

A Literature Review on Green Port

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ABSTRACT

Rapidly growing and developing globalization in today's world has led to an increase in world trade. With the increasing world trade, the transportation tools of trade have become more in demand. One of the most demanded and improved transportation modes is maritime transportation in the world trade. Increasing world trade has also led to an increasing competitive environment in trade but also in maritime transportation. This competitive environment in maritime transportation resulted to the ports becoming global logistics centers. Since ports gained more importance, the sustainability of ports became a prominent issue to be achieved. The "Green Port" term is an important improvement tool for the sustainability of ports. The purpose of this study is to examine the literature of green port related studies, observe the advancements and bring out the deficiencies if there is. To do this, a research has conducted to find green port related studies in the database of Web of Science, Science Direct and Yeditepe University Library. As a result of the research, more than 600 studies were reached, then those that did not include the green port keyword were excluded from these findings. Finally, the findings were filtered according to their areas of study (filtered to transportation and social sciences) and to their relevance rate, and the result of the research was reduced to 21 studies. Throughout this study, these 21 studies examined and analyzed according to their content and finally the overall conclusions were presented.

INTRODUCTION

Due to current position of worlds resources and increasing awareness of humanity towards protecting the world, sustainability became essential for every industry, sector, place etc. *Sustainability concept has comprised of three dimensions named as triple bottom line are as follows: economic welfare, environmental management, social commitment* (Willard, Bob, 2012). Green Port approach positioned in the environmental management concept of the sustainability concept. However, the green port approach also has positive affects in economic activities while responding environmental issues.

In some countries, carrying out green performance criteria's has become a legal requirement. However, the levels of these green performance criteria's depends from country to country. Also, it's still not a legal requirement in some countries.

In the following parts of this study, green port literature review has been executed.

LITERATURE REVIEW ON GREEN PORT

21 studies were gathered and divided into their publication years for this study. The "green port" policy was launched in Port of Long Beach in January 2005 for the first time with a series of environmental protection plans developed from seven aspects. But there is not many researches between 2005-2010 about green ports, since it's a new area. So, the studies from 2010 to 2020 were examined in this study. The chronology method has been chosen for to be able to analyze the research advancements in the area through the years.

The results when the articles divided to their publication years;

- 1 study in 2010
- 2 studies in 2011
- 2 studies in 2012
- 2 studies in 2013
- 2 studies in 2014
- 2 studies in 2017
- 1 study in 2018
- 7 studies in 2019
- 2 study in 2020

Table 1 shows the distribution of the examined studies according to the years.

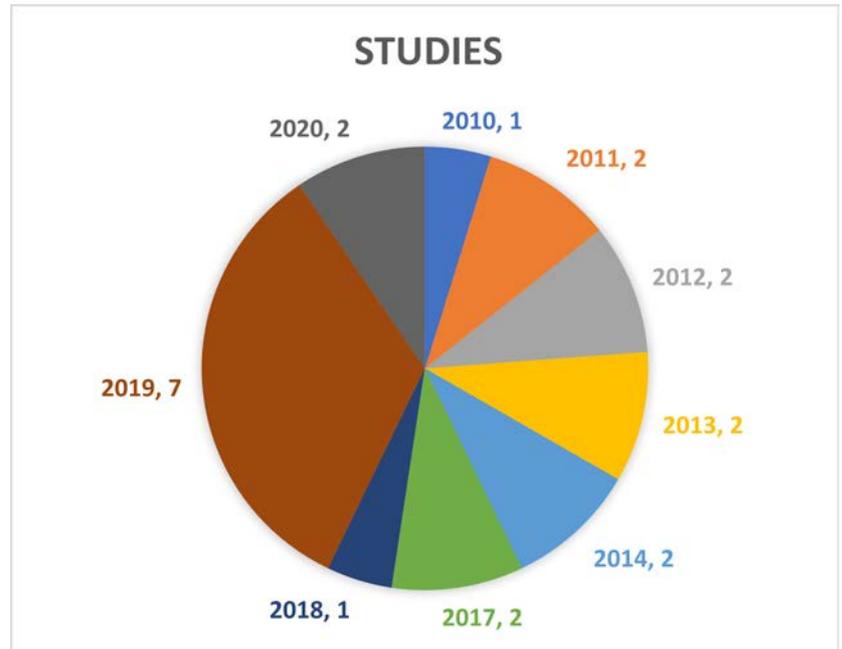


Table 1

Table 2 shows the articles studies with their authors and publication year.

Table 2

YEAR	STUDIES	AUTHORS
2010	<i>A Simulation for Optimum Terminal Truck Number in a Turkish Port Based on Lean and Green Concept</i>	<i>Soner Esmer, Ismail Bilge Cetin, Okan Tuna</i>
2011	<i>How will Greek ports become Green ports?</i>	<i>Despina Anastasopoulos, Dr. Stavros Kolios, Dr. Chrysostomos Stylios</i>
2011	<i>Discussion on Green Port Construction of Tianjin Port</i>	<i>He Ying, Ji Yijun</i>
2012	<i>Evaluating the effects of green port policy: Case study of Kaohsiung harbor in Taiwan</i>	<i>Ching-Chih Chang, Chih-Min Wang</i>
2012	<i>Green port dues — The case of hinterland transport</i>	<i>Rickard Bergqvist, Niklas Egels-Zandén</i>
2013	<i>Impacts of electric rubber-tired gantries on green port performance</i>	<i>Yi-Chih Yang, Wei-Min Chang</i>
2013	<i>An evaluation of green shipping networks to minimize external cost in the Pearl River Delta region</i>	<i>Y.H. Venus Lun, Kee-hung Lai, T.C. Edwin Cheng</i>
2014	<i>The Greening of Ports: A Comparison of Port Management Tools Used by Leading Ports in Asia and Europe</i>	<i>Jasmine Siu Lee Lam & Theo Notteboom</i>
2014	<i>SUSTAINABLE PORT INFRASTRUCTURE,</i>	<i>Bostjan PAVLIC, Franka CEPAC,</i>

	<i>PRACTICAL IMPLEMENTATION OF THE GREEN PORT CONCEPT</i>	<i>Boris SUCIC, Marko PECKAJ, and Bogomil KANDUS</i>
2017	<i>A Study on Green Shipping in Major Countries: In the View of Shipyards, Shipping Companies, Ports, and Policies</i>	<i>Taehee Lee, Hyunjeong Nam</i>
2017	<i>Contribution to the implementation of “Green Port” concept in Croatian seaports</i>	<i>Paola Badurina, Marijan Cukrov, Čedomir Dundović</i>
2018	<i>A novel model for the quantitative evaluation of green port development – A case study of major ports in China</i>	<i>Wan Chengpeng, Zhang Di, Yan Xinping, Yang Zaili</i>
2019	<i>Differentiating on port fees to accelerate the green maritime transition</i>	<i>Alvar Mjeldea, Øyvind Endresena, Einar Bjørsholb, Caroline Wang Gierløffc, Even Husbyd, Johanne Solheime, Narve Mjøsa, Magnus S. Eidea</i>
2019	<i>Green port marketing for sustainable growth and development</i>	<i>Jasmine Siu Lee Lama, Kevin X. Li</i>
2019	<i>Alternative Maritime Power application as a green port strategy: Barriers in China</i>	<i>Jihong Chen, Tianxiao Zheng, Akhil Garg, Lang Xu, Sifan Li, Yijie Fei</i>
2019	<i>Environmental Performance Indicators for Green Port Policy Evaluation: Case Study of Laem Chabang Port</i>	<i>Rattaporn TEERAWATTANA, Yi-Chih YANG</i>
2019	<i>Evaluating the key factors of green port policies in Taiwan through quantitative and qualitative approaches</i>	<i>Po-Hsing Tseng Nick Pilcher</i>
2019	<i>Green port project scheduling with comprehensive efficiency consideration</i>	<i>Wei Wang, Li Huang, Jian Gu & Liupeng Jiang</i>
2019	<i>Analysis of the main factors for the configuration of green ports in Colombia</i>	<i>Abraham Londoño-Pineda, Tatiana Arias-Naranjo, Jose Alejandro Cano</i>
2020	<i>Enabling a green just-in-time navigation through stakeholder collaboration</i>	<i>Jordi Arjona Aroca, José Andrés Giménez Maldonado, Gabriel Ferrús Clari, Nuria Alonso i García, Lucía Calabria and Jorge Lara</i>
2020	<i>Identifying the appropriate governance model for green port management: Applying Analytic Network Process and Best-Worst methods to ports in the Indian Ocean Rim</i>	<i>Ziaul Haque Munim, Henrik Sornn-Friese, Mariia Dushenko</i>

LITERATURE REVIEW THROUGH THE YEARS

YEAR 2010:

Actually, researches mentioned the real concept of “green port” starts in 2011 but one article from 2010 has been included to this review for to be able to see the last approaches to the greening of ports before the creation of green concept. Normally, the articles which includes sustainability in ports, greening of ports are also considered as related to the green port concept but mostly the ones which has the key word of “green port” on their title has been included to this review, for to be more specific on the green port concept.

In 2010's article the main concept is not green concept but still the importance of green approaches on ports is mentioned through in the article. The general concept of the article is about lean port but, in the article, it was argued that lean production contributes to a decrease in the environmental damage.

Overall, it shows us, the idea of greening ports is there in 2010 but the researches and concepts are not conducted in accordance. Also, its seen that greening of ports only mentioned in gas emissions dimension in 2010 but in the essence, it has more dimensions rather than only gas emissions and air pollution. This gives us a frame of in which level "green port" studies was in 2010, which was not detailed at all. But again, there is some facts which will give birth to other "green port" studies in the future.

YEAR 2011:

In 2011, we see the green port concept starting to take shape and more and more details are given in accordance with the concept. However, it's mentioned in the form of a case study for on more specific regions that the concept can be implemented in. The common issues examined in the 2011's articles are the affects and impacts of the current ports (which are not green ports) and current environmental analysis of these ports and also importance of sustainability in ports. The issue of sustainability in the port has gain popularity since 2009 when some countries signed a global agreement (Kyoto Protocol) to reduce greenhouse gas emissions, so it's almost common for all of the port-related articles. However, the research of on how current ports impacts the environment is considerably new and also is one of the reasons which gave birth to green port concept. The further implication has been taken in one of the 2011's article. The requirements of green port concept have been explained and suggestions are given for how to transform a port into a green port. Also, more specifically, the affected parties of current ports and the environmental benefits of the green port concept has been explained.

Overall, in 2011, we see the first characterizations of green port concept, the comparison of current port with a green port and the requirements of a green port. Yet still, we see green port from one perspective which is environmental perspective. Of course, the concept itself is an environmental concept but there is more dimension of green port should be examined in accordance with advantages.

YEAR 2012:

In 2012 while we see a specific region-based article, we also see an article covers the case of hinterland transportation which is a broader point of view. It can be considered as an improvement in the concept through the years. However, the one region-based article covers the effects of green port policy in only one dimension which is on air pollution. This time it can be considered as an improvement because the concept has been characterized before and the effects of the concept has been examined in one specific issue. On the other hand, a broader aspect of the concept has been examined in the other article and this time the demand for more sustainable transport solutions, green port's effectiveness and efficiency in terms of cost, quality and environmental impact has been explained. It's the first time the concept examined with its other dimensions.

Another important issue is a whole different aspect of green port concept has been mentioned in one of the articles. The relationship between green port and the stakeholders of

the port, the stakeholder's perspective and the implications for managerial practice has been discussed and this really brings a different side of the concept into the middle. Also, the dues of green port have been discussed for the first time too.

Overall, we see that the new perspectives and approaches has been revealed about the concept during 2012. More details about green port concept have been mentioned and also the concept has got closer to implication process with studies getting more advanced in the area.

YEAR 2013:

There are interesting issues to be mentioned in 2013's articles. First of all, we see that one of the articles has a literature review part, which means enough studies and analysis has been conducted to be able to mention about a literature review even for to a part. In the first article of 2013, we see that the studies are getting more specific and the effects of certain tools or substances on the performance of the green port have begun to be examined. And again, in this context alternatives have been created or researched for these tools or substances.

On the other hand, we see a really different approach in the second article, external cost has been used as a tool to assess the environmental impact of transport activities. Which means, environmental impact of ports has been tied to a cost even if its indirect. Also, the relationship of port development and environmental quality has been mentioned as if they are highly related. This approach can bring the notion of the relationship of competitiveness and green port, in the future.

Overall, in 2013 we see the concept has been examined from the general to the more specific. Also, we see that articles started to be getting closer to actual advantages of green port concept rather than environmental. The small sentences in the articles will give birth to whole different aspects for the concept, in the future.

YEAR 2014:

In 2014 we started to see the actual implementation of green port concept in ports around the world. That is the reason we see the implementation of the green port activities and actors involved and the methodological approach for the practical implementation of the green port concept, in of the articles. The common issues mentioned in the articles are the legislative environmental policies and the analysis of various green tools used by the port authorities. Which means that some of the countries actually required ports to become green and the green tools which were examined before in the last years have been used by the ports. And new findings were founded in accordance such as the more integrated these tools are used, the more effective the green port will be. This means a further step has been taken in accordance with the green port concept.

Another important issue is that the articles are both now talking about the competitiveness dimension of green port concept. The comparisons of the old ports and green ports has been held throughout the articles. Now it is considered as a requirement for the competitiveness of ports and new approaches and further improvements are highly needed for the concept.

Overall, we see much more detailed understanding of green port concept with much more mentioned dimensions. And the issues are getting more and more specific into the green

tools. The concept itself has been framed but the need for more improved tools to be used in the concept is outstanding in the articles. And the concept being a requirement now means that it gained more popularity which can give birth to other actions taken by legal authorities in other countries, in the future.

YEAR 2015 & 2016:

In the year of 2015 and 2016, almost no article found which directly concerns the green port concept. At the beginning 2 articles were included for these years but later they have been removed. Because they were more on the side of sustainability in maritime business and sustainability in ports which will affect the purpose of this study by breaking the rule of relevancy rate which mentioned before. While choosing the articles for this study, it was the priority to make sure the articles have a concern about the green port concept itself. Actually, sustainability in ports is highly related to green port concept but the articles were removed just because the filtering method which is used for this study.

On the other hand, we see that there was a need of improvement for the green tools will be used in the green port concept, in the last following years. That may be the reason there are lack of materials in these years because the improvements in tools, machineries and substances may occur as an engineering or biology related studies.

YEAR 2017:

In 2017, we see finally see the real green ports around the world. One of the articles is all about the green criteria's implemented by the green ports around the world. To be more specific, all the green ports in the world and all of their green implementations has been mentioned country by country. Also, the legislations and regulations of the countries towards the green implementations in ports has been examined, again country by country. This article actually was not a good fit for this study because of the filtering method and had been removed in the beginning. But it has a big importance in the chronological development of the studies in the area, so it was worth mentioning in the review.

On the other hand, we see a collective work in this year. One of the articles compiled all the articles written so far and mentioned about implementations of measures and dimensions of green port concept. With this, it's safe to say that Green Port concept's framework has been drawn because the other mentioned topic is the adoption of Green Port concept in the further development of seaports.

Overall, in 2017 ports around the world are following green port concept and the legal authorities of countries are taking actions in accordance with greening of the ports. The researchers conducted in this field have started to repeat themselves and the need for new approaches and aspects towards green port concept occurred. Also, the ports which adopted green port concept are mostly located in the Europe and Asia, so further studies in other regions of the world can be expected in the following years.

YEAR 2018:

As expected, in 2018 the issues in the study were the lack of research for green port concept in developing countries. There has been enough research conducted about the concept in accordance to developed countries, but not really for the developing countries. That is the

reason of 2018's study's one aim is to fulfill the lack of information for green port development considering both developed and developing nations. However, this time we see a different kind of study because study's main aim is to develop an assessment model for the evaluation of green port development, and did so by identifying drivers, pressures, states, impacts and resources of the green port development.

As mentioned before there is a need for new approaches, aspects in the literature and this article fulfill this duty by developing a tool for the green port concept and covering up some of the missing issues so far.

YEAR 2019:

Most of the articles examined through this study are from 2019. As mentioned in the last following years, there were a need for new approaches and aspects about the study. And another need was for the studies conducted about green port concept in developing countries. In 2019, these needs were responded by the researchers. So, year 2019 section can be examined according to these needs. In the following paragraphs, 2019's articles will be examined in 2 parts; the ones which responses the need of new aspects and approaches and the ones which responses which responses the need for studies of green port concept implementation in developing countries. This may be the best method since there is more article in this section.

The ones which responses the need for studies of green port concept implementation in developing countries has similar concerns. 2 of them are actually conducted for the same developing country. One of the outstanding content for all of the studies in this section is that all they all have a literature review part, since all most of the framework has been shaped in the last years. The common concerns are evaluation of the key factors and environmental performance indicator of the green port concept, the legislative requirements of these specific countries on green port policies. In one of the articles, an outstanding concern is about the countries which doesn't have any kind of legislative requirement of green port policies, because this time the commitment of management team of port authorities and societies towards green port policies gains more importance, so further studies in regard to this specific issue became a need. On the other hand, there is one article which concerns both of the parts in this section, because it's a new approach which consist alternative maritime power application as a green port strategy but discussed for a developing country. It can be considered as a further study of the article we mentioned in the year of 2018. Other than that, we don't see anything new in this part.

The ones which responses the need of new aspects and approaches includes more real time issues after the implementation of the concept has been done by the ports. 3 new approach and aspect of green port concept has been examined in this part. And all of them examines the concept from its different dimensions. While in one of the articles the detailed port fees and incentives towards green port policy, the other one gives attention to green port project scheduling with efficiency consideration which develops an optimization model and, in the conclusion, reveals the payback of investing on green port policies. On the other hand, green port marketing has been discussed in of the articles, and it is a totally new aspect we see so far. The study takes the attention to marketing practices of green ports which represents the actual mean of the need for different aspects. Further studies are expected in this aspect of green port, because the approach needs and improvement on ideas and actually is a really important issue for green port concept since the concept's has an importance in the

competition of ports. And this new approach may have an increasing effect in competition between ports.

Overall, some of the expectations for the concept were responded in this year and these responses gave birth to new expectations for further studies in the newly developed aspects. The further studies and explanations are expected in the marketing and managerial aspects of the green port concept. Also, the studies about green port practices of countries which has weaker economies is expected in the future years.

YEAR 2020:

As expected, in year 2020 we see a study about the green port concept combined with its implementation in a country which has a weaker economy. However, these two aspects were expected to be studied separately. Because there were lack of information about these two aspects, so “little bit of this, little bit of that” approach is not quite suitable as of now.

On the other hand, again we see another 2-aspect combination in the other article. This time the idea of Green Just-in-time navigation for the ports has been developed. It’s overall a new aspect and approach for the concept. However, the study is not a 100% good fit for this review because of the filtering methods used (it doesn’t contain the keyword of “green port”). But anything related to greening of ports should have been included to the 2020 section because they are the last improvements to be mentioned, and also it is worth mentioning that there are almost no studies about the green port concept in 2020, and it can be related to Covid-19 Pandemic, which keeps the logistics agenda busy. It’s unfortunate to end the review with no improvements in the current year, however the expected studies mentioned at the end of year 2019 section, can be published in the following years.

CONCLUSSIONS

The aim of this study is to review the studies in between 2010 and 2020 about the green port concept. Through this review, the improvements in the green port concept have been discussed. And also, this review made us realize the base idea of the green concept and additional aspects and approaches towards the concept.

Even though there were studies related to green port concept, their main topic was sustainability in the ports. That’s why these studies were excluded from the review because this review has a priority to include the studies which accept the green port concept.

It has been seen that green port concept has been examined mostly for European and Asian countries, there is lack of information for the implementation of the green port concept in weaker countries in terms of their ports. Further studies are a need for countries like Pakistan, Bangladesh, Mauritania because green port is an environment concerned idea and if the aim of the idea is to protect the environment then, environment is the same environment all around the world, so it should be protected in everywhere.

And in the articles, it has been seen that in the countries which has no legislative requirements for green port practices, the commitment of port authorities and stakeholders comes into play. So, what could be done for to enhance the commitment of port authorities towards green port policies? This is an important issue which should be studied for to be able to behave green port policies worldwide. Because green port concept fulfill it’s aim only if the green port policies are adopted by the whole world ports.

Overall, these were the issues should be covered up in the literature review of green port concept. Other than that, further studies for development of new tools and more studies for managerial and marketing aspect of the green port concept are expected.

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