the average variance extracted for each of the scales was determined and calculated. The average variance extracted (AVE) shows the average community for latent factor, which should be 50% or more. In addition, item reliability can be evaluated by the size of the factor loadings of the measures on their corresponding constructs, which should be at least 0.4 (Bell et al., 2018). On the other hand, reliability analysis refers to the level of consistency of the scale used to measure the specified construct. Cronbach's Alpha, as the most commonly and usually utilized trial test of reliability, was applied. It was demonstrated that 0.7 is a satisfactory reliability coefficient but lower thresholds are sometimes used in the literature (Fuentes-Huerta et al., 2018).

This section tests the validity and reliability of the Environmental Quality; it was measured using four dimensions; Water Pollution, Air Pollution, Noise Pollution and Land and sediments Pollution. Table 2 shows the factor loading of the statements as well as the average variance extracted for the water pollution. It was found that the factor loadings all statements are greater than 0.4. In addition, the result of AVE is more than 50%, therefore, all construct statements are valid. It is also observed that the Cronbach Alpha is more than 0.7. This means that the constructs statements are reliable to form this construct.

Items	Factor-Loading	AVE	Cronbach's Alpha
WP1	.846	89.891%	.984
WP2	.894		
WP3	.912		
WP4	.896		
WP5	.890		
WP6	.924		
WP7	.916		
WP8	.913		
AP1	.875	89.780%	.994
AP2	.899		
AP3	.909		
AP4	.909		
AP5	.888		
AP6	.905		
AP7	.900		
AP8	.904		
AP9	.892		
AP10	.883		
AP11	.899		
AP12	.880		
AP13	.904		
AP14	.909		
AP15	.890		
AP16	.899		
AP17	.908		
AP18	.901		
AP19	.895		
AP20	.905		
AP21	.900		
NP1	.907	90.863%	.975
NP2	.875		
NP3	.933		
NP4	.903		
NP5	.924		
LP1	.945	94.854%	.973
LP2	.946		
LP3	.954		
MS1	.925	90.921%	.975
MS2	.904		
MS3	.900		
MS4	.892		
MS5	.925		
WS1	.942	93.055%	.963
WS2	.940		
WS3	.910		
EU1	.931	93.399%	.986
EU2	.916		
EU3	.946		
EU4	.939		
EU5	.932		
EU6	.940		
GH1	.882	89.972%	.978
GH2	.892		
GH3	.917		
GH4	.913		

Items	Factor-Loading	AVE	Cronbach's Alpha
GH5	.905		
GH6	.890		
HH1	.936	94.158%	.969
HH2	.940		
HH3	.948		
HQ1	.910	91.351%	.968
HQ2	.918		
HQ3	.913		
HQ4	.912		
PG1	.919	92.968%	.962
PG2	.934		
PG3	.936		
CE1	.894	93.065%	.985
CE2	.935		
CE3	.923		
CE4	.936		
CE5	.947		
CE6	.949		
PT1	.889	92.560%	.973
PT2	.949		
PT3	.917		
PT4	.947		

Descriptive Analysis for the Respondents Profile

The descriptive statistics is a tool in which it explains and gives a distinct understanding of the features of certain data set, by giving short summaries about the respondents and how the diversification had been applied to select a representative sample for the population under study. In addition, the researcher could be able to identify if there is a gap for improvement in the research variables or not. Data is described here using tables of frequencies, which shows the number and the percentage of respondents sharing in the questionnaire under each category. Table 3 illustrates this by showing the frequencies for the respondent profile .

Regarding Gender, it could be observed from Table 3 that the number of 'Male' respondents (n = 292) is higher than 'Female, with a percentage of 37.9%. Considering Age, it could be noticed that respondents at the age group of '41-60 yrs.' are the most frequently appearing, with a number of 179 respondents and a percentage of 23.2% of the sample under study. Similarly, respondents, which having the master degree are the most frequently appearing than other respondents, with a number of 161 responses and a percentage of 20.9% .

Likewise, respondents with income level of '3000-4000' (n = 164) are higher than other respondents, with a percentage of 21.3% of the sample under study. In addition, respondents, which are married (n = 238) are higher than other respondents with a percentage of 30.9%.

Table 3: Descriptive Analysis for Respondents Profile

	Frequency	Percent%	Total
Gender			
Male	292	37.9	385
Female	93	24.2	
Age			
From 18-25	36	4.7	385
From 26-40	170	22.1	
From 41-60	179	23.2	
Education Level			
University Student	34	4.4	385
Bachelor Degree	156	20.3	
Master Degree	161	20.9	
PHD Degree	34	4.4	
Income Level			
Less than 1000$	24	3.1	385
From 1000-2000	32	4.2	
From 2000-3000	58	7.5	
From 3000-4000	164	21.3	
More than 4000$	107	13.9	
Marital Status			
Single	93	12.1	385
Married	238	30.9	
Divorced	38	4.9	
Widowed	16	4.2	

Testing the Main Variable of the Research

In this section, the independent sample t-test for the statements used to measure the main variable of the research. Table 3 illustrates that p-value is equal to 0.000, which means there is a significant difference between green port operations before and after application. It is observed from table 4 that the mean value of water pollution after application is greater than the mean value of water pollution before application, which means that the water pollution performs better after application. The mean value of air pollution after application is greater than the mean value of air pollution before application, which means that the air pollution performs better after application. The mean value of noise pollution after application is greater than the mean value of noise pollution before application, which means that the noise pollution performs better after application. The mean value of Land and sediments Pollution after application is greater than the mean value of Land and sediments Pollution before application, which means that the Land and sediments Pollution performs better after application. This means that Environmental Quality after application the green port operation is better than before application.

Table 4 illustrates that p-value is equal to 0.000, which means there is a significant difference between green port operations before and after application. It is observed from table 4 that the mean value of materials selection after application is greater than the mean value of materials selection before application, which means that the materials selection performs better after application. The mean value of water consumption after application is greater than the mean value of water consumption before application, which means that the water consumption performs better after application. The mean value of energy usage after application is greater than the mean value of energy usage before application, which means that the energy usage performs better after application. This means that Use of Energy and Resources after application the green port operation is better than before application.

Table 4 illustrates that p-value is equal to 0.000, which means there is a significant difference between green port operations before and after application. It is observed from table 29 that the mean value of general waste handling after application is greater than the mean value of general waste handling before application, which means that the general waste handling performs better after application. The mean value of hazardous waste handling after application is greater than the mean value of hazardous waste handling before application, which means that the hazardous waste handling performs better after application. This means that Waste Handling after application the green port operation is better than before application.

Table 4 illustrates that p-value is equal to 0.000, which means there is a significant difference between green port operations before and after application. It is observed from table 29 that the mean value of habitat quality after application is greater than the mean value of habitat quality before application, which means that the habitat quality performs better after application. The mean value of port greenery after application is greater than the mean value of port greenery before application, which means that the port greenery performs better after application. This means that Habitat Quality and Greenery after application the green port operation is better than before application.

Table 4 illustrates that p-value is equal to 0.000, which means there is a significant difference between green port operations before and after application. It is observed from table 28 that the mean value of community promotion and education after application is greater than the mean value of community promotion and education before application, which means that the community promotion and education performs better after application. The mean value of port staff training after application is greater than the mean value of port staff training before application, which means that the port staff training performs better after application. This means that Social Participation after application the green port operation is better than before application.

Table 4: Independent Sample T-Test for the Research Variable

	Grouping Variable	N	Mean	Sig (2-tailed)
WP	1.00 (Before)	385	1.8312	0.000
	2.00 (After)	385	4.3792	
AP	1.00 (Before)	385	1.7506	0.000
	2.00 (After)	385	4.2805	
NP	1.00 (Before)	385	1.7143	0.000
	2.00 (After)	385	4.2753	
LP	1.00 (Before)	385	1.6494	0.000
	2.00 (After)	385	4.2052	
MS	1.00 (Before)	385	1.6935	0.000
	2.00 (After)	385	4.2831	
WS	1.00 (Before)	385	1.8416	0.000
	2.00 (After)	385	4.3273	
EU	1.00 (Before)	385	1.6753	0.000
	2.00 (After)	385	4.3818	
GH	1.00 (Before)	385	1.8883	0.000
	2.00 (After)	385	4.3818	
HH	1.00 (Before)	385	1.6390	0.000
	2.00 (After)	385	4.2104	
HQ	1.00 (Before)	385	1.8779	0.000
	2.00 (After)	385	4.4909	
PG	1.00 (Before)	385	1.7039	0.000
	2.00 (After)	385	4.2468	
CE	1.00 (Before)	385	1.8649	0.000
	2.00 (After)	385	4.3922	
PT	1.00 (Before)	385	1.8909	0.000
	2.00 (After)	385	4.4078	

8. CONCLUSIONS, RECOMMENDATION AND LIMITATION

This study aims to test the performance of ports before and after the application of green port. To test this goal, the researcher used the classical philosophy in this study and the inductive approach because they are more compatible with the nature of the research and with what the researcher wants to reach. Consequently, the data required to test the goal of the study was collected through the quantitative data issued from the questionnaire that was distributed to collect the required data from seafarers. Statistical method such as: independent sample t-test had been used. Each of the measures of validity and reliability are also used, and the truthfulness and reliability of the data are intended as two important conditions that must be fulfilled and available to start using the available data to respond to the research hypotheses.

The recommendations of the current research are that the research should focus on other operations that affect the performance of green port. Future research will be able to have a better timeframe to be able to collect a larger sample as well as follow the technique of random sampling. More future research is needed to explore the effect of applying the green port on ports performance .

This research has several limitations through the study that I covered. First, the time limit to finish the research, which was a hindrance to collecting a larger sample size to represent the data under study. The second limitation was the small number of sample size used in the questionnaires collected, which pushed them to the blanket count method.

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