

The Relationship between the Green Port Concept and Competitiveness (A Comparative Applied Study for the Port of Tripoli)

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العلاقة بين مفهوم الميناء الأخضر والقدرة التنافسية (دراسة تطبيقية مقارنة لميناء طرابلس)

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Abstract

Seaports are supposed to function in an ever-changing environment. The dynamics of the changes and challenges are expanding, mainly because of global trade trends and industry developments. Seaports must remain innovative and prepared to keep pace with and participate in these changes. In addition, most of the countries of the world are moving towards making their ports green to increase their competitiveness, and make them without pollution. This research aims to convert the port of Tripoli from a traditional port to a green port to increase its competitiveness among other Mediterranean ports. Using a review of previous papers in the field.

Keywords: Competitiveness, Environmental Requirements, Efficiency, Green Ports.

الملخص

تعمل الموانئ البحرية في بيئة دائمة التغير؛ حيث تتوسع التغييرات والتحديات، ويرجع ذلك أساسًا إلى اتجاهات التجارة العالمية وتطورات الصناعة. لذلك يجب أن تظل الموانئ البحرية مبتكرة وجاهزة لمواكبة هذه التغييرات والمشاركة فيها. بالإضافة إلى ذلك، تتجه معظم دول العالم نحو جعل موانئها خضراء لزيادة قدرتها التنافسية وجعلها خالية من التلوث. يهدف البحث إلى تحويل ميناء طرابلس من ميناء تقليدي إلى ميناء أخضر لزيادة قدرته التنافسية بين موانئ البحر الأبيض المتوسط الأخرى وذلك عن طريق عرض الدراسات السابقة الخاصة بموضوع الدراسة.

الكلمات الدالة: التنافسية، المتطلبات البيئية، الكفاءة، الموانئ الخضراء.

1. Introduction

The port authorities' work in recent times has focused on creating a set of development measures that will ensure the expected technical and organizational conditions for port operations in the

future, in addition to a variety of social and environmental aspects necessary to maintain and improve the quality provided, this set of measures is of particular importance to the port industry. It is called Green Port, and that term refers to the ports taking specific measures to ensure that the port's development strategy in all economic, regulatory and environmental fields in the future leads to raising its efficiency, effectiveness and optimal operation (Oniszczyk-Jastrząbek *et al.*, 2018).

Green ports play a major role in achieving the goals of reducing pollutant emissions to the environment, and can also contribute to raising the operational and economic performance, and improving the competitiveness of ports, and the level of converting ports into green ports varies from country to country and from port to port, as there are many reasons for this. Disparities such as port functions and geography, the country's economic and political systems, and port functions that include the port's infrastructure and management, buildings, equipment, warehouses, labor, and other additional activities, and the green port, also known as the environmental port, represents a model for the sustainable development of ports, which does not meet the requirements of the environment. Not only does it meet and increase the port's economic efficiency (Badurina, 2017).

There is a set of determinants discussed in the research on environmental impact assessment, the rate of harmful emissions, the extent of compliance with environmental requirements, and the reduction of global warming, and this is done when evaluating the process of transition to a green port. The research has many implications for port management, as all priorities are considered, and practices that port authorities focus on in port operations such as the movement of goods, improving the use of equipment, speeding up the time of loading and unloading ships, and management systems, and taking them into account when switching to the green ports system, in addition to that the research contains the procedures and methods used in the process of converting gray ports to green ports, and to identify the competitive efficiency of the port of Tripoli after this conversion, which is under study.

2. Literature Review

This part of the research deals with some studies and research related to green ports by presenting their objectives, methodology and the most important results that have been reached, and the research and studies are divided into four sections, the first part of which deals with researches that dealt in comparison with the ports of the three continents (Europe, Africa and Asia), and the second part concerning the research conducted on European ports (Italy, Poland, Croatia, Turkey), the third section is concerned with Asian ports research, and the fourth section includes one research on Latin American ports (Brazil), followed by the gap of previous studies and scientific addition.

2.1. Comparative Research for the Ports of the Three Continents (Europe, Africa, and Asia).

Lawer *et al.* (2019) explained that targeting and exploring the economic benefits associated with implementing green port policies is the most important for international maritime

organizations without adopting the idea of a green port itself and applying it according to specific procedures and roles. Therefore, this study aimed at selective adoption and how port authorities interact in Europe and West Africa. With the idea of a "green port", as it seeks to explore the sustainable transformation of ports in Europe and West Africa, the research data was collected in 29 interviews from environmental officials in the ports, terminal operators and related maritime stakeholders from four ports in Europe and West Africa, in addition to the information that was made. Compiled through literature reviews and analysis of documents, the ports included in the research are: Tema (Ghana), Lagos (Nigeria), Abidjan (Cote d'Ivoire) in West Africa, and the twin ports of Bremen and Bremerhaven (Germany). A semi-structured interview guide was used in conducting all The interviews, and through this method, the research team was able to obtain a comprehensive picture of how the studied ports dealt with the idea of a green port and the rationality on which their choice of measures, tools and Techniques, and after collecting the data, it was analyzed to show the effect of contextual factors on the selective adoption of the green port standards, and a content analysis was performed on the data to identify common and disparate themes.

The results showed that Bremen ports in Europe have implemented measures that are mainly directed towards addressing air quality, energy and mitigating climate change, while West African ports are adopting measures that are mainly directed towards the sustainable management of waste, oil spills and polluted water management. Different time periods depending on their environmental priorities, key issues, governments' regulatory agendas, financial capabilities, and the jurisdiction of the port authorities, as it turns out that the twin ports of Bremen have a strong focus on infrastructure technologies and integrated management approaches more than West African ports.

Abdul Nabi *et al.* (2019) clarified the relationship between the environmental requirements for the implementation of smart ports and the sustainability of supply chains, as well as the relationship between the energy requirements for the implementation of smart ports and the sustainability of supply chains, and relied on a descriptive approach and content analysis, in addition to collecting data from the ports of Port Said and Rotterdam that answer the research questions, In addition to the secondary data from the Port Authority, the results showed a significant correlation relationship between the environmental dimension (greenhouse gas emissions), the economic dimension, and the social dimension of the sustainability of supply chains in the case of the Port and Rotterdam, and between the application of the requirements of the smart port, and in the case of East Port Said Port must Developing and increasing production capacity, taking into account the environmental dimension and achieving sustainability, and showing the existence of a significant correlation between the impact of trading volume and the social dimension, and accordingly the concept of sustainability for the supply chain is not achieved, and the research recommended the necessity of achieving sustainability for the supply chain in all its dimensions (the environmental dimension, the economic dimension, Social dimension).

The study of Munim *et al.*, (2020) aimed to assess port governance models in implementing GPM practices methodically, by formulating the MCDM framework taking into

account four port governance models and five GPM practices as a network of elements. The results were compared and synthesized by two methods: ANP and BWM. ANP is one of the widely used MCDM methods. Subjective judgments on five GPM practices relating to four port governance models were collected from three executives of three ports in three developing countries, Bangladesh, Sri Lanka and Tanzania, and judgments were analyzed using ANP Super Decisions and Solver Linear's file. BWM Excel, and the analysis of the results showed that increasing privatization in port management would improve the implementation of GPM in these countries, and the results also indicated the following: Port authorities should focus on introducing sustainable port operations such as cargo movements, improving equipment use, and speeding up loading and unloading of ships. Moreover, cooperation initiatives should be taken between terminals within the port or neighboring ports to improve the implementation of GPM, and the results indicated that the governance model has been given the highest priority, so the study recommends port authorities to consider the owner model based on contextual factors For the host country of the considered ports and the potential defects of the owner's model such as the monopolistic behavior of the private port owner, speculation with the port land and lack of interest in development i Long night.

2.2. The Research on European Ports

The study of Bucak and Kuleyin (2016) aimed at analyzing the opinions of Turkish port managers to reveal the prioritization of green performance indicators specific for ports in Turkey, as it is necessary to take into account the environmental dimension of sustainability in order to protect the marine environment, human health, and urban beauty. Ports achieved green performance indicators, and according to the methodology of the study, the green port performance standards were obtained, through the opinions of experts and managers related to the port and the interviews organized with them, and a data collection tool (questionnaire) was created from reviewing the literature on five main topics, and accordingly a model was designed A questionnaire, after being completed by experts and managers, the differences between the opinions of experts and port managers were analyzed through the Hierarchical Analysis Method (AHP).

The green performance indicators obtained were collected and formulated in the form of priorities for the main indicators and their sub-indicators, and all similarities were analyzed. And the difference between the opinions of experts and managers regarding the indicators and their contents, and the results highlighted that the main criterion of the highest priority is taking into account the environmental dimension of sustainability, which was represented in the absence of a need Against liquid pollution and liquid spills that threatened the environment in the port, the results also showed that the comparative analysis of the main criteria (indicators) showed differences of opinion among managers, especially in "marine conservation", "air pollution management" and "time of implementation of the environmental vision", "and operating facilities in the port," the study recommended that the Turkish government give a government incentive to Turkish ports in order to reduce environmental concerns and achieve green performance indicators.

Badurina *et al.* (2017) mention that port systems are major consumers of energy, and ports find it difficult to adapt to innovative solutions in terms of energy saving and energy efficiency, and do not contribute to energy efficiency or environmental protection and sustainable development, and sea ports are among the main engines of pressure on the environment, Because of these facts, this research aimed to present proposals related to converting seaports into environmentally friendly ports "GREEN" through the PORT DEVELOPMENT project proposal, presented by the Croatian Multimodal Transport Group, as one of the proposals of the Ionian Adriatic Sea program, as some of the proposals require advanced technology and resources. While others, such as the "green port" development model, do not require any special skills. These proposals represent a small contribution to the great efforts made for energy efficiency, environmental protection and sustainable development. The results indicated that the concept of "green port" requires effective organization and leadership, and policies. Coherent systems, innovations and management system for environmental protection, energy efficiency, and sustainable development, each seaport can adopt a new "greener" strategy and prevent It has updated its current system in order to reduce and eliminate the potential consequences of operational and illegal discharges of waste materials. Most ports develop waste management plans in order to protect the port area from waste from ships and daily port operations. The results provided a proposed model for implementing the concept of developing a "green port" that achieves Reducing resource consumption and designing green logistics seaport systems as a prerequisite for achieving environmental protection, energy efficiency and sustainable development, and the results indicated that implementation is not possible without effective cooperation between public agencies and private companies who are the key to the successful treatment of waste in seaports and surrounding areas while improving the quality of port services. Marine to make it more competitive in the market.

Casazza *et al.* (2018) emphasizes that the quality of life is deteriorating, especially in the urban environment due to the cumulative effect of exposure to pollutants, and urban ports represent a special case in the quantities of pollution due to the multiple and overlapping effects, for this reason, the research aimed to apply appropriate control measures that form the basis for identifying strategic options towards a more livable environment in port cities, it is important to develop scientifically sound methodological options for conducting initial surveys using available low-cost technologies while maximizing their effectiveness, and the research relies on a case study approach in the Naples port area (southern Italy). This work refers to the use of a free program. It can be downloaded and installed in a smartphone for the purpose of conducting local noise pollution surveys, and after determining the quality of the data collected through initial laboratory calibration, a series of field surveys are conducted in 12 different points of the Naples port area and the metrics are analyzed, and then the points can be identified. It has environmental polluting noise characteristics, and thus these areas can be separated in future monitoring operations, which reduces the measurement points (from 12 to 2). These were obtained to an option that can be applied to other environmental criteria, in addition to the

possibility of implementing the quality of surveys more through the use of aerial platforms, in order to obtain an evaluation of three-dimensional environmental scenarios in the future.

Oniszczyk-Jastrzabek *et al.* (2018) research aimed to determine the level of awareness of port representatives in Gdansk, Gdynia and Szczecin-Shoynogesi in the region related to the concept of green ports, and this is done by discussing development and investment measures in Polish ports to ensure compliance in all three areas (economy, society and environment) with measures Sustainable growth, which means discussing the transformation of Polish ports into green ports, and the research was conducted with representatives of the Polish seaport authorities by proposing and discussing measures for developing green ports and determining the directions that should be adopted in the strategies for developing marine ports, and the research used an intentional (objective) sample. It includes 18 employees, and the questionnaire was conducted (June 28-30, 2018) online, and the questionnaire consisted of fourteen questions and was measured on the Likert scale, and the results showed that the Polish ports did not join the Eco Ports initiative that started in the ports of the European Union, as the results showed. Increasing environmental awareness of respondents in Polish ports, although the methods are insufficient to move from the level of advertising to the level of activity in order to become effective A, the results confirmed that it is necessary to clearly diagnose the relations of ports with the environment and take into account aspects of environmental protection in both operational and investment activities, and in line with best commercial practices. The research recommended that port authorities formulate and update their vision and action plan periodically for the development of Polish ports, and provide information on sustainability trends and the environment in order to reduce polluting emissions to the environment.

2.3. Asian Ports Research

The study of green performance criteria for sustainable ports in Asia (Lirn *et al.*, 2012) aimed to measure the green performance of some ports by conducting a survey to determine the performance indicators of the main green ports and to assess the general green performance of three major ports in Asia, which are Shanghai, Hong Kong, and Kaohsiung; and suggesting resources that can be used to effectively improve the sustainability performance of ports. With regard to the research method, a questionnaire was designed that included seventeen green performance indicators for ports, and the indicators were presented to the selected sample (respondents) to assess the importance of these indicators, and the Likert scale of five was used. Points, where "1" referred to the least importance and "5" indicated the greatest importance.

After reviewing the port performance indicators to determine the environment-related indicators, the selected indicators were used to design a questionnaire for the Analytical Hierarchy Process (AHP), in which the weight and degree of performance of each indicator was calculated from The seventeen green indicators among the three main container ports through the responses obtained, and the results showed that improving the sustainability performance of green ports effectively is done through three indicators: Avoidance Pollutants during cargo handling, port maintenance, noise control, and sewage treatment, and these three indicators were identified by respondents in two ports, Hong Kong, and Kaohsiung from the three studied

ports, while the Shanghai port had the largest number of important indicators required to improve. In addition to the first three indicators, the results showed other indicators which are avoiding air pollutants, encouraging the use of low-sulfur fuels, and the use of electrical-powered equipment.

The results of the research provided the seventeen green ports performance indicators to support decision-making to help port authorities evaluate their performance.

Also, Tseng and Ng (2020) showed that there are many strategies to reduce pollution inside the various ports in Taiwan, and each port administration can use a different strategy to protect the terrestrial and marine environment of the port, and in the same context, their research aims to choose the optimal strategy to reduce pollution in Taiwan ports, and protect Better environment, and determine the best port in Taiwan that reduces pollution, which facilitates the same approach in other ports, and the study was conducted through three ports, which provides an integrated picture of how the country deals with achieving the minimum pollution of ports and the implementation of green ports, in order to develop a model Effective decision evaluation, and with regard to the study methodology, four criteria and eleven sub-criteria were developed using the FAHP analytical hierarchy process model and by reviewing relevant secondary documents and data, in addition to using a personal interview with a questionnaire to obtain the opinions of 23 experts working in four groups (freight operators).

Port (operators, government officials and academics) in three ports, which are Kaohsiung, Keelung, and Taichung. The evaluation, followed by the environmental policy used in the port, then technology and modern technologies, and finally the interest of stakeholders, and when comparing the three ports, it became clear that Kaohsiung port was chosen as the best port in reducing pollution, followed by Keelung and Taichung ports, as the study showed that decision analysis techniques to reduce pollution Ports, and assessment criteria related to the protection of the port environment, lead to an improvement in the sustainability of the green port.

2.4. Research on the Ports of Latin America (Brazil)

In paper, Moura and Andrade (2018) aim to present an approach to define the green port in the port of Santos located in Santos, São Paulo, Brazil, in addition to identifying and analyzing the green processes that occur in the port, and to study the different techniques and methods that aim to make the port environment more Sustainability, and the methodology used in this work is a bibliographic review of the topic (which brings in cognitive support and provides scientific support for research) and semi-structured interviews with port managers at Santos Port, in which open questions were posed at the end of the semi-structured interview to obtain more insights into the sustainable development of the port.

Santos, and the theoretical reference was mainly supported by documentary and international journals, and field work was used in this research where data were collected from people in charge of the port who contributed to understanding the problem and the application of sustainable operations in the port of Santos, and the most important results are the port's need to implement Public policy with systematic rigor to comprehensively monitor port operations

and allow public and private companies to invest in technology and innovation, with the goal of obtaining certification International Green Port, and a liquid station for solids operating in a sustainable way should be established in Santos Port, reducing truck traffic and using railways to carry out operations, with the aim of reducing emissions of gases and pollutant particles into the atmosphere, and the environmental priorities of Santos Port should be air quality Energy consumption reduction, noise reduction, safe disposal of port and ship waste, port development, land, water quality, dust reduction, dredging operations reduction, development and enhancement of port environmental management tools and methodologies and specific environmental indicators to monitor trends in environmental performance.

2.5. Gap of Previous Studies and Scientific Addition

All previous research has shown the importance of indicators and standards that must be strategically adopted to convert traditional ports into green ports. Although the reference review of previous studies included twenty-seven (27) ports around the world, they did not address any of the Libyan ports and study them.

The scientific addition to this research is that it is the first study to examine and interpret the relationship between the concept of the green port, competitiveness and operational efficiency in the port of Tripoli as one of the Libyan ports, and this is done using environmental indicators, standards and requirements previously referred to in previous studies.

3. Research Problem

Ports play an important role in promoting economic growth in developing and developed countries, and at the same time, the role of modern ports goes beyond shipping, unloading and other traditional operations known over the years, and modern trends depend on three directions of performance: economic, environmental and social, and that depends on the idea of developing Ports are towards addressing the environmental impacts to ensure the well-being of future generations while preserving natural resources.

Ports that balance the three dimensions (economic, environmental and social) of sustainability often referred to as green ports. Although ports are indispensable to a country's economy, they have harmful environmental impacts. Therefore, the development goals of the Global Port Sustainability Program affirmed commitment to work programs in infrastructure resisting environmental pollution, climate change, and clean energy while ensuring safety, security and ethical policy (Ziaul *et al.*, 2020).

Previous research on the environmental and climatic impacts of maritime activity in ports focused on analysis and quantification, and it is sufficient to know that the volume of emissions from the international shipping industry is responsible for 2.8% of global greenhouse gases (greenhouse gases), and shipping also causes local air pollution by emitting sulfur oxides. In addition, nitrogen, and ports are facing increasing pressure to reduce their environmental impact (European Commission, 2020; and Dushenko *et al.*, 2019).

The research problem is crystallized in the extent of suffering in Libyan ports, especially the port of Tripoli, from the high quantities of emissions polluting the environment, which causes an increase in the pollution of the land and marine environment of the port, and consequently the efficiency of the port of Tripoli in its operational and economic performance decreased, and its competitiveness decreased with the ports of the northern Mediterranean countries. The research aims to convert the port of Tripoli from a traditional port to a green port to increase its competitiveness among other Mediterranean ports, reduce the amount of polluting emissions, in addition to raising its economic and operational efficiency to become similar to green ports in the northern Mediterranean basin. The research also deals with the definition of the concept of green ports, and how the current Libyan ports are converted into green ports, especially the port of Tripoli, as an example.

4. The Importance of Research

The importance of this research comes in the presence of developments in all the ports of the world countries that sought to make their ports green ports to increase their competitiveness. Therefore, the need has become urgent and necessary to transform the port community, Tripoli, Libya, with its departments and sectors, to a green port to increase its efficiency and operational capacity and reduce the harmful environmental impacts, especially the size of polluting emissions. The port, and this research is considered by its discussion of green ports and their relationship to competitiveness among the first researches in this field because of the novelty of this concept, and the research is considered one of the first researches that discuss the concept of green ports and their relationship to the competitiveness in the port of Tripoli as one of the Libyan ports, which then facilitates its application to all Ports. The research also provides decision-makers, the concerned authorities and all those dealing with the port of Tripoli with all the information and data through which the procedures for transferring the port from a traditional port to a green port are carried out according to each administration and sector in the port. The importance of this research is due to the fact that it contains the main and preliminary steps for the transformation of the port. The research also provides environmental conditions and considerations at specific points for port officials to be taken at every stage of the transfer, in a way that positively affects the accuracy, flexibility and timing of this transformation.

5. Research Methodology

The style of descriptive studies was chosen, which aims to know as much information and characteristics as possible about the studied phenomenon, to find out its causes, explain it and extract its significance, and this is done in the context of the social reality in the port of Tripoli in which the studied phenomenon is taking place, and the descriptive analytical approach is used because it includes an organized attempt to analyze A complete and accurate interpretation of the current situation of all aspects of the relationship between the concept of the green port and the competitiveness of the port of Tripoli, in addition to the fact that the use of this approach

allows studying the different conditions that affect the competitiveness of a port when it turns into a green port.

6. Research Analysis

The potential impacts of Green Port development on the coastal ecosystem will be case specific, depending on the system's vulnerability to the different effects and mitigating measures.

- An assessment of the state of the current coastal ecosystem, ecological feedback, and environmental requirements of physical, chemical, and biotic aspects for ecosystem functioning is required, using indicators that cover economic, social, and environmental issues to determine whether port development would have an impact on the coastal ecosystem.
- Ecosystem services can be used to address the socioeconomic effects of impacts on the coastal ecosystem.
- A financially viable green port may be more expensive to build and operate.
- The main economic incentive to make an alternative port design or take mitigating measures are the costs and efficiency associated with erosion and sedimentation Processes into the entrance channels and port basins.
- The most considerable risks and opportunities for green port development lies in the morphology of the system: the use of natural depths reduces the extent to which depth needs to be designed and maintained by dredging and hence habitats are less disturbed.
- Since the location of a green port is crucial for different disciplines, it is desirable if the location choice is part of the design process since these aspects are closely connected and could affect operational management.
- Different disciplines in the green port development are interlinked and can therefore influence and enforce each other to reach a balanced environmental good status in line with economic growth.
- Ecosystem-based management is a management approach that is relevant and required in green port development.
- Co-creation of knowledge on multi-disciplines (ecology, morphology, governance, and socio-economy) with all stakeholders is necessary to develop the optimum port or port expansion.

7. Conclusions

The initially stated overarching aim of this research was to identify the environmental and economic impacts of applying green port concepts to the Port of Tripoli in the current situation. Green port is a relatively new approach and it has been recognized that there were a number of limitations to the study. There were a number of practical difficulties have been encountered. One challenge was proposing a model that proves the relationship statistically between applying the green port concept and the criteria that represent the competitiveness of the port. Therefore,

we recommend conducting a questionnaire that measures all the characteristics that represent a competitive port and the criteria for implementing green ports, and the relation between each one.

The green port differs completely from the normal port in terms of the mechanism of construction and operation and thus the environmental impact and the economic return. The environmental port plays an important role in promoting economic development in the surrounding areas, and the environmental impacts are minimized, while the traditional seaports are a source of environmental pollution, whether water or Air, soil or noise, as the maritime transport of goods causes environmental damage, whether in the port or the surrounding area. Examples of the negative impact on the environment include marine engines, ship equipment and machinery, and cargo loading and unloading machinery on berths, as well as harmful emissions, carbon dioxide, nitrogen oxides, sulfur dioxide, primary and secondary gases, and other air pollutants resulting from port activities, including smog. Particulate pollution, which leads to disturbance of the natural balance, water pollution from reservoirs leaks, destruction of fish wealth, marine organisms, endangered species, drainage of wastewater, contaminated ship tanks water, traffic congestion during the handling of goods, soil pollution, and hazardous solid waste, those effects that increase dramatically while dealing with Dirty bulk goods.

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