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ASSESSMENT OF PORT SUSTAINABILITY INDICATORS IN THE SUSTAINABILITY REPORTING PROCESS

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ABSTRACT

Sustainability reporting has become an institutionalized tool for transferring the performance of a company in environmental, financial and social performance, unfortunately, lack of common port sustainability indicators (PSI) used by all ports in port sustainability reports, is the main motivation of this study. Therefore, the main aim of this study is to decide prevalently used port sustainability indicators in the sustainability reporting process by measuring their usage frequency and to suggest PSIs set to the ports for future sustainability reports. To reach that aim of the study, first port sustainability indicators that focused on port sustainability measurement in current literature will be gathered together to obtain sub-dimensions of sustainability, then 7 different ports sustainability reports which published in 2014 will be analyzed via the NVivo 8 software programme. At the end, the most used and unused port sustainability indicators (PSIs) in the sustainability reporting process will be identified under the three main dimensions of sustainability. One of the important results of the study is; 34 of the 60 PSI's that identified are not included in any port sustainability report. In the last part of the study, research limitations and suggestions for future studies are included.

Keywords: Port Sustainability Indicators (PSIs), Port Sustainability Measurement, Seaports, Sustainability Reporting
Jel Code: Q56[1]

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SÜRDÜRÜLEBILIRLIK RAPORLAMA SÜRECINDE LIMAN SÜRDÜRÜLEBILIRLIK GÖSTERGELERININ DEĞERLENDIRILMESI

ÖZET

Sürdürülebilirlik raporlamasının, bir şirketin ekonomik, çevresel ve sosyal konulardaki performansını iletmenin kurumsallaşmış bir aracı haline gelmesine rağmen, güncel liman sürdürülebilirlik raporları incelendiğinde tüm limanlar tarafından kullanılan ortak liman sürdürülebilirlik göstergeleri (PSI)'nin olmayışı bu çalışmanın temel motivasyonu olmuştur. Bu yüzden bu çalışmanın amacı; sürdürülebilirlik raporlarındaki kullanım sıklıklarını ölçerek yoğun olarak kullanılan liman sürdürülebilirlik göstergelerine karar vermek ve sektör uygulayıcılarına gelecek sürdürülebilirlik raporları için kullanılabilecek liman sürdürülebilirlik göstergeleri seti önermek olarak belirlenmiştir. Bu amaca ulaşmak için, öncelikle mevcut yazındaki, sürdürülebilirlik ölçümü üzerine odaklanmış liman sürdürülebilirlik göstergeleri derlenmiş ve sürdürülebilirlik alt-kriterleri elde edilmiştir, sonra 7 farklı limanın 2014 yılında yayınlanan sürdürülebilirlik raporları NVIVO 8 yazılımı aracılığı ile analiz edilmiştir. Sonuçta, sürdürülebilirlik raporlaması sırasında en çok kullanılan ve hiç kullanılmayan liman sürdürülebilirlik göstergeleri, sürdürülebilirliğin üç temel boyutuna göre tanımlanmıştır. Çalışmanın ilk kısmında belirlenen 60 liman sürdürülebilirlik göstergesinin 34 tanesinin çalışma kapsamında analiz edilen hiçbir liman sürdürülebilirlik raporunda yer almaması çalışmanın dikkat çekici sonuçlarındandır. Çalışmanın son bölümünde araştırma kısıtları ve gelecek çalışmalar için önerilere yer verilmiştir.

Anahtar Kelimeler: Liman, Liman Sürdürülebilirlik Göstergeleri, Liman Sürdürülebilirlik Ölçümü, Sürdürülebilirlik Raporlaması
Jel Kodu: Q56

1. INTRODUCTION

Ports composed of different businesses dealing with different activities and offering a wide range of services (Hakam, 2015: 14), are among the most harmful to the environment due to their characteristics such as amount of waste they produce, harmful emissions and noise pollution they cause (Darbra et al, 2005: 866). Therefore, to reduce this harm sustainability is one of the important concepts for port industry (Broesterhuizen et al, 2012: 1). Sustainability in the port industry is of growing fear for port authorities, policy makers, port users and local communities (Acciaro et al., 2014: 480). Furthermore, according to Sislian et al. (2016: 19), in seaports and related activities, environmental matters are not only

repeatedly emerging but also becoming a competitive factor. For all of these reasons sustainability is one of the important concepts for port sector. Even though, the sustainability concept is a relatively recent approach in the maritime literature, and still a gap exists in this field (Sislian et al., 2016: 19), the sustainability of seaports has been the focus of the media, the industry and the research community (Hakam and Solvang, 2013: 803). Thus, especially environmental issues in port industry, have become an increasingly important focus in a global trend recently (Shiau and Chuang, 2015: 27) at the end port authorities are began to pay increasing attention to environmental, sustainability and security issues as a result of stakeholder pressure from market players, public bodies, social interest groups and individual citizens which is growing (Bergmans et al., 2014: 109).

In this study, firstly port sustainability indicators that focused on port sustainability measurement in current literature will be gathered together to obtain sub-dimensions. Then, 7 different ports sustainability reports which published in 2014 will be analyzed via the NVIVO 8 software programme according to the 3 dimensions of sustainability and their sub-dimensions obtained in the first part of the study. At the end, the most used and unused port sustainability indicators (PSIs) in the sustainability reporting process will be identified under the three main dimensions of sustainability; environmental, financial and social.

2. SUSTAINABILITY INDICATORS AND MEASUREMENT

Sustainability concept is mainly assumed to have originated in the (1987) Brundtland Report called ‘‘Our Common Future’’ by the United Nations World Commission on Environment and Development (Yadava and Sinha, 2014: 549). Sustainability issues have become a directory principle and aim for human and economic development over the past 30 years since the publication of the Brutland Report in the 1987. The Brundtland commission report also has the most quoted definition of sustainability which is (Hernández et al., 2012: 13): “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland Report, 1987: 16).

While measuring sustainability, concept must be taken into account and be found a balance between environmental, financial and social factors that are also referred as the triple bottom line of sustainability (Sislian et al., 2016: 19) or called three dimensions of sustainable development (Tanzil et al., 2006: 41). That triple bottom line is defined as 3P in several papers, which are People, Planet and Profit. In 3P classification, *People* stands for the social criteria as corporate social responsibility, *Planet* consists the criteria for the environment, and the *Profit* criterion will be formulated as the financial Net Present Value (Broesterhuizen

et al, 2012: 5). Similar to triple bottom line of sustainability, three dimensions of sustainable development are separated as economic growth, social progress, and stewardship of the environment (Tanzil et al., 2006: 41). Consequently, three value driven dimensions are visualized and help monitor the port sustainability performance (Hakam, 2015: 15). A sustainability report submits the company's values, strategies, governance model and its commitment to a sustainable global economy (GRI, 2018). In addition, sustainability reporting help organizations to measure and understand their sustainability performances and then set goals to change more efficiently (GRI, 2018). The use of indicators has become standard method to measure sustainability after the publication of the Brundtland Commission Report in 1987 and the Earth Summit in 1992 (Milman and Short, 2008: 759). Sustainability indicators are differentiated from other indicators by their need to measure the system ability to adapt, change and continue to function over a long time of span (Milman and Short, 2008: 759). "Indicators" and "metrics" are interchangeably words used for referring to measurement of sustainability, yet somehow term of "indicators" used more broadly in current literature (Tanzil et al., 2006: 42). Therefore, the use of "indicators" word for referring the measurement of sustainability was deemed appropriate in this study.

When it comes to the universality of these indicators, Turcu (2013) declares that sustainability indicators are not universal and "not only useful for measuring progress, but also for identifying problems, setting sustainability goals and suitable management solutions at the local level". However, to gain progress it is important to make healthy comparisons between sustainability performances of industries. Thus, it is thought that having a standard and universal sustainability measurement indicators set is crucial. Addition to those, measuring the sustainability becomes even more substantial as the business adage of "only what gets measured gets managed" suggests (Tanzil et al., 2006: 41).

Table 1: General Characteristics of Port Sustainability Indicators (PSIs)

Characteristics	Definitions
Representativeness	The indicators should represent environmental behaviour as accurately as possible
Conciseness	The indicator should allow for the simplification of the number of variables, which characterizes a phenomenon of condensing the information with the least possible loss of information
Purpose	The indicator should allow an activity to be evaluated in such a way that goals are accomplished
Usefulness	The indicator should be a useful tool for the activity
Relevance	Within the environmental awareness framework
Adaptability	Being adapted or easily adapted to other indicators, models and prediction systems (EEA, OCDE, EC, etc.)
Comparability	Over time (the development of a phenomenon), and within regional, national and international frameworks
Sensitivity	The indicator should be sensitive to environmental changes with fast, adaptable and appropriate responses to them. Thus, they should have variable values according to the changes in the phenomenon
Clarity	The system should be coherent and focus on essential data. The indicators should be concise, accurate, simple and easy to interpret
Reliability and objectivity	In obtaining and developing the data
Easy to obtain	From the phenomenon being evaluated
Continuity	The collecting data criteria should be constant over time in order to compare results
Regularity	The indicators should be determined at appropriately short intervals for the purpose of having the opportunity to actively pursue and influence the desired data
Scientific verification	The indicator should be preferably quantitative. If this were not possible, it should be hierarchically categorized
Well-defined limits	The indicator should provide information about its own limitations
Cost-effectiveness	The indicator should be administratively efficient in terms of the costs involved in obtaining the data and use of the information

Source: Peris Mora et al., 2005: 1653.

Similar to sustainability indicators, PSIs are also ensure a foundation to measure, monitor, and improve the sustainable development of ports (Shiau and Chuang, 2015: 27). Key port sustainability indicators used to measure port sustainability and sustainable development of an industry (Tanzil et al., 2006: 43). A smooth running port sustainability measurement system should not only describe the current state of the port system but should also provide an early warning of different problems (Milman and Short, 2008: 759). Because of their nature ports are known as one of the most polluting sectors so they present an opportunity to reduce different types of emissions highly and until now in sustainability concept the main attention has been given to reduction of emissions in transport, shipping and port industry (Broesterhuizen et al, 2012: 1).

To reduce emissions many ports started different sustainability programmes and invested in large amounts over the years. In 2006, the port of Los Angeles started a Clean Air Action Program (CAAP) which led to emission reductions of %50 to %75 in five years' time and it was the most ambitious program in the world for cleaner ports (Broesterhuizen et al, 2012: 2). Bremenports converted electricity supply into green electricity in 2011 (Bremenports Sustainability Report, 2014). Port of Cork has installed High Mast Lighting Voltage Control Units in 2010 and 2011. Systems cost €1,400 to install and energy savings of 30% have been achieved (Port of Cork Environmental Report, 2014). In 2015, the Port of Gothenburg became a climate-neutral company. By investing in solar cells, biogas and district heating and other environmental measures, emissions have been reduced to a minimum (Sustainability Report of Gothenburg Port Authority, 2015).

3. SUSTAINABILITY REPORTING

Sustainability reporting is such an implementation of measuring and being accountable to internal and external stakeholders for organizational performance to the aim of sustainable development (Yadava and Sinha, 2014: 549). In the 21. Century it became a necessity to develop an indicator system for measuring, reporting, and monitoring port development to improve port sustainability for port operators (Shiau and Chuang, 2015: 27) due to all emissions and pollutions caused by ports. Ports are increasingly under pressure to show especially their environmental sustainability situations (Darbra et al, 2005: 866). Because of that, most of the literature has focused on developing indicators for measuring port environmental impacts; however, the social and financial aspects have been relatively ignored both measuring and reporting processes (Shiau and Chuang, 2015: 28).

Meanwhile Global Reporting Initiative (GRI) provided a systematic approach for the companies to report their performance on social, environmental, and economic dimensions of sustainability and developed sustainability reporting guidelines (Yadava and Sinha, 2014:

549). After that sustainability reporting has become an institutionalized way of communicating a company's sustainability performance on financial, environmental and social issues (Bergmans et al., 2014: 109).

According to KPMG international survey of corporate responsibility report (2008) %79 of the leading 250 companies of Fortune 500 published sustainability report in 2008 while %52 of them published sustainability report in 2005. Therefore, Yadava and Sinha (2014: 550) states that there is a continuous growing in the numbers of organizations that publishes sustainability report. But unfortunately when it comes to port sector it is difficult to find sustainability report which is qualified, decent and uniform. With regret, very few ports are publishing sustainability report that has these three features.

In 2013 Turcu states that sustainability indicators are non-universal but useful for both measuring current progress and identify current problems. Addition to Turcu (2013: 16), Hakam (2015: 16) states that it is possible to decide which port is best performing, in other words determining the dominant value driver that will improve the ports performance with a minimum investment. Therefore, this study aims to propose a set of port sustainability indicators (PSIs) to the implementers in the sector which can be universal by determining the most mentioned indicators in the ports' sustainability reports.

4. METHODOLOGY

PSIs to be used in measuring the usage frequency in ports sustainability reports are gathered together in several sources in current literature and in this study they will be named after sub-dimensions of PSIs. To gather these sub-dimensions, first, 34 expert based PSIs taken directly from the study of Shiau and Chuang (2015). In that study Shiau and Chuang, used rough sets theory (RST) to evaluate and simplify 110 initial PSIs and that 34 expert based PSIs were selected by a group of people that consist of the Taiwan International Ports Corporation (TIPC), academic researchers, and industry representatives. In current study, dimensions, that are in the form of formulas have been simplified aiming adapted to the suitable format. After that process 24 sub-dimensions obtained. 15 sub-dimensions are taken from Hakam (2015), in that study Hakam used a sustainability index that created for the given port and dimensions which suit current study was taken directly. Additionally, 8 sub-dimensions are taken from Tanzil et al., (2006). Tanzil gives a list consists of important aspects of sustainability used for starting point and used to develop sustainability indicators. In (2005) Peris-Mora et al., found 17 indicators to develop an environmental sustainability measuring system. In current study 5 of those indicators were used as sub-dimension. At the end of this process 52 sub-dimensions gathered. 28 of them are environmental sub-dimensions, 15 of

them are financial sub-dimensions and 9 of them are social sub-dimensions. All 52 sub-dimensions are shown below Table 2.

Table 2: Port Sustainability Indicators

Ports Sustainability Indicators	
Environmental Indicators	Emissions of GHGs
	Emissions of air pollutants
	Noise
	Renewable/alternative energy usage
	Recycling of ships
	Recycling of hazardous wastes
	Recycling of equipment
	Emissions of GHGs/area of warehouse
	Emissions of GHGs/average service time for ships
	Emissions of GHGs/number of import and export containers
	Emissions of GHGs/annual revenues
	Fuel consumption
	Electric consumption
	Water consumption
	Air quality
	Atmospheric contaminant emissions: CO, NOx, SOx, PM10 particles
	Greenhouse effect (Carbon footprint): CO2, CH4, N2O
	Water quality
	Waste creation
	Waste disposal
	Eco-efficiency
	Wasted resources
	Material recycling
	Noise pollution
	Inner port water quality
	High risk areas for soil pollution
	Creation of sludge from dredging
	Efficient electric energy consumption
Financial Indicators	Annual capital investments
	Floor space of passenger service areas
	Annual ship visits
	Annual revenues

	Annual passenger visits
	Annual revenues/capacity of annual container throughput
	Annual revenues/area of container yard
	Annual revenues/handling efficiency of gantry cranes
	Annual passenger visits/annual capital investments
	Capacity of annual bulk and general cargo throughput/annual capital investments
	Capacity of annual container throughput/annual capital investments
Financial Indicators	Dwell time
	Rate of return on turnover
	Cargo handling revenue per ton of cargo
	Capital equipment expenditure per ton of cargo
	Labor expenditure
	Annual accident rate in port area
	Annual fatalities in port area
	Annual number of injured in port area
	Employee training
Social Indicators	Social impacts of operations
	Stakeholder engagements
	Human rights
	Workplace conditions
	Security

Source: Created by the author

After creating Table 2, indicators shown into it, analyzed with NVIVO 8 package programme to calculate usage ratio of each of them in chosen ports sustainability reports. Although, the concept of sustainability has been in the literature for three decades, it has recently become popular. For this reason, the number of ports issuing regular sustainability reports is rather limited. In fact, some ports publish a sustainability report every two or five years instead of publishing an annual report. The study included all seven ports that published the annual sustainability report in 2014, in English and in compliance with GRI standards as a sample.

NVIVO Software supports qualitative and mixed methods research (www.qsrinternational.com, 2017), and used prevalently to qualitative data analysis (Bakla and Demir, 2015). It has been seen as helping the researcher while searching an accurate and transparent picture of the data in data analysis process (Welsh, 2002: 1). NVivo software has several advantages and can greatly improve the quality of research. By removing the manual

tasks, it enables researchers to discover trends, define themes and get results faster while minimizing the error margin (Wong, 2008: 18). Ultimately, it makes the analysis of qualitative data more systematic, easier, and more accurate (Wong, 2008: 19).

5. FINDINGS

a. Analyzes of Environmental Indicators

Usage frequency, relevance ratios and the coverage ratios of environmental sustainability indicators that obtained from the literature survey in ports own sustainability reports given detailed in Appendix 1. Figure 1, shows the summary of usage frequency, relevance ratios and the coverage ratios of environmental sustainability indicators.

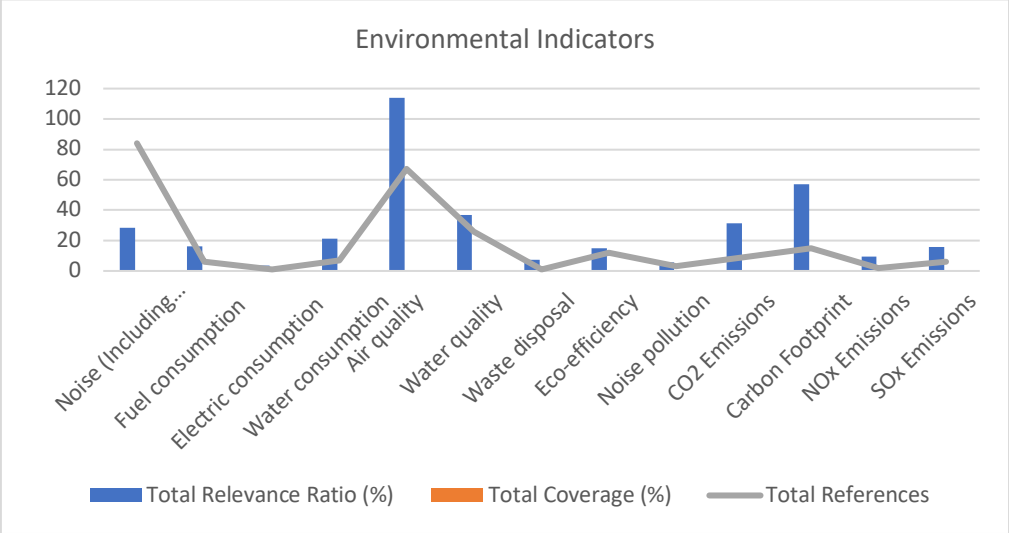

Figure 1: Analysis of Environmental Indicators

In order to make a comparison between obtained numbers and ratios, the word "port" is used as an indicator at the bottom of the table, because it is the most used word in all reports. Also, since some of the variables in Table 2 have more than one variable to be queried, these variables are divided and listed separately during the analysis (e.g. atmospheric contaminant emissions: CO, NOx, SOx, PM10 particles).

As a result of the analyzes, any indicator can be found that commonly used in the sustainability reports of all ports. In addition, it is observed that, 18 of 32 environmental indicators were not used in any port's sustainability report. Those 18 environmental sustainability indicators are listed as; Emissions of GHGs, Emissions of air pollutants, Renewable energy usage, Alternative energy usage, Recycling of ships, Recycling of

hazardous wastes, Recycling of equipment, Area of warehouse, Waste creation, Wasted resources, Material recycling, Inner port water quality, High risk areas for soil pollution, Creation of sludge from dredging, Efficient electric energy consumption, CH4 Emissions, N2O Emissions, Atmospheric contaminant emissions and PM10 Particles Emissions.

In addition to that, Noise, Fuel consumption, Electric consumption, Water consumption, Air quality, Water quality, Waste disposal, Eco-efficiency, Noise pollution, CO2 emissions, NOx emissions, SOx emissions and Carbon footprint indicators are listed as the indicators used in the sustainability reports of the selected 7 ports. Information of how many ports used these indicators and usage frequency of these indicators are summarized and given in Table 3.

Table 3: Summary of Environmental Indicators Usage Frequency

Environmental Indicators	Frequency (References)	Sources
Noise	84	6
Air Quality	67	6
Carbon Footprint	15	5
Water Quality	26	4
Fuel Consumption	6	3
CO2 Emissions	9	2
Water Consumption	7	2
Eco-efficiency	12	1
SOx Emissions	6	1
Noise Pollution	3	1
NOx Emissions	2	1
Waste Disposal	1	1
Electric Consumption	1	1
Port	3302	7

According to Table 3, Noise and Air quality indicators are the most used indicators found in 6 different port sustainability reports. Carbon footprint used 5 port sustainability reports. Water quality followed them with 4 port sustainability reports, Fuel consumption with 3 port sustainability reports and CO2 emissions and Water consumption indicators with two port sustainability reports. Eco-efficiency, SOx Emissions, Noise Pollution, NOx Emissions, Waste Disposal and Electric Consumption are used one port sustainability report only. Total usage frequencies of those indicators are shown Table 3 also. The “port” word is used as an

indicator at the bottom of the table in order to make a comparison between obtained numbers.

b. Analyzes of Financial Indicators

The financial sustainability indicators usage frequency, relevance ratios and the coverage ratios that obtained from the literature survey, in ports own sustainability reports demonstrated detailed in Appendix 2. Figure 2, demonstrates the summary of usage frequency, relevance ratios and the coverage ratios of financial sustainability indicators.

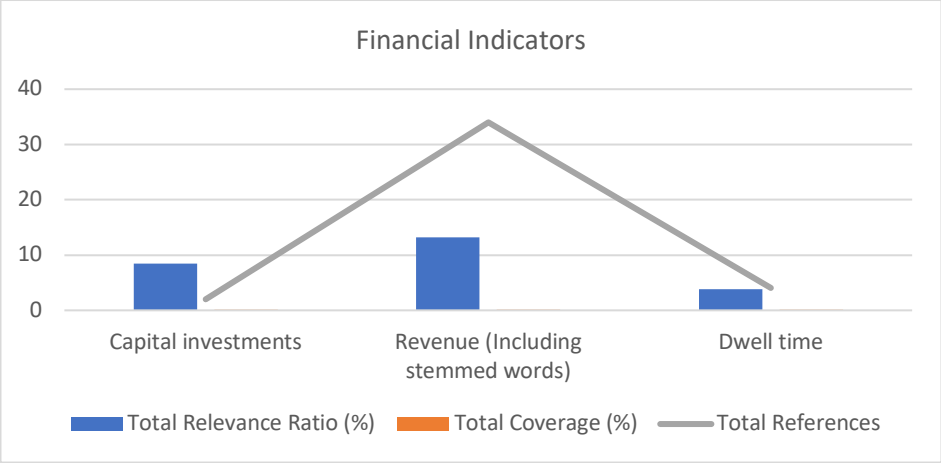

Figure 2: Analysis of Financial Indicators

As a result of the analysis, just one variable, which is revenue, found that commonly used in the sustainability reports of all ports. In addition, it is observed that, 14 of 17 financial indicators were not used in any port's sustainability report. Those 14 financial sustainability indicators are listed as; floor space of passenger service areas, annual ship visits, annual passenger visits, capacity of annual container throughput, area of container yard, handling efficiency of gantry cranes, capacity of annual bulk and general cargo throughput, rate of return on turnover, cargo handling revenue, capital equipment expenditure, labor expenditure, average service time for ships, number of import and export containers and annual revenues.

Today, many businesses including ports are publishing an annual financial report in addition to the sustainability report. However, since the scope of this study is designated as sustainability reports, these financial reports have not been reviewed. Even if the data of such indicators are included in the financial reports of ports, it is expected to be included in the sustainability report also in accordance with GRI standards.

At the end of the analysis of financial indicators, only three indicators were found in current port sustainability reports. Details of these indicators are summarized and given in Table 6.

Table 4: Summary of Financial Indicators Usage Frequency

Financial Indicators	Frequency (References)	Sources
Revenue	34	7
Capital Investments	2	2
Dwell Time	4	1

According to Table 4, Revenue indicator is used all seven port sustainability reports 34 times. Capital investments used 2 port sustainability reports and Dwell time used just one port sustainability report.

c. Analyzes of Social Indicators

Usage frequency, relevance ratios and the coverage ratios of social sustainability indicators that obtained from the literature survey in ports own sustainability reports given detailed in Appendix 3. Figure 3, shows the summary of usage frequency, relevance ratios and the coverage ratios of social sustainability indicators.

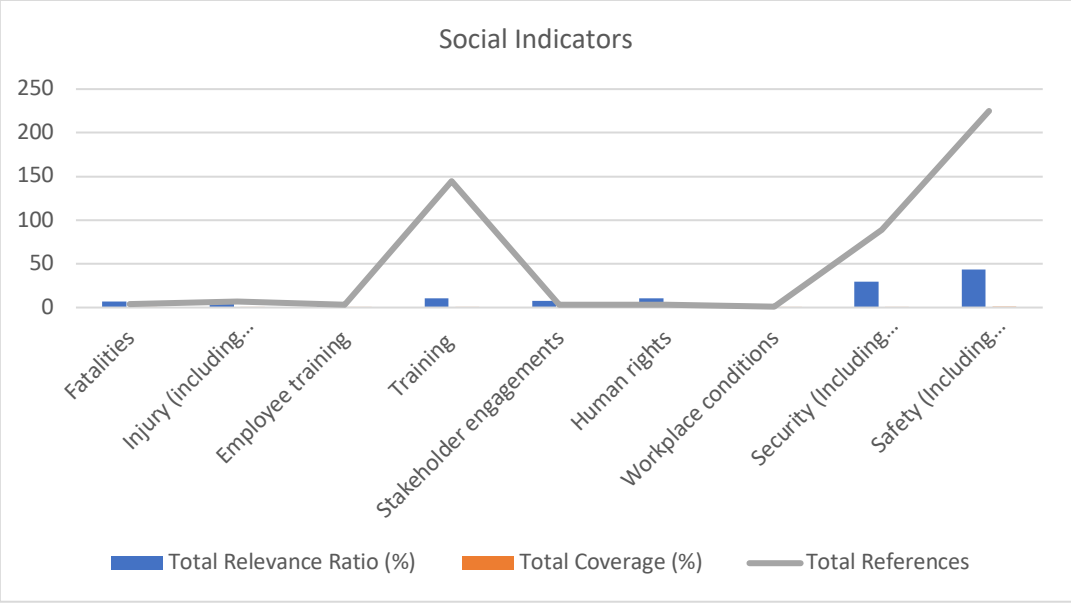

Figure 3: Analysis of Social Indicators

The words "safety" and "security" used for different concepts in English create an important concept confusion in Turkish usage. This is why the word "security", which is a Turkish word, is used instead of the word "safety" originating in Arabic (Gerede, 2006 :27). However, as Kriaa et al. (2015) states, the concepts pointed out by the word "safety" and the concepts pointed out by the word "security" are completely different from each other. While the concept of safety is related to the risks that may be potentially affected on the system environment, the security concerns the risks that may have consequences on the system itself or its environment (Kriaa et al., 2015: 159). In this manner it is thought that its necessary to add the “safety” indicator in social dimension of sustainability. The “Safety” indicator has not been found in literature survey but as it is used extensively in all port sustainability reports, it has been included the analysis by the authors of the study.

As a result of the analysis, just two social indicators were not used in any port’s sustainability report which are; accident rate and social impacts of operations indicators. As a bright side of the study, Indicators like security, safety and training that can be named as vital indicators are found all seven sustainability reports. Other 6 indicators also found ports sustainability reports which are; fatalities, injury, employee training, stakeholder engagements, human rights and workplace conditions. Details of social indicators used in port sustainability reports are summarized given in Table 5.

Table 5: Summary of Social Indicators Usage Frequency

Social Indicators	**Frequency (References)**	**Sources**
Safety	225	7
Training	145	7
Security	89	7
Injuries	7	3
Fatalities	4	3
Employee Training	3	2
Human Rights	3	2
Stakeholder Engagements	3	1
Workplace Conditions	1	1

According to Table 5, Safety, Training and Security indicators are the most used indicators found in all seven port sustainability reports 459 times. This means ports are really care of

these vital issues gladly. After that, 3 ports gave place to injuries and fatalities in their sustainability reports. Employee Training and human Rights followed them with 2 port sustainability reports. Finally, stakeholder engagements and workplace conditions took place only one port sustainability report.

At the end of the findings, results of Table 3, Table 4 and Table 5 summarized. In Table 6, the usage ratios of selected indicators for each port are calculated as environmental, financial, social and total, and general picture of the current situation of port sustainability reporting has been established. Given in Table 6, at the end of the all analysis, Port of Los Angeles used %23,3 of all chosen indicators in three dimensions of sustainability, and it is the biggest ratio of all. After Port of Los Angeles, Port of Vancouver and Port of Coruna used %21,6 of indicators. Port of Valencia followed them with the %18,3 using rate, Port of Hamburg with %16,6, Port of Dublin with %15. With the %11,6 indicators using rate Port of Gothenburg took the last place.

Additionally, all indicators examined in the study for environmental, financial and social dimensions are listed in Table 7 as used and unused indicators in ports' sustainability reports. It is thought that the variables mentioned in the Table 7 will contribute to the practitioners as they are constructed from the indicators obtained from the literature survey and proposed to be used for sustainability measurement by different authors.

Table 6: General Summary of Findings

	Los Angeles		Vancouver		Gothenburg		Coruna		Hamburg		Dublin		Valencia	
	Indicator Frequency	Reference	Indicator Frequency	Reference	Indicator Frequency	Reference	Indicator Frequency	Reference	Indicator Frequency	Reference	Indicator Frequency	Reference	Indicator Frequency	Reference
Environmental Indicators	8/32	42	5/32	62	1/32	3	9/32	91	5/32	14	4/32	12	2/32	16
Financial Indicators	2/17	5	3/17	6	1/17	3	1/17	8	1/17	4	1/17	1	1/17	13
Social Indicators	4/11	14	5/11	71	5/11	12	3/11	113	4/11	43	4/11	16	8/11	211
Total	14/60	61	13/60	139	7/60	18	13/60	212	10/60	61	9/60	29	11/60	240
Total Ratio (%)	%23,3		%21,6		%11,6		%21,6		%16,6		%15		%18,3	

Table 7: Used and Unused Indicators in Three Main Dimensions of Sustainability

Environmental Indicators		Financial Indicators		Social Indicators	
Used	**Unused**	**Used**	**Unused**	**Used**	**Unused**
Noise	Emissions of GHSs	Revenue	Annual ship visits	Safety	Accident Rate
Air Quality	Emissions of air pollutants	Capital Investments	Floor space of passenger service areas	Training	Social Impacts of operations
Carbon Footprint	Renewable/alternative energy usage	Dwell Time	Annual passenger visits	Security	
Water Quality	Recycling of ships		Capacity of Annual container throughput	Injuries	
Fuel Consumption	Recycling of hazardous wastes		Area of container yard	Fatalities	
CO2 Emissions	Recycling of equipment		Handling efficiency of gantry cranes	Employee Training	
Water Consumption	Atmospheric contaminant emissions (CO, NOx, PM10 particles)		Annual capital investments	Human Rights	
Eco-efficiency	Greenhouse Effect (CH4, N2O)		Capacity of annual bulk and general cargo throughput	Stakeholder Engagements	
SOx Emissions	Waste Creation		Rate of return on turnover	Workplace Conditions	
Noise Pollution	Wasted resources		Cargo handling revenue per ton of cargo		
NOx Emissions	Material recycling		Capital equipment expenditure per ton of cargo		
Waste Disposal	Inner port water quality		Labor expenditure		
Electric Consumption	High risk areas for soil pollution				
	Creation of sludge from dredging				
	Efficient electric energy consumption				

6. RESULTS

When environmental dimension of sustainability is analyzed in port sustainability reports, it is seen that Port of Coruna gave place 9 chosen environmental indicators in its sustainability report. Unfortunately, it is the biggest number of all 32 chosen environmental indicators. Also, any common indicator can be found in all seven ports sustainability reports and this makes impossible to make comparison between ports environmental sustainability performances. As it was mentioned literature part of this study, ports known as one of the most polluting sectors, and therefore they provide an opportunity to reduce emissions significantly. However, in order to start reduce emissions they can be measured and compared indeed. Moreover, our expectation from all port managements is to give place 12 used environmental sustainability indicators, given in Table 3, in their sustainability reports to see, measure and compare their sustainability performances with each other.

Unfortunately, financial dimension of sustainability is barely analyzed in this study. It's because of the chosen indicators are too specific or financial dimension of sustainability in ports sustainability reports are too narrow. Of course many businesses including ports are publishing an annual financial report in addition to the sustainability report and they add their financial situation in annual financial reports besides sustainability reports. However, even if the data of such indicators are included in the financial reports of ports, it is expected to be included in the sustainability report also in accordance with GRI standards. At the end three chosen financial indicators found and just one of them used for all seven ports, which is "revenue".

When analyzed social dimension of sustainability in port sustainability reports, vital indicators like security, safety and training are found all seven sustainability reports as a bright side of the study. In addition to that general frequencies of chosen social indicators are better than other two dimensions of sustainability in ports sustainability reports. Nearly all indicators are used by half of ports. That makes comparatively possible to compare ports social dimensions of sustainability with each other. In that point, at least half of sector practitioners use deficient indicators in their port sustainability reports to demonstrate exact situation of the ports social sustainability. Also it has been noticed that the "accident rate" indicator has never been used by any port in their sustainability reports. Due to its nature, this indicator has vital importance and it should be included all sustainability reports.

There are no universally used port sustainability indicators so all the indicators used in the study are based on the indicators obtained through analysis in the past port sustainability studies. Due to the nature of social sciences, subjectivity of the obtained data to a certain extent is seen as the first limitation of study. Also the scope of this study is designated as,

ports sustainability reports in the very beginning of the study. For that reason, financial reports of ports have not been included the survey in the financial dimension of sustainability. Even if the reasons of this situation explained in the related section of the study, it is the other research constraint of this study.

The duplication of the same work a few years later using the future sustainability reports of the ports used in the present study will be useful for observing changes in the port sustainability reporting process. In addition, to analyze the common variables obtained in the study using different analysis methods, to measure or/and compare their port sustainability performances will be useful both sector practitioners and current literature.

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Appendix 1: Analysis of Environmental Indicators

	Los Angeles			Vancouver			Gothenburg			Coruna			Hamburg			Dublin			Valencia		
	Relevance Ratio (%)	References	Coverage (%)	Relevance Ratio (%)	References	Coverage (%)	Relevance Ratio (%)	References	Coverage (%)	Relevance Ratio (%)	References	Coverage (%)	Relevance Ratio (%)	References	Coverage (%)	Relevance Ratio (%)	References	Coverage (%)	Relevance Ratio (%)	References	Coverage (%)
Emissions of GHG's	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Emissions of Air Pollutants	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Noise (Including Stemmed Words)	2,6	2	0,01	9,3	34	0,16	N/A	N/A	N/A	5,9	32	0,06	3,5	3	0,02	2,7	1	0,01	4,5	12	0,02
Renewable Energy Use	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Alternative Energy Use	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Recycling of Ships	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Recycling of hazardous wastes	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Recycling of equipment	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Area of warehouse	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Fuel consumption	4,8	1	0,01	6,3	2	0,03	N/A	N/A	N/A	5,1	3	0,02	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Electric consumption	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3,4	1	0,01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Water consumption	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	7,9	4	0,02	N/A	N/A	N/A	13,2	3	0,07	N/A	N/A	N/A
Air quality	28,4	19	0,15	31,2	23	0,24	N/A	N/A	N/A	15,5	14	0,06	8,6	1	0,01	20,1	6	0,09	10,2	4	0,02
Water quality	13,5	9	0,09	6,7	2	0,02	N/A	N/A	N/A	10,7	14	0,07	6	1	0,01	N/A	N/A	N/A	N/A	N/A	N/A
Waste creation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Waste disposal	N/A	N/A	N/A	7,5	1	0,01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Eco-efficiency	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	15	12	0,06	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Wasted resources	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Material recycling	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Noise pollution	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5,8	3	0,02	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Inner port water quality	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
High risk areas for soil pollution	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Creation of sludge from dredging	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Efficient electric energy consumption	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CO2 Emissions	7,3	1	0,01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	24,2	8	0,11	N/A	N/A	N/A	N/A	N/A	N/A

Appendix 2: Analysis of Financial Indicators

	Los Angeles			Vancouver			Gothenburg			Coruna			Hamburg			Dublin			Valencia		
	Relevance Ratio (%)	References	Coverage (%)	Relevance Ratio (%)	References	Coverage (%)	Relevance Ratio (%)	References	Coverage (%)	Relevance Ratio (%)	References	Coverage (%)	Relevance Ratio (%)	References	Coverage (%)	Relevance Ratio (%)	References	Coverage (%)	Relevance Ratio (%)	References	Coverage (%)
Capital investments	4,2	1	0,01	4,2	1	0,02	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Floor space of passenger service areas	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Annual ship visits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Revenue (Including stemmed words)	1,8	4	0,02	1,6	1	0,01	2,1	3	0,04	1,8	8	0,02	2	4	0,03	1,7	1	0,01	2,2	13	0,04
Annual passenger visits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Capacity of annual container throughput	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Area of container yard	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Handling efficiency of gantry cranes	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Capacity of annual bulk and general cargo throughput	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dwell time	N/A	N/A	N/A	3,8	4	0,04	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Rate of return on turnover	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cargo handling revenue per ton of cargo	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Capital equipment expenditure per ton of cargo	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Labor expenditure	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Average service time for ships	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Number of import and export containers	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Annual revenues	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Appendix 3: Analysis of Social Indicators

	Los Angeles			Vancouver			Gothenburg			Coruna			Hamburg			Dublin			Valencia		
	Relevance Ratio (%)	References	Coverage (%)	Relevance Ratio (%)	References	Coverage (%)	Relevance Ratio (%)	References	Coverage (%)	Relevance Ratio (%)	References	Coverage (%)	Relevance Ratio (%)	References	Coverage (%)	Relevance Ratio (%)	References	Coverage (%)	Relevance Ratio (%)	References	Coverage (%)
Accident Rate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Fatalities	N/A	N/A	N/A	N/A	N/A	N/A	2,3	1	0,01	N/A	N/A	N/A	N/A	N/A	N/A	2,2	1	0,01	2,1	2	0,01
Injury (including stemmed words)	N/A	N/A	N/A	2,3	1	0,01	2,5	1	0,01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2,5	5	0,02
Employee training	3,1	2	0,03	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2,4	1	0,01
Training	1,4	7	0,04	1,4	8	0,06	1,4	4	0,06	1,5	53	0,15	1,5	12	0,11	1,4	7	0,08	1,6	54	0,18
Social impacts of operations	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Stakeholder engagements	N/A	N/A	N/A	7,6	3	0,06	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Human rights	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5,6	1	0,01	N/A	N/A	N/A	4,9	2	0,01
Workplace conditions	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3,6	1	0,01
Security (Including stemmed words)	2,9	4	0,02	6,9	26	0,19	2,7	1	0,01	3,1	8	0,02	5,5	15	0,12	3,1	2	0,02	5,7	33	0,11
Safety (Including stemmed words)	2,1	1	0,00	8,4	33	0,19	5,1	5	0,05	6,6	52	0,11	6	15	0,10	4,8	6	0,05	10,6	113	0,28