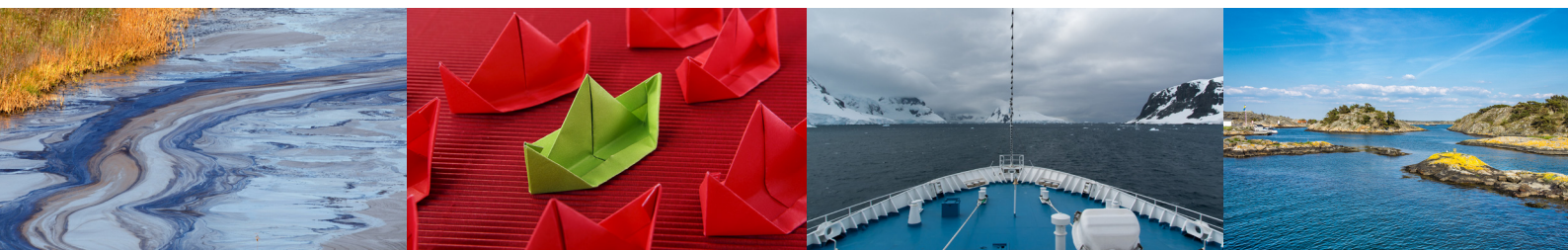


LIGHTHOUSE REPORTS

Pre-study on sustainability indices for shipping

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A feasibility study initiated and sponsored by Lighthouse 2017

www.lighthouse.nu

IVL Rapport C 258
ISBN 978-91-88319-87-6

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Initiated and sponsored by Lighthouse 2017



Summary

Demands on reporting and communication of the sustainability performance within a company as well as externally and how the demands on continuous improvement are fulfilled, has led to a development and also standardisation of sustainability indicators and indices. In shipping, like in all sectors, numerous indices or reporting systems have been developed and are used for various purposes. The aim has often been for communication with cargo owners and passengers, but also to be used as a basis for economic incentives intended to decrease emissions in ports and fairways. With increased demands on aspects included, it is obvious that a future sustainability index for shipping needs to include social and economic aspects in addition to natural environment and resource use.

The present report is a pre-study with a review on existing indices in the shipping sector, and an outlook to other areas, followed by a discussion on possible development paths of more comprehensive sustainability indices.

The conclusions are:

The available environmental indices for shipping are many and there are initiatives, like CSI, that cover many relevant aspects. However, the indices are not very developed what concerns working conditions or socioeconomic costs. Also, economic parameters describing the ship-owner as a company are not included.

The scrapping process foreseen for a ship can be further developed and included in indices.

For further development, the following is suggested:

- Develop indicators that can be used for describing work environment with the goal of introduction into an index.
- The development of socioeconomic cost assessments, for example in terms of ecosystem services, is interesting and could be included in indices in the future. It is recommended that this development is followed for future use.
- At the moment, there is not an easy way to include the economic dimension in terms of economic stability of the company in an index, but this should be further investigated.
- The possible use of MRV (Monitoring, Reporting, Verification) in indices should be evaluated.

Sammanfattning

Olika krav på rapportering och kommunikation av hållbarhetsprestationer inom ett företag såväl internt som externt, samt hur kraven på kontinuerlig förbättring är uppfyllda har lett till utveckling och standardisering av hållbarhetsindikatorer och index. Inom sjöfarten liksom i andra sektorer har flera index eller rapporteringssystem utvecklats och används för olika ändamål. Syftet med index i sjöfartssektorn har ofta varit kommunikation med lastägare och passagerare, men också att användas som underlag för ekonomiska incitament som syftar till att minska utsläppen i hamnar och farleder. Med ökad efterfrågan på fler aspekter som bör beaktas är det uppenbart att ett framtida hållbarhetsindex för sjöfarten måste innehålla sociala och ekonomiska aspekter utöver naturmiljön och resursanvändningen.

Denna förstudie fokuserar på en kartläggning av befintliga index inom sjöfartssektorn, följt av en diskussion om möjliga utvecklingsvägar för mer omfattande hållbarhetsindex.

Slutsatserna är:

Miljöindexen är många och det finns initiativ, som CSI, som täcker många relevanta aspekter. De sociala aspekterna när det gäller arbetsförhållanden beaktas inte idag, och här finns ett potentiellt utvecklingsområde. Ekonomiska parametrar som beskriver redarens verksamhet som ettr företag ingår inte.

Det finns några tekniska/miljömässiga aspekter, som skrotning, som kan utvecklas och inkluderas i index.

Följande områden föreslås för fortsatt utveckling:

- Utveckla indikatorer som kan användas för att beskriva arbetsmiljö med mål att inkludera i ett index.
- Utvecklingen av utvärdering av socioekonomiska kostnader, exempelvis i form av ekosystemtjänster är av intresse och skulle i en framtid kunna inkluderas i ett index. Det rekommenderas att utvecklingen följs för framtida användning.
- För tillfället finns inte något enkelt sätt att inkludera den ekonomiska dimensionen i form av ekonomisk stabilitet i ett företag i ett index, men detta bör undersökas vidare.
- Möjligheten att inkludera data från MRV (Monitoring, Reporting, Verification) indikatorer bör utredas.

Content

1. Introduction	5
2. From measurement and observations to an index	6
3. Existing indices for shipping	7
3.1 Environmental	7
3.2 Social impact	9
3.3 Social impact of scrapping in the existing indices	10
3.4 Economic	10
4. “Non shipping” indices and tools	11
4.1 Environmental impact	11
Ecosystem services	11
4.2 Societal costs	12
4.3 Social aspects, working conditions - Frameworks of importance in making indices and International Regulations in work environment	13
Maritime Labour Convention, 2006, as amended (MLC, 2006)	13
International Maritime Organization, IMO work environment regulations and guidelines	14
European Union	14
4.4 National legislation (Sweden) on work environment	15
Arbetsmiljölagen (AML)	15
Arbetsmiljöförordningen (AMF)	15
Arbetsmiljöverkets författningssamling (AFS)	15
Fartygssäkerhetslagen (FSL) och Fartygssäkerhetsförordningen (FSF)	16
Föreskrift om Systematiskt arbetsmiljöarbete (SAM)	16
4.5 Non-mandatory work environment agreements	16
ITF	16
IMEC	17
4.6 Classification Societies and work environment	17
4.7 Economic parameters that may be included	17
5. Analysis – state of the art and possible developments	18
6. Conclusions - suggested continued work	19
7. References	20

1. Introduction

Demands on reporting and communication of the sustainability performance within a company as well as externally and how the demands on continuous improvement are fulfilled, have led to a development and also standardisation of sustainability indicators and indices. Within GRI, the United Nations Global Reporting Initiative, there are a number of guidelines for sustainability reporting at company level (UNEP). The reporting has been developed to provide an extension to the environmental reporting included in many environmental management systems. This reflects the general trend of reporting and management systems with development from taking only natural environment into account to also take aspects like health and safety into account. In the end, the reporting is developed into sustainability reports.

In shipping, like in all sectors, numerous indices or reporting systems have been developed and are used for various purposes. The aim has often been for communication with cargo owners and passengers, but also to be used as a basis for economic incentives intended to decrease emissions in ports and fairways. With increased demands on aspects included, it is obvious that a future sustainability index for shipping needs to include social and economic aspects in addition to natural environment and resource use.

The present report is a pre-study with a review on existing indices in the shipping sector, and an outlook to other areas, followed by a discussion on possible development paths of more comprehensive sustainability indices.

2. From measurement and observations to an index

An index is a way of communicating a complex context. The index starts with measured data (quantitative or qualitative) from which indicators, data that describes a larger situation and are possible to measure and follow up, can be identified. An example of an indicator can be measured data on nutrients (phosphorous and nitrogen) in the water in the Baltic Sea, that are used to follow the state of the ecosystems. For some applications, when easy communication and comparison is needed, the indicators are merged into one number, an index. The index thus has no physical meaning in itself. An index is also dependent on the understanding and agreement of the underlying considerations between potential users. This also sets demands on the transparency of the underlying data. Often an index is administrated by an organisation that collects and quality assesses the data.

The selection of sustainability indicators to be used sets many demands. Donella Meadows has described this in a report where criteria for indicators, like being relevant, measurable, possible to understand and not possible to manipulate, are discussed (Meadows, 1998). The indicators are useful not only in communication, but also internally within a company for learning and follow up.

The increased demand for transport by society is increasing the demands for lowered environmental effects from shipping. In an inventory of existing environmental indices for shipping performed in 2011, there were more than 30 initiatives identified, of which many do not fulfil the criteria described by Meadows (Svensson, 2011).

The selection and development of index system and administration is thus important in order to get legitimacy of the index. There is also a previous study on criteria for environmentally differentiated port fees by Winnes and Fridell (Fridell and Winnes, 2013).

Swedish fairway fees will be based on results from Clean Shipping Index, CSI, as of January 1st 2018, where the ships are divided into different classes based on emissions of CO₂, NO_x, sulphur and particles. Also, environmentally hazardous compounds used on-board, water use and waste management are included.¹ CSI was one of the indices evaluated in the earlier review that fulfils many of the criteria.

To obtain a complete picture of a company's or ship's role in sustainable development, there is no tool today that covers all aspects.

¹ http://www.sjofartsverket.se/pages/4993/Bekrivn_avgmodell%20160315.pdf

3. Existing indices for shipping

3.1 Environmental

There are a number of ways to evaluate the environmental performance of shipping. The 38 different environmental performance initiatives focused on the shipping industry identified in 2011 has grown, but there are differences in which parameters are prioritised and valued (Svensson, 2011). We have decided to look into the most commonly used indexes in the shipping industry:

The Blue Angel (RAL-UZ 110) *is an environmental label for ship operation. It is created by the Environmental Label Jury which is an independent, decision-making body for the Blue Angel and includes representatives from environmental and consumer associations, trade unions, industry, the trade, crafts, local authorities, academia, the media, churches, young people and the German federal states.*

Clean Cargo Working Group (CCWG): *Performance Metrics Tool calculates and manages CO2 emissions from ocean container transport but also focuses on emissions to air, chemicals, water and waste. The organisation has members such as large container shipping companies and multinational shipping companies using the performance metrics tool.*

Clean Shipping Index (CSI) *is a tool for cargo owners to select clean ships and quality ship operators. Transport buyers use it to calculate and minimise their environmental footprint. Ship-owners present the environmental profile of their fleet to a network of large customers who consider this in procurement situations. Ship-owners also use it as a bench-marking tool in order to identify areas for environmental improvement. CSI is driven by a non-profit organization.*

Environmental Ship Index (ESI) *is an index focused on reducing emissions of NOx, SOx and particulates, as well as CO2 in the longer term, to be achieved by initiating changes in behaviour among ship owners/operators and ports. Data is reported through ESI website and ship owners receive rebates from incentive providers such as ports. ESI was started by the World Ports Climate Initiative.*

Green Award *is a certification system focusing on safety, security and environmental issues. Green Award rewards high safety and environmental standards in shipping and makes above standard ship operation economically more attractive through a number of incentive providers, both ports and others.²*

Green Marine Environmental Program *is a framework for maritime companies to first establish and then reduce their environmental footprint. The initiative has a broader focus than the above-mentioned indexes as ship owners, ports, Seaway corporations, terminals and shipyards can participate. The participants have to improve to maintain certification. The result is a ranking for each performance indicator on a 1-to-5 scale. Level 1 constitutes the monitoring of regulations, while Level 5 indicates leadership and excellence.*

Triple-E *is an environmental and energy efficiency rating scheme for ships. It provides a rating from 4 to 1 (1 being the highest) and is based on a verification of a ship's environmental*

² [http://www.greenaward.org/greenaward/22-all-incentive-providers-\(list\).html](http://www.greenaward.org/greenaward/22-all-incentive-providers-(list).html)

performance. Each rating level demonstrates a level of efficiency for vessel and company, and provides a picture of the environmental performance.

Different indexes prioritise different environmental indicators, depending on who is the initiator and which interest they have in how the shipping industry influences the environment. In the attachment to this report, there is a table where the different indexes are compared on the indicators they include. The list should not be seen as conclusive, due to the short amount of time to research the content of the indexes.

Findings

There are many of the indexes that have indicators focusing on emissions to air during operations. However, indicators connected to the ship's activities in the ports are not included to the same extent. Indicators such as noise in ports, dust emissions in ports, and odours in ports are only included by Green Marine and then only in absolute measures. For instance, if the port develops a permanent discussion forum for the public, port users and the port, they fulfill level 5 performance indicator (the highest level, indicates leadership and excellence). Possible emissions from the cargo as such is included in the Blue Angel label (for tankers) and for all types of vessels for Green Marine. Only Green Award has an indicator on mooring wire lubrication. The indication is whether or not the shipping company use lubrication on the mooring wire and whether it is certified according to European Ecolabel for Lubricants (EEL).

Only Blue Angel label and Green Award have indicators connected to hull stress monitoring, which is a safety aspect, but if not dealt with correctly could have devastating effects on the environment. Hull stress monitoring indicates the stress of the hull structure, but also the design fatigue in the hull.

Only two of the indexes – Blue Angel label and Green Marine - include aquatic noise pollution from shipping. However, the only requirement in Blue Angel is to measure sound emissions from the hull and propulsion system if it has been modified (Blue Angel, 2015). The focus of the underwater noise performance indicator in Green Marine is to reduce underwater noise made by transiting ships in salt water and thereby reduce impacts to marine mammals. Level 3 performance (the highest) would be to not only regularly clean hull and propeller blade, determine the cavitation inception speed (CIS) for each vessel in the fleet, review the list of sensitive areas in Canadian and US waters, but also to actively participate in providing whale sighting data (in Canadian and US waters) through a logbook and develop and adopt a Marine Mammal Management Plan (MMMP) in order to reduce the potential adverse effects of vessels. According to the World Health Organization, anthropogenic noise pollution is the most hazardous form of environmental change and is recognised as a major global pollutant (WHO, 2011). As two thirds of the globe is covered with water, there is a need to find out how aquatic life is reacting and responding to this type of pollution. Kunc et al. (2016) has found evidence for negative effects of anthropogenic noise on an individual's development, physiology, and/or behaviour in both invertebrates and vertebrates. The need for more research in this area, including the problems of measuring under water noise, might be the reason that few of the indexes have included this as an environmental indicator.

3.2 Social impact

There is no specific index today that takes the social impact in general into account, although these issues are discussed in sectors like the cruise industry due to the need for information to passengers. The main exception concerning working conditions is for scrapping, which is included in CSI.

The general concept of social sustainability and how to evaluate this is discussed in two recent articles by Missimer et al (Missimer et al., 2017a, b). The authors conclude that proposed principles are that in a socially sustainable society, people are not subject to structural obstacles to 1) health, 2) influence, 3) competence, 4) impartiality and 5) meaning-making.

An attempt has been made to make an index for the cruise industry by combining generic reporting systems and the cruise industry characteristics.(Bonilla-Priego et al., 2014). The index has been derived by adapting corporate reporting systems like GRI (Global Reporting Initiative), the Carbon Disclosure Program and other international initiatives to the cruise industry to obtain a sector specific index.

The index includes (Bonilla-Priego et al., 2014)

- *Labour conditions (GRI inspired)*
 - o *Employment*
 - o *Labour management relations,*
 - o *Occupational health and safety*
 - o *Training and education*
 - o *Diversity and equal opportunities*
- *Labour conditions (additional)*
 - o *Accommodation and working conditions*
 - o *Working hours*
- *Human rights*
 - o *Investment and procurement practices*
 - o *Non-discrimination*
 - o *Freedom of association and collective bargaining*
 - o *Child labour*
 - o *Forced and compulsory labour*
 - o *Security practices*
 - o *Indigenous rights*
- *Impact on society*
 - o *Community*
 - o *Corruption*
 - o *Compliance*
- *Product responsibility including health and safety*
 - o *Product and service labelling*
 - o *Marketing communications*
 - o *Customer privacy and compliance*
- *Economic impacts (cruise specific)*
 - o *Creating jobs at destination*

3.3 Social impact of scrapping in the existing indices

At the end of a vessel's life, usually occurring when the ship is around 25-30 years old, ships are often scrapped for the metals they contain. A serious health, safety and environmental problem is the ship breaking on the beaches of Bangladesh, India and Pakistan, where workers cut up vessels without protective equipment. Both Blue Angel and Green Award have indicators stating that scoring will be received if there is an inventory of hazardous materials on board. Additionally Blue Angel has a mandatory compliance with the industry directive "Guidelines on Transitional Measures for Ship-owners ". Among other requirements, the shipping company must ensure that the recycling facility is competent. Clean Shipping Index has a question on ship scrapping, but has not included the answer in the scoring model for the index.

3.4 Economic

None has been found.

4. “Non shipping” indices and tools

4.1 Environmental impact

Ecosystem services

There are a number of large research projects in progress relating to assessment of the impacts of shipping and to find ways of describing the total impact. One example is the socio-economic cost terms by ecosystem service valuation. Ecosystem services are functions that nature provides to man constituting a prerequisite for our existence, for example natural climate regulation or water resources. By applying ecosystem service valuation, the areas of special importance to impact are identified. This is a way of getting information for development of regulations and economic incentives and to make priorities.

One of the most common models for assessing human relationships with the environment is the DPSIR (Driver-Pressure-State-Impact-Response) framework. There are a variety of modified DPSIR frameworks available to assess different environmental impacts and via the ongoing EU-project SHEBA the DPSIR framework has been adapted for shipping to assess the environmental impact on the Baltic Sea.

The DPSIR framework has been proposed and are also in use by several EU member states in their work within the EU Marine Strategy Framework Directive (MSFD) (Smith et al., 2016). DPSIR is a structured way to analyse the social-ecological system i.e. how different anthropogenic drivers influence ecosystems and how responses to changes in the ecosystem affect these drivers and the ecosystem in turn.

In the SHEBA project, emission factors of different subsystems (table 1) have been produced, allowing the calculation of the Pressure (load) of different pollutants, e.g. kg of copper from antifouling paints. The Pressure data can subsequently be used to assess the State, i.e. the concentrations of different pollutants in the marine environment, and what Impacts that change in State may have on Ecosystem services. This shipping adapted DPISR framework can be used both by policy makers when assessing cost-efficient measures to reduce environmental impact of shipping and by ship owners when deciding on e.g. changes in technology/products. In addition, it can be used to assess the total emission of pollutants from different ships and can thus be used to improve environmental Indexes.

Table 1. DPSIR concept for shipping with classes, levels and subcategories (From the SHEBA project)

Classes	Levels	Description
Indirect Drivers	1	Economic growth, population growth, urbanisation, trade, fuel prices, climate change, etc.
Direct Drivers	2	Shipping and leisure boating
	3	Ship types: Tug, Vehicle carrier, Ice breaker, Service/Pilot vessel, Tanker, Reefer, Container ship, Passenger cruiser, Passenger ferry, General Cargo, Search and rescue, Yacht (leisure boat)
Sub-system	4	Subsystems: Antifouling, Ballast water, Biofouling on ships, Bilge water, Cooling water, Black water, Grey water, Food waste, Scrubbing water, Stern tube oil, Litter, engine operation, boiler operation in ports
Pressures	1	Pollutants: Contaminants, nutrients, invasive species, acidification, litter and underwater noise, air pollution
	2	Cumulations of pollutants
State	1	Concentrations and levels of pollutants in the Baltic Sea and the surrounding atmosphere
	2	The cumulative effect to the environment: E.g. loss of algal species, crustaceans and fish
Impacts	1	Effects on ecosystem services: e.g. maintaining nursery populations and habitats
	2	Effects that changes in ecosystem services have on human wellbeing: e.g. reduced fish stocks, impacts on tourism
Response	1	Changes in technology, society, economy, policy
	2	Specific measures/instruments

4.2 Societal costs

One way to measure the impact on the environment and the health of an activity is to use the concept of external costs. External costs arise when an action by an individual or a group implies harmful effects on others, such as air pollution effects on health, forest growth or fish reproduction. External costs are thus covered by society or individuals, other than those responsible for the action. The use of this concept has several benefits: the total cost of an action is presented, making it possible to make more informed decisions on policies; different impacts, such as pollution to air, water pollution, noise, and accidents, can be compared with each other; it makes it possible to identify which impacts are most important. There are different ways to assess the external costs (Maibach et al. 2008). For air pollution, the impact method is normally used where the effect of the emissions on health risks, premature deaths, crop yields etc. are assessed and valued. Other methods include abatement costs and willingness to pay for avoiding a certain effect. External costs are regularly calculated when assessing the costs and benefits of infrastructure projects and suggested policy instruments. For an index on the degree of sustainability of ships, this concept would be a way to describe the overall picture, including different impacts. However, even though there are established methods when it comes to air pollution impact, the valuation of other effects is more difficult. For example, for the impact on water quality and ecosystems in the sea there are no established methods for valuation. It is also debated how to value the climate changes coming from the emissions of green-house gases.

4.3 Social aspects, working conditions - Frameworks of importance in making indices and International Regulations in work environment

Work environment at sea involves several organisations such as ILO (International Labour Organisation, 2017a), IMO (International Maritime Organization, 2017), EU (European Union, 2017), ITF (International Transport Workers' Federation, 2017) and IFSMA (International Federation of Shipmasters' Association, 2017). These organisations deal with e.g. work hours, manning and working conditions on board. What is globally decided is however only minimum requirements which everyone must fulfil. Some countries choose to have a stricter approach to the condition on board through national legislation.

Maritime Labour Convention, 2006, as amended (MLC, 2006)

Entry into force: 20 August 2013

The Maritime Labour Convention, MLC is often labelled as the “Seafarer’s Bill of Rights” and is considered as the “fourth pillar” of the international regulatory regime for quality shipping together with SOLAS, MARPOL and STCW (IMO, 2009; IMO 2013, IMO 2010). The overall goal for the MLC is to ensure decent working conditions to sea farers regardless nationality and flag state. It also facilitates a more fair competition for those operators that are fulfilling the requirements in the MLC.

ILO has approved amendments to the MLC to further strengthen the position of the seafarer by adding issues such as protection of abandoned seafarers, provision of financial security for death or long-term disability of seafarers and establishing binding international law on essential issues for the shipping industry (ILO, 2017a).

MLC comprises Part A (mandatory Standards) and Part B (non-mandatory Guidelines) and is organised into general areas under five Titles:

- Title 1: Minimum requirements for seafarers to work on a ship
- Title 2: Conditions of employment
- Title 3: Accommodation, recreational facilities, food and catering
- Title 4: Health protection, medical care, welfare and social security protection
- Title 5: Compliance and enforcement

Compliance with MLC rests on the flag state and through Port state controls where the flag states (the state under which flag the ship operates) are responsible for ensuring implementation of the rules on the ships that fly its flag. Detailed inspections result in the issue of a "Certificate of Maritime Compliance", which should always be present (and valid) on-board the ship. The management of the ship must have routines in place for complaints procedures for its crew and investigations in case of incidents and accidents occurring (International Labor Organization, 2017b).

The inspection in ports depends on whether a Certificate of Maritime Compliance is present on board. If the Certificate is present, compliance is to be assumed in principle, and further investigations only have to take place if the certificate is not in order, there are indications of non-compliance and/or complaints from the crew. For ships that don't have the certificate, an inspection is performed and are then much more detailed to ensure that the

ship has complied with the provisions of the convention. The convention is thus indirectly also valid for ships from countries not having ratified the MLC (International Labor Organization, 2017b).

International Maritime Organization, IMO work environment regulations and guidelines

International Maritime Organization issues mandatory regulations and guidelines which include different aspects of the work environment on-board. The two major documents are the International Safety Management Code and the Safety Management System.

International Safety Management (ISM) Code

The purpose of the ISM Code is to provide an international standard for the safe management and operation of ships and for pollution prevention. ISM includes all aspects of the safety on board, including the work environment. All ship owners responsible for the operation of the ship must establish and implement a policy to fulfil the requirements stated in the ISM code. This also includes a “Designated Person” ashore which has direct access to the highest level of management and is available at all times for the crew to contact. All procedures that are required must be documented and compiled in a Safety Management Manual, which is kept on-board (IMO, 2014).

Safety Management System (SMS)

SMS is an organised system which is planned and implemented by the shipping companies and provides a description of how the vessel operates on a day to day level, how to prepare for emergency situations and what procedures to follow in case of an emergency. The purpose of the SMS is two folded, to ensure safety of the ship and of the marine environment and is a part of the ISM code. SMS shall ensure that all ships comply with and follow mandatory safety rules and regulations, codes, guidelines and standards recommended by IMO and classification societies as well as all policies stated by the shipping company concerning the vessel (IMO, 2014).

European Union

Recently, EU labour law, equality and non-discrimination for EU workers, has become applicable also to seafarers. The purpose is to give seafarers the same right as employees on-shore and to provide an enhancement of the workers living and working conditions. Another purpose with this set of rules and regulations is to prevent unfair competition in the shipping sector, by ensuring all operators have the same obligations in all EU member states.

The EU strongly supports the MLC and has transferred large parts of the Convention in its legislation and implemented it into EU Law (Directive 2009/13/EC).

To further enforce the implementation of the MLC, EU has introduced two Directives;

- Flag State responsibilities and Port State obligations for the Member States to ensure that the Member States concerned effectively discharge their obligations as flag States with respect to the implementation of the relevant parts of MLC (Directive 2013/54/EU).
- Port State control which obliges Member States to ensure, through their inspection mechanism, that the treatment of ships and its crew, flying the flag of a State which is

not a MLC ratifying is not more favourable than that of a ship, and its crew, of a ship flying the flag of a MLC ratifying State (Directive 2013/38/EU, Directive 2009/16/EC)

Other directive aiming at improving the working conditions for seafarers are;

- Working time (Directive 2009/13/EC, Directive 1999/63/EC)
- Improving safety at sea, combat unfair competition from third-country ship owners and protect the health and safety of seafarers on board ships using EU ports (Directive 1999/95/EC).

Other social-specific directives which are applicable to seafarers are:

- Health and safety (Directives 89/391/EEC, 92/29/EEC)
- Working time (Directives 1999/95/EC)
- Social Security (Regulation (EC) No 883/2004)

In addition to this, the scope of five EU labour law Directives are including seafarers to further improving their work rights (Directive 2015/1794/EU). Thus, these additional EU social law becomes applicable to seafarers;

- Protection of employees in the event of the insolvency of their employer (Directive 2008/94/EC)
- Information and consultation of employees (Directive 2009/38/EC, Directive 2002/14/EC)
- Approximation of MS laws on collective redundancies (Directive 98/59/EC)
- Approximation of MS laws on safeguarding employees' rights in the event of transfers of undertakings, businesses or parts of undertakings or businesses (Directive 2001/23/EC)

4.4 National legislation (Sweden) on work environment

In addition to the international and EU mandatory set of rules and regulations any country is free to add additional demands to further improve the work environment of their flagged ships. This paragraph is used by Sweden as an example of national specific regulations. In 2003 Sweden decided to apply the same set of rules and regulations for the work environment on board as was mandatory for land based workplaces.

Arbetsmiljölagen (AML)

A comprehensive overall view of the work environment, including physical, psychosocial and social aspects. The law provides a framework for healthy work environment. (Sveriges Riksdag, 2017a).

Arbetsmiljöförordningen (AMF)

Complement to the AML including safety representative, safety committees and reporting of accidents and incidents (Sveriges Riksdag, 2017b)

Arbetsmiljöverkets författningssamling (AFS)

AFS is transferred to The Swedish Transport Agency statutes (TSFS) and the supervisory authority is The Swedish Transport Agency. Explaining the mandatory requirements stated in AML and provides advice on how to fulfil them (Arbetsmiljöverket, 2017).

Fartygssäkerhetslagen (FSL) och Fartygssäkerhetsförordningen (FSF)

This law is mainly about the seaworthiness of the ship, technical requirements, hull and propulsion and auxiliary equipment on board. The work environment is included, safe manning, prevention of accidents and incidents, provision etc. Both FSL and FSF are supplementary to AML and AMF. (Sveriges riksdag, 2017c; Sveriges Riksdag 2017d)

Föreskrift om Systematiskt arbetsmiljöarbete (SAM)

To fulfil the demands within work environment legislation, there is a need for a systematic approach. SAM provides you with that and the four pillars which SAM rests on are “integration into daily work”, “participation”, “risk assessment” and “action” (Arbetsmiljöverket, 2017b).

4.5 Non-mandatory work environment agreements

Besides the mandatory regulations, there are a lot of non-mandatory agreements between unions and employers. One of the most important agreements for seafarers worldwide are the ITF agreements which are applicable only for ships flying a flag of convenience (FOC). Non-FOC or national flag ships may be covered by National Agreements, but these are a matter for the local union in the flag country. (itfseafarers.org 2017)

ITF

The International Transport Workers' Federation (ITF) is an international trade union federation of transport workers' unions. All trade unions with members in the transport industry are approved for membership of the ITF. There are about 4.5 million transport workers from some 150 countries who are members of the ITF. ITF is a Global Federation Union which is allied with the International Trade Union Confederation (ITUC).

The main aims of the ITF are as following:

- to promote respect for trade union and human rights worldwide
- to work for peace based on social justice and economic progress
- to help its affiliated unions defend the interests of their members
- to provide research and information services to its affiliates
- to provide general assistance to transport workers in difficulty

The main ITF activities can be summed up under three key headings:

- representation
- information
- practical solidarity

The ITF represents the interests of transport workers' unions in bodies which take decisions affecting jobs, employment conditions or safety in the transport industry, such as the International Labour Organisation (ILO), the International Maritime Organisation (IMO) and the International Civil Aviation Organisation (ICAO). (ITF, 2017)

IMEC

The International Bargaining Forum (IBF) is the mechanism by which maritime employers, represented by the Joint Negotiating Group (JNG), and seafarer's unions, represented by the International Transport-Workers' Federation (ITF) could negotiate over the wages and conditions of employment of seafarers serving on ships to which ITF Special Agreements apply, see above FOC under non-mandatory agreements. IMEC interests have recently expanded to cover a wider range of labour supplying countries and to the negotiation of international wage rates, as well as those applying to national flag.

IMEC also coordinates the application of IBF agreements on behalf of its members through local negotiations. IMEC membership covers about 220 member organisations as of March 2016 (IMEC, 2017)

4.6 Classification Societies and work environment

The former role of a classification society was to supply reliable information about the conditions of ships for under-writers and cargo owners. Today, the role of classification societies is more towards a global function that integrates many aspects of ship safety: construction and operation standards, technical requirements, and human factors. This approach, which also embraces the original role, will claim preparation for the future challenges of safety at sea. (Boisson, 1994).

The International Association of Classification Societies (IACS) provides a forum for the international classification societies to share, discuss, research and adopt technical criteria to enhance maritime safety. IACS has for many years been given consultative status with the IMO. It remains the only non-governmental organisation with Observer status enabled to develop and apply Rules. (Romero M. C. 2013)

4.7 Economic parameters that may be included

There are many tools describing the economic statement of companies. Most of these are based on historic data, but this is only one part of the "economic sustainability" of a company. In the concept of risk appraisal on shipping investments the risk is divided into three parts: *economic risk* related to the world economy that is volatile and not related to the company or ship, *operating risk* is dependent on the performance of the ship and the shipping company managing it and a poorly maintained ship will be at risk of unplanned and costly maintenance, and *shipping market risk* related to the shipping market changes due to supply and demands for tonnage. Over-ordering is included in this risk (Stopford, 2008). This information could potentially be included in an economic index at ship's level.

5. Analysis – state of the art and possible developments

The environmental impact is the parameter handled in a large number of indices and labels. Most of these are developed for a specific application, like basis for fees or communication with customers. The number of transparent indices is still low. The introduction of Monitoring, Reporting and Verification (MRV) in Europe may be an interesting source for more data to be included in an index.

An issue sometimes mentioned by ship owners is the large importance of the economic incentive when using indices as a basis for fees. This needs to be evaluated before using an index for economic incentive. For example, the trade-off between lower fuel prices, high investment in emission abatement technology for an old ship and the potential reduced port or fairway fees is essential.

For the present indices, the conclusion is that the developed indexes cover significant environmental indicators, but the result when using these for economic incentives is not fully evaluated. There are also some areas that are not covered. Environmental impacts connected to ports are not included in the current indicators, but there are some indices that are intended to use specially for ports.

Only one index has indicators focused on responsible ship recycling, and this is an area where the need to further develop indicators not only focusing on the operation of a vessel but also the whole life cycle.

From a social point of view, there is a large number of regulations and agreements on many aspects of working conditions, but these are generally not reflected in the indices used for communication of the performance. Attempts to identify indicators for the cruise industry have been made, but in other sectors this is not done. When it comes to ensuring a healthy work environment and respecting social compliance on board ships, there is room for development a way of communication of how the regulations are included for a specific ship.

Socioeconomic costs are not discussed as parts of shipping indicators today, but an investigation of the possible use of the development of this as a tool for decision making in other areas could be of interest also for shipping. However, the development is at an early stage and the real use in indices may take some time before becoming applicable.

Also, the analysis of the economic state of a ship-owner is quite complicated and not straightforward to be introduced in an index. The possibility should be further investigated.

6. Conclusions - suggested continued work

The available environmental indices for shipping are many and there are initiatives, like CSI, that cover many relevant aspects. However, the indices are not very developed what concerns working conditions or socioeconomic costs. The social aspects and pro-active work in terms of working conditions are almost not covered today, and here is a potential development area of how to take this aspect into account. Also, economic parameters describing the ship-owner as a company is not included. The scrapping process foreseen for a ship can be further developed and included in indices.

There is a need for evaluating the outcome of the use of CSI in the present use of Swedish fairway dues.

For further development, the following is suggested:

- Develop indicators that can be used for describing work environment with the goal of introduction into an index.
- The development of socioeconomic cost assessments, for example, in terms of ecosystem services, is interesting and could be included in indices in the future. It is recommended that this development is followed for future use.
- At the moment, there is not an easy way to include the economic dimension in terms of economic stability of the company in an index, but this should be further investigated.
- The possible use of MRV in indices should be evaluated.

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Attachment: Table of Indexes and the environmental indicators they include.

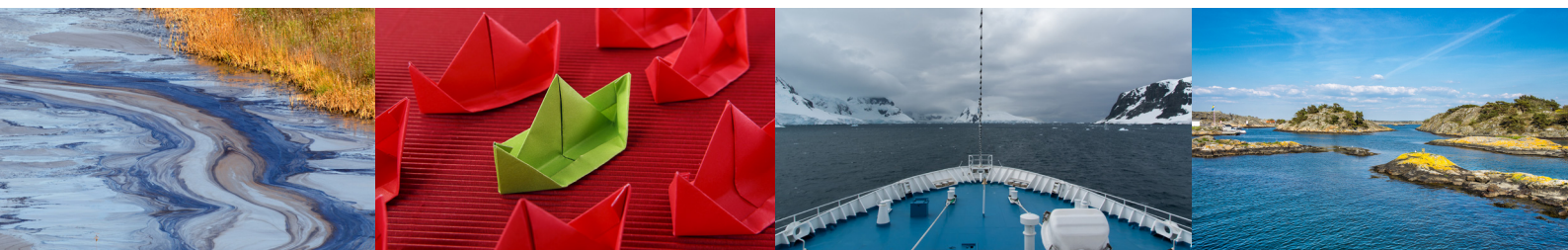
	The Blue Angel	CCWG	CSI	ESI	Green Award	Green Marine	DNV Triple E
CO ₂	X	X	X	X	X	X	X
Energy efficiency	X	X	X	X	X	X	X
NO _x	X	X	X	X	X	X	X
SO _x	X	X	X	X	X	X	X
PM / BC	X		X		X	X	
Antifouling	X	Chemicals ¹	X		X		?
Stern tube oils	X		X		X		X
External hydraulic fluids	X		X		X		X
Gear oils	X		X		X		X
Boiler-/ cooling water treatment			X		X		?
Cleaning agents	X		X				X
Refrigerants	X		X			X	
Ballast water treatment	X	Water ²	X		X	X	X
Sewage/ black water	X		X				X
Garbage handling	X	Waste ³	X		X	X	
Sludge oil handling			X		X		?
Bilge water treatment	X		X		X	X	X
Crew awareness	X [#]		X		X		X
Noise (occupational safety)	X						
Underwater noise	X					X	
Noise in ports						X*	
Dust emission in ports						X	
Odors in ports						X	
Environmental management systems	X	X	X		X		X

Personnel management+ development	X				?		X
Index/Indicator	The Blue Angel	CCWG	CSI	ESI	Green Award	Green Marine	DNV Triple E
Policy and management of the shipping company	X				X		
Ship design and ship equipment	X						
Hull stress monitoring	X				X		
Emergency towing system	X				X		
Ship Operation mgt and tech	X				X		
OPS	X		X				?
Extinguishing agents	X						
Ship Recycling	X		X				
Inventory of hazardous materials	X		X		X		X
Emissions from cargo	X				X*	X*	
Mooring wire lubrication					X		
Version	RAUL-UZ 110		Version Jan 2015		Version 2014		
Third party verification	Yes	Yes for CO ₂ and SOx	Yes			Yes	Yes
Comment	<p>#There is a requirement for an environmental management system in line with ISO14001, which entails among other things that the management should ensure proper knowledge from its personnel, who should be educated when needed</p> <p>*Only tankers</p>	<p>1. States KPI connected to chemicals</p> <p>2. States KPI connected to water</p> <p>3.States KPI connected to waste</p> <p>Scoring available for container shipping companies</p>	<p>Scoring available for oil tanker (light or heavy products), general cargo, Reefer, Bulk carrier, RoRo, RoPax, container and car carrier</p>	In house verification	<p>*For certain relevant ship and cargo types</p> <p>Scoring available for oil tanker, chemical tanker, bulk carrier, LNG carrier, Container and LPG carrier</p>	<p>* Only applicable to Great lakes and St Lawrence lakes for international dry bulk carriers.</p>	<p>Scoring available for tanker, container and RoRo</p>



Lighthouse gathers leading maritime stakeholders through a Triple-Helix collaboration comprising industry, society, academies and institutes to promote research, development and innovation within the maritime sector with the following vision:

Lighthouse – for a competitive, sustainable and safe maritime sector with a good working environment



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