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OVERVIEW ON THE COST-EFFECTIVENESS OF MARITIME SAFETY POLICY INSTRUMENTS

Jenna Viertola

Jenni Storgård

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FOREWORD

Maritime safety is an issue that has gained a lot of attention in the Baltic Sea area due to the dense maritime traffic and transportation of oil in the area. Lots of effort has been paid to enhance maritime safety in the area. To mention some examples, the Baltic Sea has been defined as a Particularly Sensitive Sea Area (PSSA), and in the Gulf of Finland, a reporting system, GOFREP, has been implemented.

Although maritime safety legislation and other maritime safety policy have improved maritime safety through the years, the risk exists is that excessive legislation and other requirements mean more costs for limited benefit. In order to utilize both public and private resources efficiently, awareness is required of what kind of costs maritime safety policy instruments cause and whether the costs are in relation to benefits.

The aim of this report is to present an overview of the cost-effectiveness of maritime safety policies: what kind of costs maritime safety policy causes, to whom, what affects the cost-effectiveness and how cost-effectiveness can and has been analysed. The results of this study imply that the overall costs of maritime safety measures do not seem to be considered burdening for the industry in Finland at the moment. Generally actors in the Finnish shipping industry seem to find maintaining a high safety level important and act accordingly. However, it seems that there is room for development in the evaluation of cost-effectiveness when new instruments to reduce risks are planned.

This study has been made as a part of the “Minimizing risks of maritime oil transport by holistic safety strategies” (MIMIC) project. The main financing of the project comes from the European Regional Development Fund, the Central Baltic INTERREG IV A Programme 2007-2013. Consortium members of MIMIC project include Kotka Maritime Research Centre, Centre for Maritime Studies of the University of Turku, Kymenlaakso University of Applied Sciences, Aalto University, University of Helsinki, Tallinn University of Technology, University of Tartu, Swedish Meteorological and Hydrological Institute and Finnish Environment Institute.

The authors of this report would like to express gratitude to all persons and organizations who participated in this study and to the project partners and financiers of the MIMIC project. The report has been reviewed by PhD Johanna Yliskylä-Peuralahti (first draft) and M.Sc Jouni Lappalainen (first and second draft), who are also acknowledged.

Kotka, 7.8.2013

Jenni Storgård
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MIMIC PROJECT FINANCIERS

MIMIC PROJECT PARTNERS

ABSTRACT

Maritime safety is an issue that has gained a lot of attention in the Baltic Sea area due to the dense maritime traffic and transportation of oil in the area. Lots of effort has been paid to enhance maritime safety in the area. The risk exists that excessive legislation and other requirements mean more costs for limited benefit. In order to utilize both public and private resources efficiently, awareness is required of what kind of costs maritime safety policy instruments cause and whether the costs are in relation to benefits.

The aim of this report is to present an overview of the cost-effectiveness of maritime safety policy instruments focusing on the cost aspect: what kind of costs maritime safety policy causes, to whom, what affects the cost-effectiveness and how cost-effectiveness is studied. The study is based on a literature review and on the interviews of Finnish maritime experts.

The results of this study imply that cost-effectiveness is a complicated issue to evaluate. There are no uniform practices for which costs and benefits should be included in the evaluation and how they should be valued. One of the challenges is how to measure costs and benefits during the course of a longer time period. Often a lack of data erodes the reliability of evaluation.

In the prevention of maritime accidents, costs typically include investments in ship structures or equipment, as well as maintenance and labor costs. Also large investments may be justifiable if they respectively provide significant improvements to maritime safety. Measures are cost-effective only if they are implemented properly. Cost-effectiveness is decreased if a measure causes overlapping or repetitious work. Cost-effectiveness is also decreased if the technology isn't user-friendly or if it is soon replaced with a new technology or another new appliance.

In future studies on the cost-effectiveness of maritime safety policy, it is important to acknowledge the dependency between different policy instruments and the uncertainty of the factors affecting cost-effectiveness. The costs of a single measure are rarely relatively significant and the effect of each measure on safety tends to be positive. The challenge is to rank the measures and to find the most effective combination of different policy instruments. The greatest potential offered for the analysis of cost-effectiveness of individual measures is their implementation in clearly defined risk situations, in which different measures are truly alternative to each other.

Overall, maritime safety measures do not seem to be considered burdening for the shipping industry in Finland at the moment. Generally actors in the Finnish shipping industry seem to find maintaining a high safety level important and act accordingly.

TIIVISTELMÄ

Itämeren vilkas meriliikenne ja erityisesti öljykuljetusten suuri määrä on herättänyt huolta meriliikenteen turvallisuudesta. Merenkulun turvallisuutta on pyritty kehittämään monin erilaisin toimenpitein ja hankkein. Riskinä kuitenkin on, että merenkulun turvallisuutta kehitetään toimenpiteillä, jotka aiheuttavat paljon kustannuksia ja parantavat merenkulun turvallisuutta vain vähän. Jotta rajalliset resurssit olisivat mahdollisimman tehokkaassa käytössä, on tärkeää huomioida myös toimenpiteiden kustannustehokkuus.

Tämän raportin tavoitteena on muodostaa yleiskuva onnettomuuksia ennalta ehkäisevien ohjauskeinojen kustannustehokkuudesta: millaisia kustannuksia niistä aiheutuu, kenelle kustannukset kohdistuvat, minkälaiset tekijät vaikuttavat kustannustehokkuuteen ja miten kustannustehokkuutta tutkitaan. Tutkimus perustuu kirjallisuuskatsaukseen ja suomalaisille merenkulun asiantuntijoille tehtyihin haastatteluihin.

Tulokset osoittavat, että kustannustehokkuutta on haastavaa arvioida. Yhtenäisiä käytäntöjä siitä, mitä kustannuksia ja hyötyjä arviointiin sisällytetään ja miten niitä arvotetaan, ei ole. Omat haasteensa analyysiin tuovat kustannusten ja hyötyjen arvotus pidemmällä aikavälillä. Usein analyysin ongelmana on myös käytettävän tiedon puutteellisuus tai epäluotettavuus.

Merionnettomuuksien ennaltaehkäisyssä kustannukset useimmiten muodostuvat investointikustannuksista alusten rakenteisiin tai laitteisiin, ylläpitokuluista sekä työvoimakustannuksista. Suuretkin investoinnit voivat olla perusteltuja, jos ne vastaavasti parantavat turvallisuutta merkittävästi. Toimenpide on kustannustehokas vain, jos se on pantu täytäntöön kunnolla sekä viranomaisten että käytännön toimijoiden toimesta. Kustannustehokkuutta heikentää, jos toimenpide aiheuttaa päällekkäistä tai toistuvaa työtä. Myös teknologian vaikeakäyttöisyys tai vanhentuneisuus voi heikentää toimenpiteiden kustannustehokkuutta.

Tulevaisuudessa meriturvallisuuden ohjauskeinojen kustannustehokkuuden tutkimuksessa on tärkeää huomioida erilaisten ohjauskeinojen riippuvuus toisistaan sekä vaikuttavien tekijöiden moninaisuus. Yksittäisen ohjauskeinon kustannukset harvoin ovat yksistään kovin merkittävät kokonaisuuden kannalta ja yleensä jokainen ohjauskeino voidaan arvioida turvallisuutta parantavaksi. Haasteena onkin eri ohjauskeinojen arvotus ja se, miten löytää toimivin eri ohjauskeinojen kokonaisuus. Yksittäisten ohjauskeinojen kustannustehokkuuden tarkastelun suurin potentiaali on määritellyissä riskitilanteissa, joissa voidaan tarkastella keskenään vaihtoehtoisia toimenpiteitä.

Yleisesti ottaen haastateltavat eivät pitäneet turvallisuudesta aiheutuvia kustannuksia Suomen merenkululle liian rasittavina. Myös suomalaisen merenkulun turvallisuustasoa pidettiin yleisesti korkeana, mikä osoittaa, että turvallisuuteen ollaan valmiita panostamaan.

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ABBREVIATIONS

AIS	Automatic Identification System
APM	Additional Protective Measure
CBA	Cost-Benefit Analysis
CSR	Corporate Social Responsibility
DW Route	Deep Water Route
DWT	Dead Weight Tonnage
EU	European Union
FSA	Formal Safety Assessment
FSC	Flag State Control
GCAF	Gross Cost of Averting a Fatality
GOFREP	Gulf of Finland Reporting
ENSI	Enhanced Navigation Support Information
HELCOM	Helsinki Commission
HSC	Host State Control
ILO	International Labour Organization
IMO	International Maritime Organization
ISM Code	International Safety Management Code
NCAF	Net Cost of Averting a Fatality
NECA	Nitrogen emission control area
P&I Clubs	Protection & Indemnity Clubs
PSC	Port State Control
PSSA	Particularly Sensitive Sea Area
RCO	Risk Control Option

SAFGOF	Research project “Evaluation of the traffic increase in the Gulf of Finland during the years 2007 – 2015 and the effect of the increase on the environment and traffic chain activities”
SAR	Search and Rescue
Trafi	Finnish Transport Safety Agency
TSS	Traffic Separation Scheme
UN	United Nations
UNCLOS	United Nations Convention on the Law of the Sea
VTS	Vessel Traffic Services

1 INTRODUCTION

The Gulf of Finland is an important sea area for both trade and recreation. Some 2000 large vessels sail continuously in the Baltic Sea, making it one of the busiest sea areas in the world (HELCOM 2012). Maritime transportation in the Baltic Sea has grown remarkably during 2000s and it is expected to increase further in the future. The rapid growth in maritime transportation is connected with economic growth in the Baltic Sea region and in the increasing oil transportation by Russia (Kuronen et al. 2008; Brunila & Storgård 2012).

Oil tanker traffic crosses the Gulf of Finland mainly in the east-west direction, as crude oil is transported from Russia to oil refineries to in the Baltic Sea and all over the world. East-west tanker traffic intersects with passenger traffic between Helsinki and Tallinn, making the spot between Helsinki and Tallinn one of the most risky areas in the Gulf of Finland (Ylitalo et al. 2008). Largest oil ports of the Gulf of Finland and areas with significant accident risks are presented in figure 1.1.

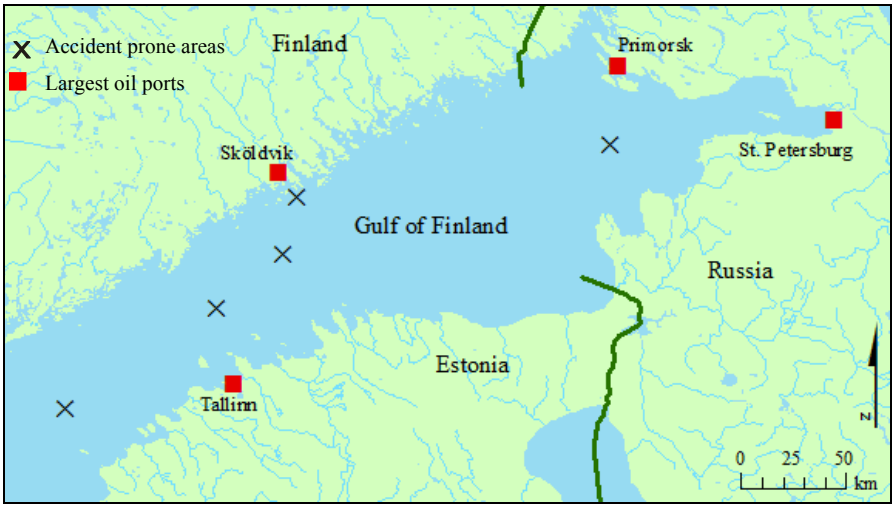

Figure 1.1 Four largest oil ports of the Gulf of Finland in 2011 and areas with a large accident risk (Holma et al. 2012, Ylitalo et al. 2008).

In 2011 approximately 301 million tons of liquid bulk (including oil and oil products, liquid chemicals and other bulk reported as liquid cargo) was handled in the Baltic Sea ports, of which some 155 million tons of oil and oil products via the Gulf of Finland. The total amount of all cargo types handled in the Baltic Sea ports grew with 3.7 per cent and the amount of liquid bulk with 0.4 per cent from the year before (Holma et al. 2012).

At the moment, the largest vessels in the Baltic Sea can carry up to 150 000 tonnes of crude oil (Ministry of the Environment 2011). If a large oil accident occurred in the Gulf of Finland, the consequences would be devastating. An oil spill of 10 000 tonnes is considered to be a disaster in many sea areas, but in the proximity of Finland, an oil spill of 5000 tonnes or even less is enough to create a catastrophe (Ministry of the Environment 2011).

Growing traffic has kept the accident risk high in the Gulf of Finland in the past years (Kujala et al. 2009). At the moment, Finland has preparedness to combat a maximum of 30 000 tonnes of oil. Fortunately, the probability of an accident that large is considered to be very small (Ministry of the Environment 2012). A large accident would destroy the habitat and livelihoods of the people and the very special and delicate flora and fauna that live in the area.

Maritime safety can be governed with maritime safety policy instruments, which aim to maintain the risk level as low as possible. With the instruments, both public and private interests can be promoted, as safety is improved and companies can, for example, increase their efficiency if traffic flows fluently. Shipping companies use resources to fulfil legal requirements. In addition, some companies take actions that go beyond laws and regulations. On the other end, there are companies which compromise safety as they try to save costs by operating below the minimum standards, for instance by operating with substandard vessels (Knapp 2007).

Past accidents have increased awareness of the oil spill risk and the possible consequences that an accident could have (Vanem et al. 2008). Accidents have influenced the development of maritime safety legislation, which has often been updated as a response to a hazardous event. A framework for safety legislation is being formed at an international level. The implementation of the legislation and controlling compliance to it are the responsibility of flag states and port states. Unfortunately, similarly to shipping companies, also states have varying interest over the responsibilities they have considering maritime safety. Different ways of reading legislation and harsh competition in the industry can be considered as a threat to safety. (Kuronen & Tapaninen 2010)

In order to utilise both public and private resources efficiently, awareness is required of what kind of costs maritime safety policy instruments cause and whether the costs are appropriate in relation to the benefits. So far the costs and the cost-effectiveness of maritime safety policy instruments have been studied poorly, though many other aspects of maritime safety have been studied rather widely. It is important that cost-effectiveness of maritime safety policy instruments is studied in order to promote prosperous and fair shipping business both in the context of Gulf of Finland and on a global level.

1.1. Aim and scope of the study

This research studies the cost-effectiveness of maritime safety policy instruments. The aim is to sum up the “state-of-the-art” cost-effectiveness issues in maritime safety policy field and to consider the need for further studies. The study consists of a literature review on cost-benefit analysis and cost-effectiveness issues and on interviews made with maritime experts in Finland. This research is not aiming to compare actual costs or to rank different policy instruments on the basis of their cost-effectiveness, but to present a general overview on the subject.

This research aims to discover:

1. How cost-effectiveness can be studied and how it has been studied in the field of maritime safety policy
2. What kind of costs maritime safety policy instruments cause, what are the costs comprised of and do they set cost pressures to the industry or to certain actors within the industry?
3. Which kind of maritime safety policy instruments are more cost-effective than others and which factors can make an instrument less cost-effective?

The study focuses on the Baltic Sea and the Gulf of Finland and the context of maritime oil transportation because it has been conducted as part of the "Minimizing risks of maritime oil transport by holistic safety strategies" (MIMIC) project. MIMIC takes a comprehensive, holistic approach to risks related to maritime oil transportation in the Baltic Sea. The project integrates knowledge acquired in earlier projects with new information on the less studied aspects related to oil hazards.

This research is a continuation for a questionnaire research by Kuronen and Tapaninen (2010)[1], which studied maritime experts' views over the general effectiveness of maritime safety policy instruments. This research complements the theme of effectiveness with a review on the cost-effectiveness aspect of maritime safety policy instruments.

1.2. Methodology of the study

This study is based on a literature review and on expert interviews. Interviews were conducted between late May and early July 2012. The purpose of the interviews was to collect data that could provide information on the factors that make some maritime safety policy instruments more cost-effective than others. Furthermore, the purpose was to find out whether the industry considers the costs of current safety legislation to be too high or burdening for some groups of actors in the industry. As this research aims to provide a basis for further research, the focus is on the whole spectrum of instruments and on giving some examples and cases, rather than in focusing merely on one or few specific instruments.

Interviews also included questions about some specific measures to improve maritime safety (VTS, GOFREP, PSSA status) and general questions about improving maritime safety. The results of these parts of the interview study will be published separately as part of the MIMIC project during the year 2013.

Out of nine interviewed people, five were authorities, two from maritime interest groups and two from Finnish shipping companies (Appendix 1.). Out of those fifteen who were asked for an interview, nine people took part in the research. All authorities and interest groups asked were willing to give an interview. It was most difficult to get an interview from shipping companies. It turned out to be difficult to find a person who would know

[1] Output of SAFGOF (2008-2010) project: http://www.merikotka.fi/safgof/

about both the safety and the financial aspects of maritime safety policy instruments. Some of the shipping companies did not answer the query for an interview at all, whereas some responded they were not able to take part in the study. Because of the small number of interviews with the shipping companies, the results of the study mainly focus on the views of authorities and interest groups. The two interviewed shipping companies happened to be large ones and their views are not necessarily the same as those of smaller companies. However, small shipping companies have not been intentionally left out, but rather it proved to be difficult to get interviews from them.

Due to the breadth of the subject and the small body of earlier research, only a relatively limited number of interviews was conducted. The people interviewed are experts of shipping and have a long experience related to maritime safety issues. They were asked for an interview because they were expected to have some kind of a view on the cost-effectiveness aspect of safety.

Interviews proceeded mostly along the question list, which was sent to the interviewees beforehand. Semi-structural interviews made it possible to gain complementary and extra information as the interviewees could emphasise the aspects they found most important based on their expertise and viewpoint. As all the respondents were Finnish, interviews were made in the Finnish language. Interview questions can be found in Finnish in Appendix 1 and as an English translation in Appendix 2.

Research analysis is based on thematic analysis in which themed categories are formed in order to identify and analyse specific patterns found in the data. The primary categories included the general economic cost-effectiveness of maritime safety policy instruments, PSSA, VTS and GOFREP. From the transcribed interview material, also new thematic categories were formed. Corporate social responsibility, companies' safety culture and cooperation between different actors of the industry were strongly emphasised in relation to costs and safety so they were included in the analysis and conclusions of the research. From these categories, it could be analysed which kind of factors have an impact on the instruments' economic cost-effectiveness. As stated earlier, this report focuses on cost-effectiveness issues. Other parts of the interview study will be published in a separate report.

1.3. Structure of the report

This report has been divided into four chapters. In the first (chapter two), the main concepts related to maritime safety and costs are introduced. Maritime safety and risks, regulatory bodies in shipping and maritime safety policy instruments are introduced, as are the structures causing costs for societies and shipping companies.

Next (chapter three), the basic concepts of cost-benefit (or cost-effectiveness) analysis and studies analysing cost-effectiveness in maritime safety field are presented. After that, the main interview results are presented in chapter four. The last chapter draws together the main conclusions made in this research and the results are evaluated in the

light of the research questions presented in chapter one. The last chapter also explains how the study of cost-effectiveness will be continued in the MIMIC project.

1.4. Funding and cooperation

This research is made as a part of the "Minimizing the risks of maritime oil transport by holistic safety strategies" (MIMIC) project. MIMIC takes a comprehensive, holistic approach to the risks related to maritime oil transportation in the Baltic Sea. The project integrates knowledge acquired in earlier projects with new information on less studied aspects related to oil hazards. Another objective is to study and compare the effects of different societal management actions taken to avoid accidents, giving insight into the cost-effectiveness of such actions. In the project, a probabilistic model integrating models related to traffic, accident probabilities, ecosystem impacts and the society's oil spill preparedness to decrease the likelihood and consequences of oil hazards is developed.

Consortium members of the MIMIC project include Kotka Maritime Research Centre, University of Turku, Centre for Maritime, Kymenlaakso University of Applied Sciences, Aalto University, University of Helsinki, Tallinn University of Technology, University of Tartu, Swedish Meteorological and Hydrological Institute and Finnish Environment Institute.

The project is funded by the European Union and it has been approved as an EU flagship project. The financing comes from the European Regional Development Fund, the Central Baltic INTERREG IV A Programme 2007-2013; the Centre for Economic Development, Transport and the Environment of Southwest Finland; the City of Kotka; Kotka-Hamina Regional Development Company (Cursor Oy); Kymenlaakso University of Applied Sciences; the Finnish Environment Institute; the University of Tartu; Tallinn University of Technology and the Swedish Meteorological and Hydrological Institute.

The project includes five work packages. This study is a part of task one of work package five which is operated by University of Turku, Centre for Maritime. Task one is called 'Analysis and improvement of policy instruments'. The MIMIC project lasts from May 2011 till the end of December 2013.

This report has been written by researcher Jenna Viertola (BSc) and by project manager Jenni Storgård (M. Soc. Sc.). All interviews were made and transcribed by Jenna Viertola. The publication reflects the views of the authors. The Managing Authority of the Central Baltic INTERREG IV A Programme 2007-2013 cannot be held liable for the information published in this report.

2 MARITIME SAFETY POLICY SYSTEM

Chapter two introduces the main concepts of maritime safety and the regulatory bodies that are responsible for maritime safety policy and ensuring the implementation of these policies.

2.1 Maritime safety and risks

Risks in maritime transportation can be divided into safety and security risks. Security, which is left outside of the scope of this research, includes such danger causing issues as piracy, armed robbery and other unlawful acts against or on board ships (IMO 1986).

Maritime safety refers to the safety of life and property at sea from environmental and operational threats, as well as to the safety of maritime environment from pollution by the ships (Urbański et al. 2009). Factors influencing maritime safety are divided by maritime laws and regulations into internal and external factors. Internal factors are related to the condition of a ship and equipment and the competence of the personnel on board. External factors include, for example, the condition of waterways and maritime safety devices, nautical charts, the quality of vessel traffic services, piloting, ice-breaker assistance and available information on weather conditions and ice and water levels.

Maritime safety aims to minimise the amount of accidents or near miss situations. An accident refers to a situation which results in any kind of damage or injury, while near miss is a hazardous event or situation where the sequence of events could have caused an accident if it had not been somehow interrupted (Storgård et al. 2012). In addition to prevention, maritime safety also includes SAR and other post-accident operations and accident investigation after hazardous situations (Kuronen and Tapaninen 2009).

McSween (2003) states, that consistent safety excellence requires a wider adaption of safety management than companies normally have. This is because compliance with safety regulations is so common it only keeps safety at an average level. Acts that go beyond compulsory laws and regulations can often be considered as Corporate Social Responsibility (CSR). Responsibility may, for example, be related to educating the crews, or to environmental awareness in shipping operations.

Hazardous situations usually result in a chain of events including a combination of unsafe behaviour and unsafe conditions (e.g. McSween 2003). McSween (2003) continues that unsafe work behaviour is a result of physical and social environment and the workers' experience of them, meaning that the safety culture of the company plays an important role in safety matters. If a company allows misbehaviour, more space for an accident to happen exists.

McSween (2003) notes that by adapting safety measures properly and going beyond regulations, accidents can be reduced. The proper adaptation of safety measures impacts safety related behaviour and decreases unsafe operations.

2.2 Regulatory bodies in shipping

Shipping is a global industry. International shipping industry carries four fifths of the world's trade (UNCTAD 2011). Because of its vastness and global nature, the shipping industry has common laws and regulations that are recognised everywhere in the world's seas. The most important decision-making regarding shipping safety is made on the international level, but some measures are also set on the regional and national levels. Roe (2008) states that in order to work as an effective policy system, different policy making stages must complement each other. According to Roe (2008) the current policy making system is designedto work as a so called nested hierarchy where the outmost level is the international and inner levels include and complement the upper ones (hierarchy illustrated in figure 2.1).

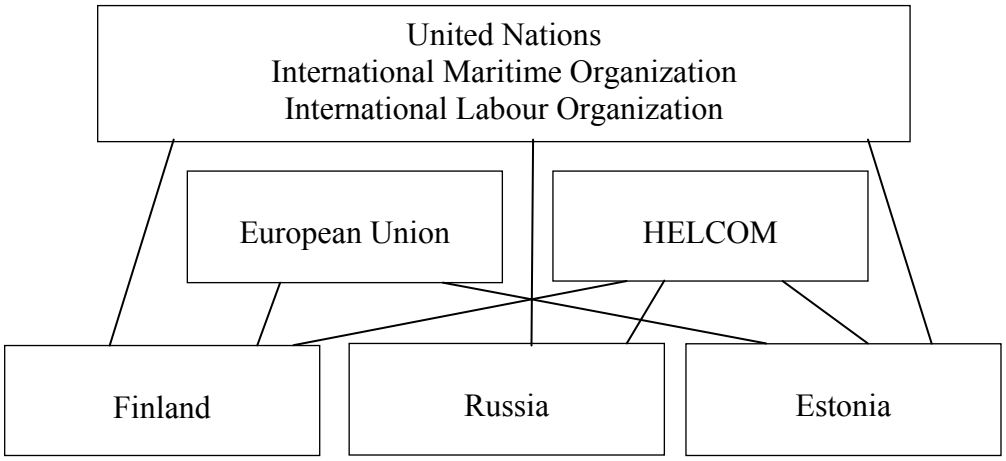

Figure 2.1 Nested hierarchy of the main regulatory bodies of maritime safety in the Gulf of Finland (Kuronen and Tapaninen 2009).

The highest regulatory body in shipping are the two United Nations agencies, the International Maritime Organization (IMO) and the International Labour Organization (ILO). IMO is responsible for the safety and security of shipping and the prevention of marine pollution by ships, ILO for the Maritime Labour Convention.

The most fundamental rules governing all uses of the oceans and their resources, including the movements of ships, was established by the United Nations Convention on the Law of the Sea (UNCLOS). All nine states surrounding the Baltic Sea and the EU have ratified the UNCLOS convention.

One of the central regional decision-maker in the Gulf of Finland is the European Union, whose shipping policies regarding safety, security and the environment are implemented through national legislation of the member states and applied through regional and local regulations (e.g. Roe 2008). On the regional level, also the Helsinki Commission (HELCOM) gives recommendations to its member states, which comprise the coastal states of the Baltic Sea. Though member states are not legally obliged to implement HELCOM's recommendations, they are considered important, as the

recommendations reflect the common values related to environmental protection in the sea area (Karvonen et al. 2006). HELCOM's aim is to protect the marine environment of the Baltic Sea and HELCOM has longer roots in history than EU decision making on maritime safety, as HELCOM was founded in 1974. A further important aspect of HELCOM is that also Russia is a contracting party of HELCOM, while not being an EU member state.

The national authorities of coastal states are responsible for maritime safety related issues in their own national waters or the Exclusive Economic Zones (EEZ). Their responsibilities include implementing the policies agreed on the higher levels of decision-making. In addition, the maintenance of fairways and safety devices, Vessel Traffic Services (VTS), piloting, nautical charting and weather, water level and ice services are governed nationally (Ministry of Transport and Communication 2009). Nations can also make bilateral or multilateral agreements with other nations.

Until 1998, the Finnish Maritime Administration (Merenkulkulaitos) was the main maritime authority in Finland. Since 2010, two government agencies operating under the Ministry of Transport and Communications have been responsible for maritime issues. These agencies are The Finnish Transport Agency (Liikennevirasto) and the Finnish Transport Safety Agency (Trafi).

The Finnish Transport Agency is responsible for maintaining and developing the standard of service in the transport system's traffic lanes overseen by the government. The Agency promotes the efficient functioning of the traffic system and aims to improve transport safety and the balanced and sustainable development of regions. (Laki Liikennevirastosta 2009) Trafi concentrates on the safety and environmental friendliness of the Finnish transport system, promotes environmentally friendly transport solutions and is responsible for transport system regulatory duties. (Laki Liikenteen turvallisuusvirastosta 2009)

2.3 Maritime safety policy instruments

Maritime safety policy instruments are used for governing the safety and environmental safety of shipping and they aim at maintaining the maritime accident risk level as low as possible. Ideally public interests such as the safety of people and environment can be ensured at the same time as the competitiveness and reputation of a company can be improved. Also post-accident procedures are a part of maritime safety, but they are left outside of the scope of this research. The spectrum of maritime safety policy instruments is depicted in figure 2.2.

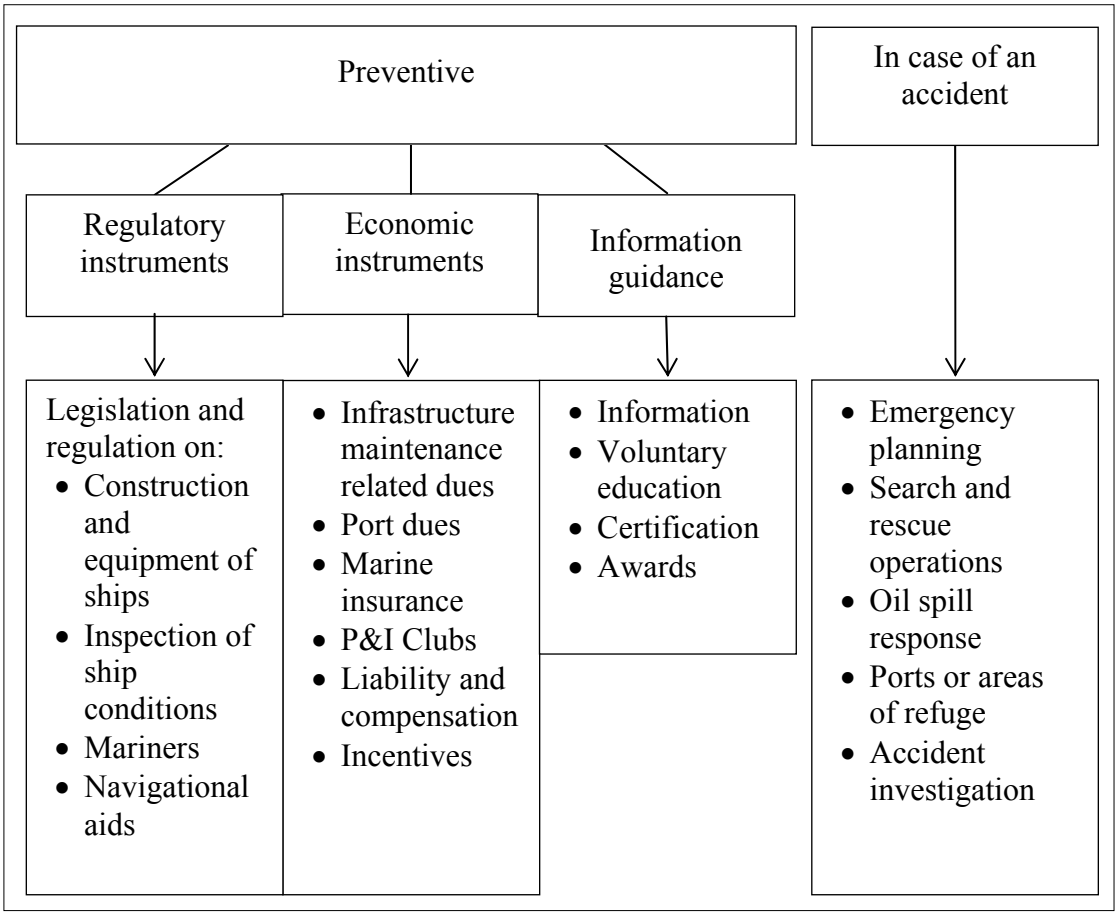

Figure 2.2 Maritime safety policy instruments in shipping (adapted from Kuronen and Tapaninen 2009).

Policy instruments are often divided into regulatory, economic and information guidance based instruments (e.g. Klemmensen et al. 2007, Vedung 2003; Vieira et al. 2007, Kuronen and Tapaninen 2009). Other classifications of policy instruments exist as well, based for example on the degree of governmental power or on the carrot/stick categorization (Vedung 2003).

Regulatory instruments aim to modify an actor's behaviour by defining or changing the sets of rules. Regulatory instruments include jurisdiction, restrictions, licenses, controls, permissions and standards (Vieira et al. 2007). Planning systems used for controlling

the use of the area or equipment, such as infrastructure, can also be included in regulatory instruments (Vieira et al. 2007). In shipping, such planning systems include fairway planning, Traffic Separation Schemes and routeing, as they are mandatory to all vessels and the systems are controlled by governmental authorities.

Economic instruments aim to make unwanted behaviour more expensive and wanted behaviour cheaper to provide companies with an economic incentive to change their operating manners and behaviour (Kuronen and Tapaninen 2010). Economic instruments include charges for services or for the use of something, taxes such as fairway dues or environmental taxes and subsidies encouraging companies to behave in a certain manner. Economic instruments are also used for covering the costs of infrastructure provided by the society and for preventing the exploitation of common resources.

Information guidance is based on the idea that shared justified information makes individuals, communities and companies change their behaviour patterns voluntarily. It includes, for example, information, research, training, standardisation, certification and awards. (Kuronen and Tapaninen 2009).

In addition to traditional governance, new forms of self-regulative governance have emerged especially in environmental governance, including, for example, self-governance, network governance, interactive governance or co-governance (Kern 2011; van Leeuwen and van Tatenhove 2010; Wuisan et al. 2010). This shift has introduced new actors into elements of policymaking and has resulted in new practices which challenge, transform and complement traditional ways of policymaking. Globalization and individualization are seen as catalysts in this shift (van Leeuwen and van Tatenhove 2010).

Different policy instruments form varying kinds of costs to actors. Costs that are formed from complying with the laws can be significant. These costs are mandatory to pay, as non-compliance may result in sanctions. Though keeping a vessel in a good condition and implementing new technology may be relatively costly for shipping companies, time and resources can be saved for example through savings in maintenance costs or in vessel inspections.

3 COST-BENEFIT ANALYSIS OF MARITIME SAFETY POLICY INSTRUMENTS

In this section, the principles of cost-benefit analysis and some related methods are presented. Details of economic analysis as part of cost-benefit analysis is not addressed here as it has been presented comprehensively elsewhere (e.g. Boardman et al. 2006; Mishan & Quah 2007). Instead the focus is on how cost-benefit analysis has been applied in the context of maritime safety.

Generally cost-effectiveness can be understood as a state where outputs are achieved with as small inputs as possible or the other way around, a state where inputs produce as large an output as possible (Vihanto 2010). Cost-effectiveness can be researched by comparing alternatives in terms of both their costs and their effects and choosing the alternative providing the best results with as minimum costs as possible (Levin and McEwan 2000). For analysing cost-effectiveness, several methods exist, of which cost-benefit analysis is most widely used. Some of the other related analysis methods are shortly reviewed in Chapter 3.1.2.

In Section 3.2 examples of studies presenting cost-benefit analysis of maritime safety measures are presented. Section 3.3 looks at the costs of maritime safety policy on a general level. At the end of the section, conclusions are made concerning the state of cost-effectiveness analysis in maritime safety policy.

3.1 Cost-benefit analysis

The aim of the cost-benefit analysis (CBA) is to study benefits and costs, to value them in monetary values and then determine the net benefits of a certain proposal or a project, and by doing this to help social decision making and to help society to allocate resources efficiently. The central characteristic of cost-benefit analysis is to look at the costs and benefits for the society as a whole, not for individual firms or for other individual players. In cost-benefit analysis, several options are typically compared to each other, of which one is often a status quo. (Boardman et al. 2006)

Cost-benefit analysis can be used to decide whether or not a particular project is worthwhile, which the best of several alternative projects are, or when to undertake a particular project. Cost-benefit analysis can be applied e.g. to an investment project, proposed changes in laws or regulations or to new pricing schemes. (Prest & Turvey 1965) In most cases cost-benefit analysis is conducted before the final decision or implementation of the project, but it can also be conducted at the end of the project. "Ex-post" cost-benefit analysis could be useful in many cases because costs realized afterwards can be calculated, which in turn would help the future development and the development of the analysis method to be more reliable. (Boardman et al. 2006)

The concept of cost-benefit analysis dates as far backas the 1800s, although it started to gain wider attention approximately from the 1960s on. A firm theoretical framework for CBA was established in late 1950s based on neoclassical welfare economics.

Governments in the US, Canada and the UK started to require formal CBA from certain policies and projects in 1960s, and after that the use of CBA was extended to other organizations (such as the UN and the World Bank) and countries. (Mishan & Quah 2007; Prest & Turvey 1965)

The cost-benefit analysis consists roughly of the following steps (Boardman et al. 2006; Prest & Turvey 1965):

1. Specifying the set of projects to be analysed
2. Deciding which costs and which benefits are to be included
3. Selecting measurement indicators for costs and benefits
4. Predicting the impacts quantitatively in the chosen time-span
5. Monetizing costs and benefits
6. Discounting costs and benefits to obtain present values
7. Calculating the net value of each alternative
8. Performing sensitivity analysis, analysing constraints
9. Making recommendations

3.1.1 Challenges and constraints of cost-benefit analysis

There are several limitations to CBA. It can be impossible or at least difficult to quantify and monetize all relevant costs and benefits, such as clean air or saved human lives. There are methods, e.g. "willingness-to-pay" analysis, which aim to put the value for these kinds of costs. (Boardman et al. 2006; Prest & Turvey 1965) In addition, there is often a lot of uncertainty connected with, for example, the prizes or interest rates. These have to be taken in consideration in the analysis as they obviously have a strong effect on the outcome. (Boardman et al. 2006)

Another limitation of CBA is that totally different types of projects or policies are incomparable with each other. Costs and benefits may consist of very different things, and their comparison would result in a distorted outcome. This is often a disappointment for decision makers and politicians who would like to see the ranking of all policy alternatives. A third limitation of the use of CBA in societal decision-making is that decisions can be affected by other goals besides pure efficiency, including regional equality, national security or political feasibility. These are often difficult to include in the cost-benefit analysis. (Boardman et al. 2006)

Problems may also arise due to the fact that deciding and measuring benefits sometimes require a lot of scientific studying and/or the information available may be conflicting and uncertain, for example study A showing that policy X decreases mortality rates and study B stating that a policy X has no effect on mortality rates or the effect is of a completely different scale than stated in the study A. It may also turn out that the same outcome is a benefit for some and a cost or a disadvantage for others: how to decide whose interest is the most important? Another challenge is presented by the difficulty of prediction: will individuals or firms behave in a predicted way? For example, a phenomenon exists called compensating behaviour that partially or totally offsets the predicted positive phenomena; e.g. when cars become safer, driving habits may become

unsafer. Furthermore, spillover effects (either negative or positive) are often difficult to predict. (Boardman et al. 2006)

3.1.2 Related methods to analyse cost-effectiveness

There are other methods for overcoming the limitations of CBA. In *qualitative CBA*, an equal number of benefits and costs are monetized and for the remaining costs and benefits a qualitative estimate of their relative importance is made. In *cost-effectiveness analysis* (sometimes called also *cost-utility analysis*), impacts are quantified, but not all are monetized. In cost-effectiveness analysis, a ratio is constructed showing the relationship between monetized and quantified benefits. Alternative regulations involve different net costs (money put on the project) and different number of quantified benefits (e.g. number of saved lives), and so alternatives can be compared with each other. Cost-effectiveness analysis has mainly been used in the analysis of health policy. (Boardman et al. 2006)

Multigoal analysis can be implemented if there are numerous of impacts that cannot be monetized and multiple values that have to be taken into consideration. In multigoal analysis, a matrix, which describes different goals and impact categories and the effects of different policies on them, is used. As cost-benefit analysis includes only one criterion (maximizing net benefits), multigoal analysis may include several criteria for decision-making. (Boardman et al. 2006)

Despite the difficulties presented by cost-benefit analysis, it is used widely and a conclusion can be made that "some information is always better than none" (Prest & Turvey 1965, 730). The value of cost-benefit analysis is also in that it forces us to raise questions about the project which might not be otherwise raised (Prest & Turvey 1965).

3.2 Cost-effectiveness of the maritime safety policy instruments

In order to calculate the efficiency or the cost-effectiveness of a preventive maritime safety policy instrument, information is needed about the costs of planning and implementing a measure and about the costs of a potential accident. In case of an accident at sea, it is relatively simple to calculate the costs of ship and cargo damages and the costs of search and rescue operations, but it is more complicated to calculate costs for so-called externalities, for example the damages for natural habitats or for human environments and activities.

Every accident has a large number of different variables, so the effects of an accident are different every time depending on the vessel, the cargo, the location, the weather conditions and so on. For example, an oil spill near coastal areas would have far more devastating consequences compared to a spill taking place in the high seas. The question of where and when an accident happens brings considerable variability into thestatistics of oil spill costs (Vanem et al. 2008; Psaraftis 2012).

New regulations often cause compulsory costs which may be encumbering for some shipping companies. Karahalios et al. (2011) add that because of this it is important to evaluate the costs and benefits of safety regulation so that all parties are convinced about the importance and gains of the proper implementation of regulations.

3.2.1 Formal Safety Assessment, FSA

IMO has created a process called Formal Safety Assessment (FSA), which has been used, for example, in decision-making at times when the cost-effectiveness of new measures has been tested or when several measures have been evaluated.

FSA is described as "a rational and systematic process for assessing the risks associated with shipping activity and for evaluating the costs and benefits of IMO's options for reducing these risks" (IMO 2002). FSA aims to improve proactivity in maritime safety and to reduce risks to a level that is tolerable. FSA aims to enhance maritime safety, including the protection of life, health, the marine environment and property. The IMO encourages a healthy industry so the cost-effectiveness of IMO’s safety measures should also maintain the competitive position of the industry. (IMO 2006)

FSA is based on five steps (presented in figure 3.1) which include the identification of hazards, the assessment of risks, risk control options (RCOs), cost-benefit analysis (of RCOs) and recommendations to decision-making after the analysis (IMO 2002).

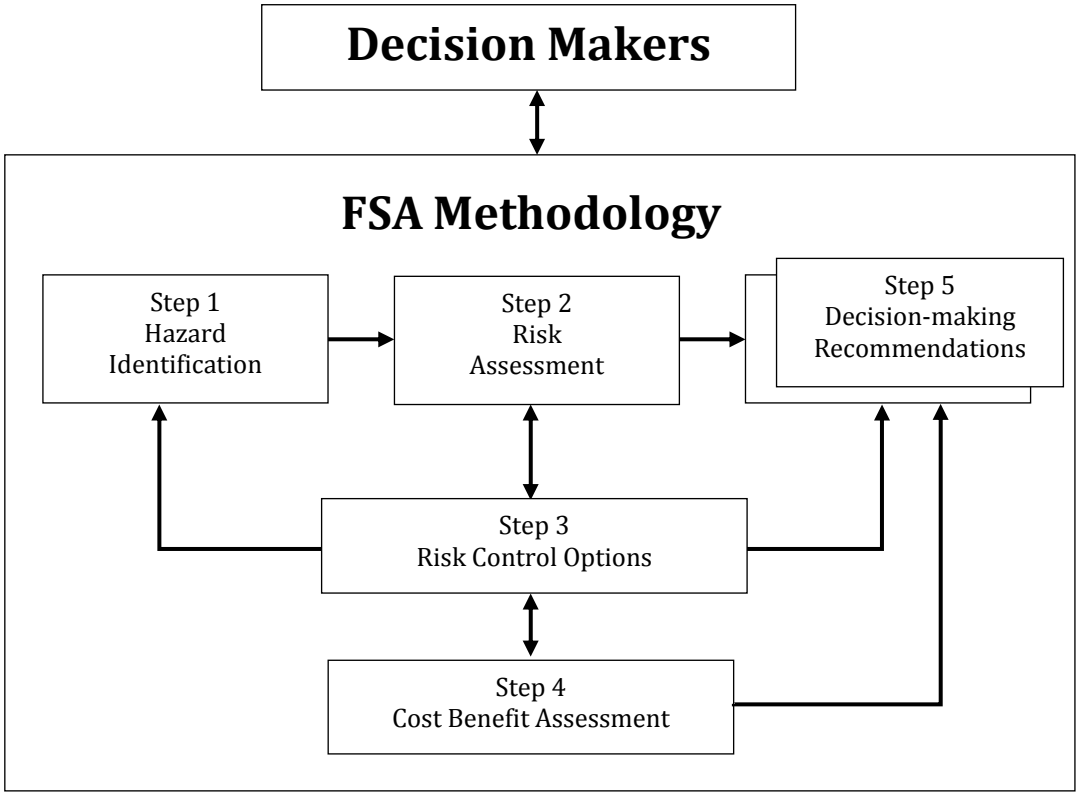

Figure 3.1 Flow chart of the FSA methodology (IMO 2002)

FSA guidelines (IMO 2007) describe the general process of Cost Benefit Assessment. In appendix 7 (IMO 2007) an example of calculation of indices for cost effectiveness is given (Gross Cost of Averting a Fatality (GCAF) and Net Cost of Averting a Fatality (NCAF)). According to Psaraftis (2012), almost all FSA studies submitted to IMO use these criteria despite of some deficiencies in them, which Psaraftis (2012) describes, and despite the fact that Guidelines do not request to use GCAF and NCAF indices in FSA analysis. In FSA, the cost-effectiveness ranking of RCOs is usually done within the so-called ALARP (As Low As Reasonable Practicable) framework defining the zone of tolerable risk (Puisa & Vassalos 2012).

In scientific literature, there are several studies focusing on FSA method from risk assessment point of view (e.g. Wang & Foinikis 2001; Lois et al. 2004; Ventikos & Psaraftis 2004; Shenping et al. 2007), but not many which would address the cost-benefit analysis part of FSA in more depth. During the years FSA has been in use in IMO, many FSA analyses have been submitted to IMO addressing specific cases (e.g. MSC/83/21/1 2007; MSC/83/21/2 2007; MSC/83/INF.8 2007; MSC/85/17/1 2008; MSC/85/17/2 2008). A collection of FSA studies done in the Baltic Sea area has been published in 2010 (Westerlund 2010).

Some studies focus on evaluating FSA methodology and also critize it (Kontovas & Psaraftis 2009; Psaraftis 2012; Puisa & Vassalos 2012). Puisa & Vassalos (2012) have found cases in which cost-benefit analysis by using GCAF and NCAF have led to false

conclusions. They propose the wider use of the concept of Pareto dominance as an alternative means of ranking RCO's. Pareto dominance compares the objects, of which each is characterised by multiple attributes, and the concept is widely used, for example, in game theory and economics. One benefit of Pareto dominance is, according to Puisa & Vassalos (2012), that it enables inclusion of interdisciplinary effects, such as environmental emissions and ergonomics, in the evaluation, while the current IMO instrument only includes risk and economics. In addition, the results are easier to understand and visualise, and it requires no limit values, as GCAF and NCAF do. (Puisa & Vassalos 2012).

Rosqvist & Tuominen (2004) propose qualification criteria for FSA in order to improve the reliability of FSA evaluations. For cost-benefit analysis (FSA step 4) they suggest to focus on the following qualification issues: expert judgement protocol (is the elicitation and use of expert judgement credible?) and stakeholder analysis (is the distribution of benefits and costs addressed from the point of view of fairness?). According to Rosqvist & Tuominen (2004) the cost component is usually not a problem in CBA, but the benefit component is more challenging to evaluate monetarily.

In their research Vanem et al. (2008) proposed a new model for evaluating the measures for prevention and control of marine oil spills. The model is based on oil spill risk and cost-effectiveness calculated with the IMO's FSA method. The researchers state that by 2007, FSA studies have considered only human safety and loss of lives, so their study is proposing novel acceptance criteria for environmental risks.

The measure of costs effectiveness related to oil spill prevention of Vanem et al. (2008) has been called CATS (Cost of Averting a Tonne of oil Spilt). Vanem et al. (2008) have formulated an evaluation criterion which was based on a review of available oil spill statistics and a weighted global average cost per tonne of oil spilt which included such cost elements as clean-up costs, environmental damages and socioeconomic costs. However, the authors acknowledged the uncertainty inherent in used statistics (Vanem et al. 2008). The set value of CATS ($60,000 per tonne of spilled oil for an assessed RCO to be cost-effective) has been criticized and new calculations have emerged since then which are more flexible for taking in consideration e.g. regional differences in the costs of an oil spill. In recent years the IMO has also developed methods to include environmental damages in the FSA methdology (Psaraftis 2012; Puisa & Vassalos 2012).

Eide et al. (2009) studied the cost-effectiveness of technical and operational measures for reducing CO_2 emissions from shipping. As a result of the study, researchers concluded that FSA is a viable way of evaluating cost-effectiveness. If FSA is used, the resulting regulations for maritime safety and environmental protection will be based on a sound rationale and the possible costs imposed by new requirements can be justified with achievable risk reductions. (Eide et al. 2009)

In their study, Eide et al. (2009) develop a decision parameter called the CATCH (Cost of Averting a Tonne of CO2-eq Heating) methodology for assessing the cost-effectiveness measures for reducing CO2 emissions from shipping. They also refer to a

calculation method introduced in FSA guidelines (IMO 2007) in which one or several risk reducing measures are analysed with respect to risk-reducing performance (expected statistical reduction in loss of lives; DR), the cost of implementation (DC) and expected commercial benefit from the measure (other than risk reduction in terms of lives saved; DB), leading to a decision parameter NCAF.

Westerlund (2010) has compared FSA studies done in the Baltic Sea area. She concludes that FSA studies have mainly been concerned with risks of oil spills in the Baltic Sea as a consequence of grounding or collision accidents. The cost-benefit analyses have been carried out by calculating the costs of accident and oil spill consequences and the costs of RCOs. However, the content of costs has varied between the studies. (Westerlund 2010)

3.2.2 Other examples of cost-benefit analysis of maritime safety measures

Brown & Savage (1996) have performed a cost-benefit analysis for the double-hull requirements of the Oil Pollution Act of 1990, which was implemented in the aftermath of the Exxon Valdez oil accident in 1989. They used government data for calculation whenever possible and presented a range of scenarios in order to tackle the problems concerning the uncertainty of data. In the costs of double-hull tankers (as compared to single-hull tankers), they included capital costs, annual operating expenses, the number of vessels required and deadweight loss. The primary benefit of double-hull tankers is the reduced spillage rate, which was divided as follows: a) calculation of the current spillage rate, b) estimating the effect that double-hulls would have on the spillage rate, c) calculating the change in the number of vessel miles, and d) placing a value on the reduced spillage. (Brown & Savage 1996)

A cost-benefit analysis for the double-hull tankers was conducted based on a 20-year vessel life, and a discount rate of 7 % was used. A cost-benefit analysis showed that even in the most probable scenario the expected benefit was only 20 % of the expected costs. Double-hulls did not show a positive net present value in any of the scenarios. (Brown & Savage 1996) This result is rather interesting because there is a strong belief that double-hull tankers have improved safety of maritime oil transportation greatly.

In his study, Walker (2000) has analysed the costs and benefits of a range of policy options for maintaining or improving safety in the North Sea. The cost-effectiveness analysis was performed using an approach developed by a research institute called RAND Europe. Walker (2000) included in the analysis the following impacts: safety impact, environmental impacts, economic impacts, impacts of disasters, stakeholder acceptance and financial costs. A disaggregate approach was used for analysis. Some of the impacts were described in monetary terms and others in quantitative or qualitative estimates. A display device called scorecard was used to aid in the comprehension of results. A scorecard included a summary of the impact values that could be compared with each other. According to Walker (2000), it is clear that each of the individual policy instruments enhances safety, so the more crucial question is whether the

combination of certain policy instruments represents the most cost-effective combination.

In their study, Marlow & Gardner (2006) state that the challenge for cost-benefit analysis is that benefits and costs do not occur at the same time. They also state that often cost-benefit analysis centres on reduced risks of accidents while measures can have other benefits as well. In their study on marine electronic highway in the Straits of Malacca and Singapore they include in benefits improved navigation, a reduced risk of an accident, lower insurance premiums, a smaller risk of pollution and greater safety to all users in the studied area. Another benefit is that through enhanced navigational safety, ships can increase loading which in turn increases their profits. It should also be noted that benefits are distributed to different stakeholders: in some cases shipping companies are the gainers while other benefits go to the larger community or the society. However, according to Marlow & Gardner (2006), a project or a measure is worthwhile if expected benefits are greater than the expected costs, regardless of who actually pays the costs. (Marlow & Gardner 2006).

Marlow & Gardner (2006, 190) state about cost-benefit analysis:

> *"Cost–benefit analysis attempts to put a value on all costs and benefits arising from a project over its life. Since these costs and benefits arise at different times it is essential to discount them to a present value for purposes of comparison. It is probably true to say that the costs, which tend to be more immediate and direct, can be measured with greater precision than can the benefits. Not all the benefits will have a market value and in such cases a shadow price must be imputed to them before discounting can occur."*

Karahalios et al. (2011) note that FSA methodology does not include any stakeholder views in its cost-effectiveness criteria. Because of this, in their research Karahalios et al. (2011) propose a new methodology for the research of economic cost-effectiveness. It consists of cost-benefit analysis for all the relevant stakeholders which enables identifying the potential costs and advantages for different stakeholders. By evaluating costs and benefits, a comparison among them can be done. For example, it can be shown if some regulations are too challenging to be met by the stakeholders, and it is possible to find out where a stakeholder fails or has vulnerabilities in implementing the regulation. A methodology is a combination of the Balanced Scorecard (BSC), the Analytical Hierarchy Process (AHP) and the fuzzy set theory. The BSC provides a framework for the analysis in which experts test the validity of the BSC by using fuzzy set theory. The AHP is used to determine the weight of each BSC element. (Karahalios et al. 2011)

The proposed methodology (Karahalios et al. 2011), which combines the Balanced Scorecard, the Analytical Hierarchy Process and the fuzzy set theory methods, is stated to be capable of evaluating the commercial impacts of implementation of a newly introduced regulation. These commercial impacts may include profit, competitiveness, human resources and internal process. Karahalios et al. (2011) believe these aspects have been missing from the earlier research. The results of the research conclude that it

is possible that some of maritime safety related regulation may be scientifically sound but burdening for some stakeholders.

The Finnish Ministry of the Environment (2012) conducted a cost-benefit analysis comparing measures aiming to prevent an oil accident and buying an oil combatting vessel. The research was based on Bayesian Belief Networks and it evaluated whether developing a VTS-alarm system (providing an alarm when vessels are on a collision course) or buying a new oil recovery vessel would be more beneficial concerning the cost-effectiveness of the decision. The research included many uncertainties and because of that, for instance, only months when the Baltic Sea is not covered with ice could be included in the analysis. The results revealed that under prevailing conditions and known facts would be more beneficial to use VTS-alarm system, as it would form less costs. Also the small probability of a large oil accident and the good quality of existing oil combatting vessels was acknowledged as a factor encouraging the implementation of a VTS-alarm system.

3.3 Costs of maritime safety policy instruments

The costs of maritime safety policy instruments can be looked at from several viewpoints. Costs can be directed at several stakeholders, e.g. at shipping companies or for public administration and authorities. The relative significance of the costs is affected by many factors such as the overall costs of shipping operations and of other governmental taxes and fees.

It can be discussed which costs should be included in the analysis. According to FSA Guidelines, "Costs should be expressed in terms of life cycle costs and may include initial, operating, training, inspection, certification, decommission etc. Benefits may include reductions in fatalities, injuries, casualties, environmental damage and clean-up, indemnity of third party liabilities, etc. and an increase in the average life of ships" (IMO 2007, 13). Westerlund (2010) has found the following cost categories included in FSA studies performed in the Baltic Sea area: lifecycle costs, equipment costs, initial costs, maintenance costs, operational costs and direct costs. All the costs do not occur simultaneously or immediately. Some costs might be permanent, such as maintenance costs, while some costs such as small investments occur only once (Marlow & Gardner 2006).

Maritime safety costs and expenses for shipping companies are related to regulations which include, for instance, ship design, maintenance standards, crewing, employment conditions, operating systems, company overhead costs and taxation. Some of the costs concern ships and some shore based organizations (Marlow & Gardner 2006). Largest costs often relate to the structure and equipment of a vessel, for example in the case of implementing double hulls to oil tankers. In operation, the largest costs usually relate to the use of human resources both on board and in the land-based organizations of shipping companies. Operational costs can also be related, for example, to the increased consumption of fuel (e.g. as a result of longer journey) or loss of time (Walker 2000). In

addition, maritime safety requirements can cause, among others, training or reporting costs.

The public sector costs include many issues. In Finland, ice breaking, traffic control and in practice the VTS-services are funded with fairway dues. The largest amounts of public monetary resources are used on ice breaking. Safety radio (Turku radio) and GOFREP operations are funded from the state budget as they not only work in the fairways, but also in other water areas. National authorities must provide conditions for safely equipped and manned vessels. In Finland this signifies offering nautical charts, fairways, traffic control, ice breaking and ports capable of working also in winter conditions. Furthermore, authorities have to maintain, for example, a ship register and control the ships under her flag, and to inspect foreign ships though the Port State Controls system. Also accident preparedness must exist. In addition, the state uses resources on the development of legislation and administration, as well as on research and development work.

Table 3.1.Examples of maritime safety policy instrument costs for shipping companies and the public sector

Cost type	*Shipping companies*		*Public sector*	
	Cost occurs only once	*Cost is continuous*	*Cost occurs only once*	*Cost is continuous*
Planning (e.g. R&D, regulation, design)			x	
Investment (e,g, structure, equipment, system)	x		x	
Implementation and control costs			x	x
Maintenance and operational costs (e.g. maintenance, personnel costs)		x		x

The emphasis of maritime regulations changes over time and recently emissions and environmental aspects have gained more attention (Stopford 2009). In the near future the most notable increase in costs for shipping companies is related to environmental protection. The sulphur directive, the ballast water management convention, cruise ships' waste water treatment, the anti-fouling convention and the declaration of the Baltic Sea as a NOx Emission Control Area (NECA) will have direct costs for shipping companies and countries. Companies must add new structures when building new vessels and implement structures such as scrappers or catalysers to already existing vessels. Cruise ships' waste water treatment sets demands and costs for the port

capacity but can on the other hand improve the port's competitiveness as all ports do not yet have waste water treatment facilities.

3.4 Conclusions about the cost-effectiveness studies of maritime safety policy instruments

In the context of maritime safety policy instruments, cost-benefit analysis is usually performed as part of the FSA analysis of RCOs (Risk Control Options). FSA is described as "a rational and systematic process for assessing the risks associated with shipping activity and for evaluating the costs and benefits of IMO's options for reducing these risks" (IMO 2002). In appendix 7 of FSA Guidelines (IMO 2007) an example of calculation of indices for cost effectiveness is given (Gross Cost of Averting a Fatality (GCAF) and Net Cost of Averting a Fatality (NCAF)). According to Psaraftis (2012), almost all FSA studies submitted to IMO use these criteria to calculate cost-effectiveness despite of some deficiencies in them, which Psaraftis (2012) describes, and despite of the fact that Guidelines don't request to use GCAF and NCAF indices in FSA analysis. Several authors have found out deficiencies in the applications of FSA methodology and in CBA analysis as part of it (e.g. Rosqvist & Tuominen 2004; Kontovas & Psaraftis 2009; Psaraftis 2012; Puisa & Vassalos 2012).

FSA studies have usually analysed the cost-effectiveness of maritime safety measures in reducing human safety and lives. In addition, the IMO has been developing a method to include environmental concerns in the analysis as well. According to FSA Guidelines, "Costs should be expressed in terms of life cycle costs and may include initial, operating, training, inspection, certification, decommission etc. Benefits may include reductions in fatalities, injuries, casualties, environmental damage and clean-up, indemnity of third party liabilities, etc. and an increase in the average life of ships" (IMO 2007, 13).

In relation to accidental oil spills, there has been a lot of discussion on what the costs of oil spill clean-up measures are. Instead of using fixed sums, more flexible ways of handling costs have been proposed. Besides FSA studies and GCAF and NCAF indices, some authors have been developing alternative methods to evaluate the cost-effectiveness of maritime safety measures, which in many cases rely on traditional economic methods used in CBA analysis (Brown & Savage 1996; Marlow & Gardner 2006), or on some other methods such as the Balanced Scorecard, the Analytical Hierarchy Process and the fuzzy set theory methods (Karahalios et al. 2011) or Bayesien Belief Networks (Ministry of the Environment 2012).

When looking at FSA studies performed in the Baltic Sea area (Westerlund 2010), it can be concluded that no uniform interpretation of which costs should be included in the analysis exists, even in the case where the majority of studies address the cost-effectiveness of measures decreasing oil accident probabilities in the Baltic Sea. The costs of maritime safety policy instruments can be directed at several stakeholders, e.g. for shipping companies or for public administration and authorities. All the costs do not occur simultaneously or immediately. Some costs might be permanent, such as

maintenance costs, while some costs such as small investments occur only once (Marlow & Gardner 2006).

In sum, there seems to be some level of uniformity in how cost benefit analysis is performed in FSA studies, but they have been criticized for even leading to false conclusions about the cost-effectiveness of maritime safety measures. In the literature there are propositions for the utilization of other methods, but none of them has seemed to gather wider attention. In other words, there is room for development in the cost-benefit analysis of maritime safety policy instruments.

When looking at cost-benefit analysis generally, it is acknowledged that it has several limitations and challenges, such as measuring and deciding the benefits and costs, the lack of reliable data to be used in the analysis, and how to rank options if there are, for example, conflicting interests included. To overcome some of the limitations of CBA analysis, other methods, which may include qualitative data besides quantitative, have been developed, for example cost-effectiveness analysis or multigoal analysis. They could also bring some added value to the current practices of analysing cost-effectiveness in a maritime safety context.

It seems that the evaluation of the cost-effectiveness of maritime safety policy instruments is a challenging task. This conclusion should not, however, imply that the practice is useless. It is important to gain information on the relation of the costs to the expected benefits, so that scarce resources can be used efficiently. Because perfect information can never be gained, decisions have to be made on the basis of the information that is available. However, it is important to point out the limitations of the analysis so that the users of the information, as well as decision makers, are also able to see them.

Cost-benefit analysis can be performed when alternative RCOs to reduce some particular risk are compared. It is usually the case that every RCO has some positive effect on safety so the challenge is how to rank the RCOs and which combination of RCOs brings the most cost-effective result. It has to be remembered that totally different types of projects or policies cannot be compared with each other. Costs and benefits may consist of very different things, and their comparison would result in a distorted outcome (Boardman 2006). If the effectiveness of maritime safety policy system as a whole has to be analysed, other approaches should be used.

4 INTERVIEW RESULTS

Chapter four presents the main interview results concerning the cost-effectiveness of maritime safety policy instruments. This chapter is divided to the sub-chapters according to the themes which were addressed in the interviews: costs of maritime safety policy instruments, factors increasing and decreasing cost-effectiveness and how interviewees viewed the current state of cost-effectiveness analysis of maritime safety policy instruments.

4.1 The costs of maritime safety policy instruments

The cost-effectiveness of maritime safety policy instruments is difficult to evaluate because the spectrum of instruments is wide and the instruments are often linked and related to each other, so it is difficult to evaluate them separately. Interviewees acknowledged that the amount that an individual instrument improves safety depends not only on costs, but also on the level of their implementation, on both the shipping companies and authorities' side. National authorities provide proper conditions for safe shipping in the national sea areas and shipping companies should obey laws and regulations aiming to sustain the safety of operations. The costs of maritime safety are very different for shipping companies and the society. Where shipping companies aim to gain profits with their operations, authorities operate accordingly to a budget which has to be enough for providing high quality services. The costs of services provided by authorities are covered partly from the national budget and partly by the users of the services.

As a respond to the growing traffic and accidents that have happened in the past, the amount of maritime safety regulations has increased. That also signifies increased safety related costs. Interviewees estimated that if required inputs improve maritime safety and do not impair the viability of companies or give competitive advantage to any actors, they can be considered reasonable. Some measures, for example structural changes on vessels, may demand large investments but also these were approved if gained safety and other benefits are notable.

Cost pressure was considered to be at an acceptable level at the moment and it was agreed that if necessary, costs could even be higher without harming the operation of companies or starting to feel like a burden. Interviewees found that the quantity that safety is improved with an investment is more relevant than the actual amount of money used on the way. Interviewees agreed with the focal thought of this research: resources should be deployed in a way which returns maximum benefit. It was considered that adopting new measures is not necessarily needed; instead, the existing instruments should be re-evaluated in order to make them more efficient. For instance, it was mentioned that the existing fairway system should be evaluated in order to find out whether the maintenance of all fairways is needed. Some fairways are not used so often so it was suggested that perhaps vessels from those fairways could be guided to use some other routes. Interviewees found it important that in any development no large extra work load should be put on the vessel crews. Technological improvements and

cross-border cooperation were seen as a way to integrate good practices and make them more effective.

It was noted that maritime safety measures set by the IMO, the European Union or by individual countries are usually compulsory so shipping companies cannot do anything but to pay and follow the regulations. The decisions of the IMO and the EU are made by their member states so the decisions should be such that are expected by the industry and drive the common good. It is important that regulations and demands are the same everywhere. Otherwise it would become difficult to be aware of all regulations and act according to them when sailing to a new area. Additionally, resources can be saved if there is no need to fulfil varying demands every time when sailing to a new port.

Uniform legislation was found positive because divergent demands were seen as a factor that can harm the competitiveness of an area. Few interviewees mentioned that earlier regulations could be made mandatory and even stricter in Finland before they were adapted on the international level. Interviewees considered that it is positive that this kind of custom is not used anymore. It was acknowledged that laws and regulations are not aiming to impair the shipping industry. Regulations are often implemented with compensation and other adjustment systems so that adapting to changes is possible for all companies. The shipping industry can also maintain and improve the competitiveness of a state so interviewees evaluated that overall it is beneficial for all parties that the shipping industry is viable and operates safely.

Interviewees were asked what kind of differences in costs there are for different types and sizes of vessels, or, for example, for different kinds of companies. It was acknowledged that the laws that a vessel complies with respond to the risks involved in shipping. Because of that, the regulations vary from vessel to vessel based on their size and ice class, as well as on vessel and cargo type. For example, regulations related to manning, life boats and other equipment are stricter on passenger ships than on vessels carrying less people. Cargo type impacts the demands for vessel structure. For example, oil tankers must have double hulls in order to prevent the oil from spreading to the sea in case of an accident.

Sometimes updated or new regulations demand that new structures are built on vessels. It was acknowledged that structural changes are less expensive to make on new builds than making changes on already existing vessels. Because of this, there is often a transition period before changes are required from all vessels.

Interviewees recognised that some actors do complain about safety related expenses. The industry is very competitive and it was estimated that usually these complaining actors are likely to prioritise profit or something else more than safety. Interviewees considered that safety should always be the first priority, as an accident will be notably more expensive and disastrous than the preventive actions.

Interviewees acknowledged that costs are also related to the safety culture of a shipping company. Some shipping companies do only the minimum to make their vessels pass inspections and for some companies safety works as marketing factor. Though the size

of a shipping company does not affect the regulations that are directed at the company, it was acknowledged that size can have an impact on how burdening a company finds the costs formed by regulations. What was meant with that is that costs may not seem as remarkable for a large company, but they could be burdening for a small one. On the other hand it was mentioned that the size of the company does not affect safety. It is the safety culture of a company that does.

4.2 Factors increasing the cost-effectiveness of safety measures

Interviewees found it difficult to evaluate cost-effectiveness because it is hardly simple to say how much a certain instrument has improved safety or how to give a value to environment, human life and so on. It was noticed that several different factors have an impact on maritime safety policy instruments' cost-effectiveness. Factors that were considered to make a safety measure cost-effective were, for example, related to the low implementing or using price of a device, low need for maintenance or simply the amount that a measure improves safety.

Maritime safety policy instruments often require buying new equipment or devices. Sometimes new devices require large investments, such as double hulls or other structural changes on vessels, but also some smaller investments have turned out to be highly significant for improving maritime safety. Automatic Identification System (AIS) was considered as one of these. An AIS device continuously sends updated information from vessels to VTS centres. The device reveals all the vessels equipped with an AIS, and it is possible to see vessels behind islands, which is not possible with radars. AIS was acknowledged to be very cost-effective as it improved safety remarkably with fairly low costs when it was introduced and has helped to maintain the attained safety level.

Overall technical advances were acknowledged to have contributed to maritime safety as information exchange between vessels and authorities have improved, workload has moved from man to appliances and vessel monitoring has become easier. In addition, equipment costs have decreased as technologies have generalised. On the other hand it was also noticed that some appliances have been found more useless that they were expected to be.

Measures that do not require almost any costs are naturally considered cost-effective. As an example of that kind of safety, instrument routeing was mentioned. A route, a DW route or for example a part of a Traffic Separation Scheme, does usually not need maintenance and yet routeing has a great importance in preventing groundings and collisions. When routeing was enacted in the 1970s it turned out to have a great impact on safety. Even nowadays routeing is considered to be an important passive way of maintaining and improving maritime safety, as vessels can review from nautical charts, without further assistance, where to sail in order to avoid oncoming traffic.

It must be mentioned that though low adoption, maintenance or operating costs were frequently mentioned as examples of cost-effective instruments, interviewees did not

undervalue the effect of more expensive measures. For example structural changes, such as implementing double hulls to tankers, have been notably expensive, but their influence on safety cannot be underrated. From that it can be understood the difficulty to evaluate or calculate the cost-effectiveness of certain measures. It is difficult to measure what is an adequate level of safety to be attained with certain amount of money.

In addition, it was noted that regulations only set the minimum basis for the requirements. For example, many vessels sail with the cheapest but qualified AIS equipment. The AIS devices were noticed to be rather low in price so with a slightly larger investment companies could get larger benefits from the devices, as they have more applications. It is up to the companies to decide how much they want to get in return for their safety efforts.

Many maritime safety policy instruments aim to change the behaviour of actors. On the human impact level this can be made through improving crew's skills and their mindset regarding safety matters. The International Safety Management Code (ISM Code) was noticed as a cost-effective measure, as it was thought to be a rather affordable way of improving safety. The ISM Code is an international standard for the safe management and operation of ships and for pollution prevention (IMO, 1993). It is a structured and documented system which enables shipping companies to effectively implement safety policies regarding ship, crew, and the environment while at sea. The ISM Code requires only training and a change in a company's safety culture. It was noted that if the ISM Code is well implemented, it can greatly improve safety on board.

The level of implementation is significant for all safety measures. For example, if new safety equipment is bought and installed, crew members must have the skills to use that equipment. Furthermore, the ISM Code, for instance, does not improve safety if the crew members are not committed to it.

Interviewees noted that the role of authorities is changing from controlling to service producing actors. Official supervision can be decreased as shipping companies are indicating more self-regulative actions, and authorities can concentrate on companies and vessels that are indicating to have deficiencies. Risk-based controlling can save time, money and other resources as shipping companies with proactive behaviour do not have to go through inspections so often and authorities can concentrate on known risk companies and vessels.

As a summary of the interviews, it could be stated that a good behaviour and responsibility does improve the safety and cost-effectiveness of operations. At first being responsible may be costly for a company as investments and improvements are made, but in the long term, responsibility pays off as a good reputation which can bring clients and orders. Also, vessels known to be well-maintained must also take part in Port State Control (PSC) less often than the vessels or companies that are known to have problems with safety. That signifies saved time that can be used for ordinary operations instead of waiting for the inspection to be ready. The most important aspect

is linked with responsibility: fewer accidents are likely to happen to a well-maintained vessel sailing with a well-educated crew.

4.3 Factors decreasing cost-effectiveness of safety measures

Interviewees had some difficulties to come up with maritime safety policy instruments that could be called ineffective when compared to their costs. Costs do not always consist of only something material such as equipment. Costs can also signify used work hours if the task that does not give much added value to any of the parties involved. Several interviewees agreed that ship inspections and reporting are something that could and should be made more efficient. Flag State Control (FSC), Port State Control (PSC) and Host State Control (HSC) are ship inspections which are separate but complementary systems monitoring vessels' condition, equipment and manning.

The flag state has the primary controlling responsibility over the vessels that have been registered in the country. FSC has turned out to be insufficient as the inspections are not as efficient everywhere (Ministry of Transport and Communications 2009). Because of the PSC supplements, the system with inspections concentrates on inspecting that vessels are equipped and manned according to international regulations and carry necessary certificates.

In the interviews, vessel inspections were criticised to be poorly coordinated. As a result, for poor coordination same things can be inspected in several inspections. That means overlapping work and wasted time for shipping companies. Interviewees found that there should be more information sharing between the authorities conducting the shipping inspections.

At the same time it was stated that more benefits could be gained with better coordination of the inspections, as a greater part of the vessel would be inspected. It was also acknowledged that it is good that PSC exists and can complement the FSC, because otherwise the number of inspections would not serve the need. Despite the critique, the interviewees acknowledged that targeting vessel inspections at problematic vessels has happened and this means that some improvement has been made. As mentioned in chapter 4.2, as authorities move towards risk based monitoring, Port State Control is being targeted at vessels in a poor condition and ships in better condition are checked less often, which also benefits the shipping company.

Few interviewees noted that sometimes technical improvements have not been as useful as they were expected to be or they have been replaced fast with another device or a new technology. Some technical appliances have been used less than was expected or they may have been used more for some other purpose than they were meant for. Buying unnecessary equipment is clearly not cost-effective.

4.4 Views on the current state of cost-benefit analysis of maritime safety policy instruments

Interviewees were asked whether they think that the costs of maritime safety policy instruments are analyzed well enough before the amendments are enacted. Interviewees seemed mainly to trust that the background and effects of regulations are thoroughly researched before their implementation. It was noted, that for example IMO decisions require validation from member states before they come into effect, so member states have a possibility to affecting the contents of regulations. A well-operating maritime industry can contribute to the competitiveness of a country and because of that, for instance in Finland, authorities make impact assessments related to national maritime safety regulations. Interviewees were aware of the research procedures preceding the implementation of measures, such as IMO's Formal Safety Assessment (FSA), so some interviewees believed that questions about the cost-effectiveness of safety measures should not exist. On the other hand, some interviewees did not seem to have much knowledge about the procedures, so some uncertainty concerning whether cost pressure is analyzed enough does exist.

It was also noted that decisions concerning very important changes can be made with an accelerated schedule, which may end up being harmful for analyzing the rationales behind the decisions. Related to this, it was brought up that sometimes when legislation in updated, cost pressure can be stronger for some actors or regions. For instance, the forthcoming sulphur regulation was criticised because the expenses will be larger in some places than in others. Concerning the sulphur case, some of the interviewees mentioned that perhaps decision-makers were not fully aware of the consequences of the directive. It must be noted that the sulphur directive was also mentioned during the discussion about the importance of cooperation between countries that share similar interests. Many states in the Baltic Sea were in favour of the sulphur directive and for example Finland as an individual country could not affect the decision made by the European Union.

5 DISCUSSION AND CONCLUSIONS

The Baltic Sea is one of the most densely trafficked sea areas in the world. Dense maritime traffic and especially oil transportation increases the probability of accidents, which might have devastating consequences in the sea area. Actors can act against regulations and compromise safety if regulations and demands are experienced as excessive. For those reasons, shipping companies should be encouraged to safe behavior by making the implementation of safety procedures as cost-effective and worthwhile as possible. In order to utilise both public and private resources efficiently, awareness is required of what kind of costs maritime safety policy instruments cause and the costs are in relation to benefits.

The aim of this research is to provide a general overview on the analysis on the cost-effectiveness of maritime safety policy instruments. This report describes how cost-effectiveness has been studied and how it has been taken in consideration in maritime safety policy. The report also illustrates the costs that maritime safety policy instruments cause and whether those costs burden certain actors of the industry. The results of the study are based on a literature review and on nine interviews of maritime experts. The results of this overview will be further utilised when planning future research.

On the basis of the interview results, it can be concluded that the overall costs of maritime safety measures do not currently seem to be considered burdening for the maritime industry in Finland. Interviewees seemed willing to pay for maintaining and improving maritime safety as long as the safety gains of inputs are high and the costs do not give competitive advantage to any actors. The minority of actors who complain about safety costs were evaluated to prioritise something else than safety. Generally actors in the Finnish shipping industry seem to find maintaining high safety level important and act accordingly. However, it should be noticed the that majority of interviewees represents authorities, and on the basis of this interview sample it is difficult to say if shipping companies share the views of authorities.

Typically, interviewees considered the instruments that do not require much continuous maintenance or large investments or other costs to be cost-effective. However, also such instruments, which require large investments (such as double-hulls in tankers) can be considered to be cost-effective, if the efforts have a notable impact on safety level.

It was emphasised that an instrument can be cost-effective only if it is implemented properly. Low costs of an instrument, a new piece of equipment or new procedures may end up being less effective than they could be if, for example, the crew does not have the skills and commitment to use the new equipment, or the instrument is not otherwise implemented properly. The cost-effectiveness of an instrument is also reduced if a policy instrument causes overlapping or repetitive work or if the used technology quickly becomes outdated. Overlapping ship inspections were often named as an example of repetitive work.

Though interviewees estimated that the costs of safety measures could be even higher without becoming burdening for the industry, there was strong agreement of that the existing safety measures should be reanalysed instead of applying constantly new measures. Reanalysing the existing regulation could make the utilization of existing instruments more efficient. According to the interviews, largest deficiencies related to costs and other resources seem to be related to overlapping and repetitive tasks. Because of that, an important way of enhancing the effectiveness and cost-effectiveness of maritime safety policy instruments in the future seems to be harmonising, automating and integrating.

Complying with legislation is mandatory so companies must fulfil the requirements. As bases for safety legislation have existed for a fairly long time, the costs resulting from safety legislation are an intrinsic part of shipping. Interview results indicate that currently the structure of safety costs seems to be changing. No large changes in safety regulation is in sight, so proactivity and spontaneous efforts of shipping companies are getting continuously more important in improving the level of shipping safety. In the interviews it was acknowledged that maintaining a high level of safety may be reasonably expensive. However, committing to these investments can be worthwhile as a high safety level is required also by many customers; proactive safety efforts can be considered a factor increasing the competitiveness of a company. Interviewees believed that investing in safety is worthwhile and can, in the long term, provide also other benefits than just increased level of safety. Companies can build a good reputation as a safe carrier and in the long term financial benefits can be gained. It was noted that proactivity may also improve occupational safety and work satisfaction.

The previous literature concerning the cost-effectiveness of maritime safety policy instruments implies that the cost-effectiveness is in many cases challenging to evaluate or calculate. It is often difficult to evaluate is the benefit of a certain instrument because it cannot be known if an accident would have happened if an instrument had not been implemented, or what the role of single instrument is in the prevention of accidents, when in reality development happens simultaneously in many issues and on many levels. Moreover, costs and their significance are affected by many factors, such as regional circumstances. In addition, it can be discussed which costs and whose costs should be included in the analysis.

In the context of maritime safety, policy instruments' cost-benefit analysis is usually performed as part of the FSA (Formal Safety Analysis) analysis of RCOs (Risk Control Options). In FSA studies, there seems to be some level of uniformity in how cost-benefit analysis is performed (how costs and benefits are calculated), but the studies have been criticized even for leading to false conclusions about the cost-effectiveness of RCOs. In addition, the FSA focus on the role of maritime safety measures in affecting human safety and lives, when there is a growing concern about the environmental effects as well.

When looking at cost-benefit analysis generally, it is acknowledged that it has several limitation and challenges, such as measuring and deciding benefits and costs, the lack of reliable data to be used in the analysis, and how to rank options if there are, for

example, conflicting interests involved. To overcome some of the limitations of CBA analysis, other methods, which may include qualitative data besides quantitative, have been developed, for example cost-effectiveness analysis and multigoal analysis. They could also bring some added value to the current practices of analysing cost-effectiveness in maritime safety context.

It seems that the evaluation of cost-effectiveness of maritime safety policy instruments is a challenging task. This conclusion should not, however, imply that it is a useless practice. It is important to gain information on the relation of costs to expected benefits, so that the scarce resources are used efficiently. Because perfect information can never be gained, decisions have to be made on the basis of information that is available. However, it is important to bring out the limitations of the analysis so that users of the information are also able to see the limitations.

Cost-benefit analysis should be performed when alternative RCOs to reduce some particular risk are compared. It is usually the case that every RCO has some positive effect on safety, so the challenge is the ranking of RCOs and finding the combinations of RCOs that bring the most cost-effective results. It should be kept in mind that totally different types of projects or policies cannot be compared with each other. Costs and benefits may consist of very different things, and their comparison could result in a distorted outcome (Boardman 2006).

On the basis of the literature review and the interview study, there is room for development in the cost-benefit analysis of maritime safety policy instruments. Interviewees were of the opinion that the effects of regulations are thoroughly studied before their implementation. Interviewees were aware of research procedures preceding implementing measures, such as the IMO's Formal Safety Assessment (FSA), so some interviewees believed that questions about cost-effectiveness of safety measures should not exist. On the other hand, some interviewees did not seem to have much knowledge about the procedures, so some uncertainty concerning whether cost pressure is analysed enough does exist. It was also noted that decisions concerning very important changes can be made with an accelerated schedule, which may end up being harmful for analysing the rationales behind the decisions.

5.1 Further work on cost-effectiveness of maritime safety policy instruments as part of the MIMIC project

In the MIMIC project, the cost-effectiveness of some RCOs in decreasing the probability of an oil accident in the Gulf of Finland will be studied using a Bayesian Belief Network model. Besides RCOs, the model includes future scenarios for maritime oil transportation, accident probabilities and the environmental effects of an oil accident. Selected RCOs to be analyzed in the model are connected to route planning, VTS, piloting, (prevention of an accident), to structural changes in tankers (minimizing oil leaks), and to increasing the oil combatting capacity and the development of a tool to predict the movements of oil in water (minimizing the harmful consequences). In other words, the model provides implications on whether efforts should be targeted at

prevention, minimizing the oil leaks resulting from accidents or minimizing the harmful consequences of an oil accident at sea. The model will be finished by the end of 2013.

Route planning, VTS and piloting have been selected as preventive RCOs to the model on the basis of the study of Lappalainen, Storgård & Tapaninen (2012) and Kuronen & Tapaninen (2010). Route planning is connected to the on-going development project of an ENSI system, which is coordinated by John Nurmisen Säätiö. In the model, the costs of RCOs and their effect on the probability of an accident will be analysed.

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APPENDIX 1

The list of interviewees

Titles may have changed after the interviews.

Sirkka-Heleena Nyman (Senior Adviser, shipping, Ministry of Transport and Communications), interviewed on 11.6.2012

Sanna Sonninen (Captain, Director, Finnish Transport Safety Agency Trafi), interviewed on 23.5.2012

Anita Mäkinen (Chief Adviser, Environment, Finnish Transport Safety Agency Trafi), interviewed on 31.5.2012

Matti Aaltonen (Captain, Director, Finnish Transport Agency), interviewed on 5.7.2012

Thomas Erlund (Captain, Head of Vessel Traffic Services, Finnish Transport Agency), interviewed on 11.6.2012

Markku Mylly (Managing Director, Finnish Port Association), interviewed on 23.5.2012

Olof Widén (Managing Director, Finnish Shipowners' Association), interviewed on 22.5.2012

Carolus Ramsay (Captain, Safety and Security Manager, Finnlines), interviewed on 15.6.2012

Jan Valtonen (Captain, Manager, Safety and Environment Designated Person Ashore, Neste Shipping), interviewed on 11.6.2012.

APPENDIX 2

INTERVIEW QUESTIONS in Finnish

Kustannustehokkuus

1. Miten arvioitte meriturvallisuutta edistävän lainsäädännön ja muiden toimenpiteiden varustamoille aiheuttamaa kustannusrasitusta? Pitäisikö turvallisuuteen liittyvää kustannusrasitusta mielestänne pienentää nykytasolta, vai voidaanko sitä vielä suurentaa (olettaen että kaikki joutuvat tekemään saman)?

2. Miten meriturvallisuuteen liittyvät kustannukset ovat kehittyneet pidemmällä aikavälillä? Käytetäänkö meriturvallisuutta kehitettäessä (tarpeeksi) huomiota toimijoille aiheutuviin kustannuksiin?

3. Onko erityyppisten varustamoiden välillä eroja turvallisuuteen liittyvässä kustannusrasituksessa? Esimerkiksi bulk, tankkeri, matkustaja, kontti jne., tai vaikuttaako varustamon koko/omistuspohja asiaan?)

4. Voitteko antaa esimerkkejä mielestänne kustannustehokkaista ja/tai -tehottomista toimenpiteistä? Esimerkiksi päällekkäisyyden ja toiston poistaminen, raportoinnista tai alustarkastuksista.

5. Pitäisikö kustannusten kohdentumista kehittää jollain tapaa, esimerkiksi siten että vastuullinen maksaisi vähemmän? Esimerkkejä, minkä kustannusten kohdentumista voitaisiin kehittää? Esimerkiksi väylä- tai satamamaksujen osalta.

6. Onko mielestänne uusien onnettomuuksia ehkäisevien toimenpiteiden kustannuksia suhteessa hyötyyn selvitetty riittävästi? Kuinka onnettomuuksien ehkäisemisen kustannuksia voitaisiin mielestänne mitata/ arvioida? Mitä kustannuksia laskennassa pitäisi huomioida?

7. Mikäli uusia kustannuksia asetettaisiin, kuinka kustannusten sisältö voitaisiin selvittää maksajille siten, että uusien maksujen suorittaminen tuntuisi kannattavalta?

8. Jos satama- tai väylämaksuja nostettaisiin, olisiko sillä vaikutusta Suomeen saapuvan alusliikenteen kannalta? Valitsisivatko yritykset esimerkiksi muita kulkureittejä tai satamia, joilla kyseisiä maksuja ei tarvitsisi maksaa yhtä paljon?

9. Väylämaksuja on lähiaikoina korotettu, mutta korotuspaineita on edelleen. Minkälaisia vaikutuksia väylämaksujen korotuksella olisi? Mitä vaihtoehtoisia menetelmiä voitaisiin käyttää helpottamaan korotuspaineita? Esimerkiksi verotulojen käyttö merenkulun infrastruktuurikustannuksien kattamiseen.

10. Minkälainen vaikutus seuraavilla toiminnoilla olisi meriturvallisuudelle ja kustannusten muodostumiselle? Olisiko näille toimille tarvetta?
    a) Kansallisen ja alueellisen päätöksenteon merkityksen ja mahdollisuuden kasvattaminen
    b) Alusliikenteen monitoroinnin ja VTS-keskusten valtuuksien lisääminen
    c) Miehistön kouluttaminen (Erityisesti millä osa-alueella?)

Particularly Sensitive Sea Area, PSSA

Itämeri nimettiin erityisen herkäksi merialueeksi (Particularly Sensitive Sea Area, PSSA) vuonna 2005. PSSA:han liitetään aina lisäturvamääreitä, joilla merialueen turvallisuutta pyritään parantamaan. Suomenlahdella PSSA-lisäturvamääreiksi voitaisiin tulevaisuudessa liittää esimerkiksi reittijakojärjestelmän osia, jotka ovat jo nyt olemassa olevia, mutta eivät liity statukseen.

11. IMO on korkein meriturvallisuuteen liittyviä päätöksiä tekevä elin. IMO ei kannata alueellista tai paikallista päätöksentekoa. Toimiiko PSSA-nimitys Itämerellä mahdollisuutena alueelliselle päätöksenteolle? Onko nykyistä laajemmalle alueelliselle päätöksenteolle tarvetta?

12. Kuinka hyvä tunnettavuus nimeämisellä tai siihen liittyvillä lisäturvamääreillä nykyään on? Ovatko merenkulkijat tietoisia liikkuvansa PSSA-alueella, vai noudatetaanko lisäturvamääreitä enemmän lähinnä osana aluksen tavallista turvallisuustoimintaa?

13. Onko Itämeren nimeämisellä PSSA-alueeksi mielestänne ollut vaikutusta meriturvallisuuden tilan parantumiseen? Millä tavalla? Mikä on yleinen ilmapiiri PSSA-statukseen liittyen, koetaanko alalla että statuksesta on ollut hyötyä meriturvallisuuden kannalta?

14. Minkälaisia kustannuksia PSSA-statuksen lisäturvamääreet aiheuttavat? Ovatko kustannukset mielestänne huomattavia? (Kustannuksina voidaan pitää esimerkiksi laitehankintoja tai käytettyä työaikaa, mikäli esimerkiksi raportoiminen vie runsaasti aikaa muulta työltä)

15. Kuinka PSSA:n vaikuttavuutta meriturvallisuutta parantavana statuksena voitaisiin parantaa? Tulisiko konseptia esimerkiksi brändätä enemmän suuntaan, joka toimisi julkisina ”kasvoina” meriturvallisuudelle, jotta sidosryhmät (esimerkiksi yritykset, merenkävijät, media, valtaväestö jne.) kiinnittäisivät enemmän huomiota Suomenlahden tilaan ja alusliikenteen turvallisuuskysymyksiin?

Gulf of Finland Reporting, GOFREP

Kurosen ja Tapanisen (2010) kyselytutkimuksen mukaan GOFREP:in on koettu parantaneen turvallisuustilannetta merialueella huomattavasti, mutta suurta kehityspotentiaalia vastaajat eivät usko ilmoittautumisjärjestelmällä olevan. Lisäksi osa vastaajista esitti ilmoittautumisen vievän paikoittain erittäin paljon aikaa.

16. Mikä olisi paras vaihtoehto kehittää GOFREP-järjestelmää turvallisuuden ja tehokkuuden lisäämiseksi: Järjestelmän muuttaminen pakolliseksi myös pienemmille aluksille (nykyisen rajan 300 DWT alentaminen), miehistön kouluttaminen, raportointivaatimusten karsiminen ajan säästämiseksi, järjestelmällä kerätyn tiedon hyödyntäminen, ilmoittautumisjärjestelmän kansainvälistäminen vai jokin muu?

17. Suomenlahdella toimiva GOFREP-järjestelmä on kehitetty merialueen tarpeita vastaavaksi. Kehitteillä on koko ajan laajempia alueita kattavia järjestelmiä. Tuovatko kansainväliset ilmoittautumisjärjestelmät ennemmin lisäarvoa vai lisätyötä ja kustannuksia nykyiseen GOFREP-järjestelmään? (Lisäarvo voi olla esimerkiksi tietojen hyödyntämiseen liittyvää & turvallisuuden paranemista, toisaalta edelleen raportointivelvollisuudet, laitehankinnat, ylläpitokustannukset ja koulutuksentarve saattavat lisääntyä).

18. GOFREP-järjestelmää on aikaisemmin pystytty kehittämään Suomenlahdella vain muutaman valtion haluamaan suuntaan. Heikentävätkö kansainvälisten järjestelmien synnyttämät vaatimukset tähän asti itsenäisesti tehtyä T&K-toimintaa? Voiko kattava alusliikennettä kuvaava tietokanta olla jopa turvallisuutta heikentävä?

19. Kurosen ja Tapanisen (2010) tuottaman kyselyn mukaan osa aluksien henkilökunnasta kokee raportoinnin erittäin työllistävänä. Oletteko sitä mieltä että nämä mielipiteet ovat aiheellisia ja kuinka olisi mahdollista keventää GOFREP:iin liittyvää työmäärää?

20. Alusten ilmoittautuminen ja AIS-informaatio liittyvät ensisijaisesti alusten turvallisuuden parantamiseen. Kerättyjä tietoja voidaan kuitenkin käyttää myös tutkimukseen, jolla voidaan esimerkiksi kehittää olemassa olevia tietojärjestelmiä. Käytetäänkö GOFREP-järjestelmään ja AIS-informaatioon perustuvaa tietoa mielestänne tällä hetkellä tarpeeksi tutkimukseen? Olisiko jokin aihepiiri jota kannattaisi tulevaisuudessa tutkia tai kehittää?

Vessel Traffic Service, VTS

Kurosen ja Tapanisen (2010) merenkulun ammattilaisille suorittamassa tutkimuksessa osa vastaajista oli sitä mieltä, että VTS-keskuksien aktiivisuudessa on eroja ja jotkut Itämeren VTS-keskuksista voisi toimia aktiivisemmin kuin ne tällä hetkellä toimivat.

21. Kurosen ja Tapanisen (2010) kyselyssä vastaajat korostivat sää- ja muiden olosuhdetietojen välittymisen tärkeyttä. Ovatko VTS-keskukset se toimija, jonka tulisi välittää tietoa yhä enemmän tulevaisuudessa, vai olisiko parempi kehittää edelleen muita keinoja vaihtaa tietoa (esimerkiksi internetpohjainen sovellus)?

22. Onko VTS-keskuksten aktiivisuudessa parantamisen varaa liittyen navigointitiedon lähettämiseen aluksille vai onko kyse enemmänkin merenkulkijoiden odotuksista, jotka ovat VTS-keskusten perustehtävän mukaisia velvollisuuksia suurempia?

23. Tulisiko VTS-keskusten valtuuksia ohjailla alusliikennettä lisätä, tulisiko toimintaa kehittää enemmän lennonjohtoa vastaavaksi? Minkälaisia vaikutuksia valtuuksien lisäämisellä olisi keskuksissa tai aluksilla?

24. Onko VTS-keskusten järjestely nykyisellään tehokas? (määrä, sijainti, työmäärä, yhteistyö) Onko havaittu että nykyisellä sijoittamisella olisi jo saavutettu positiivisia tuloksia? VTS-keskusten määrä on suunniteltu vähennettävän kolmeen (Hki, Turku, Lappeenranta) tämän vuoden aikana. Keskusten vähennyksellä saadaan aikaan noin 10 henkilötyövuoden supistukset. Mitä vaikutuksia muutoksella tulee varustamoille olemaan?

APPENDIX 3

INTERVIEW QUESTIONS in English

Economic cost-effectiveness

1. How would you evaluate the cost burden which is caused for shipping companies by legislation and other measures aiming to improve maritime safety? Should the safety related cost burden be decreased from the current level or can it be further increased (assuming that changes would concern all actors)?

2. How maritime safety related costs have developed in the long term? Are costs for actors taken into account appropriately when maritime safety legislation is developed?

3. Are there differences in the safety related cost burdens between different types of shipping companies? For example bulk, tanker, passenger, container and so on. Or does the size or ownership structure of a shipping company make a difference?

4. Could you please provide examples of instruments that are cost-effective and/or decrease cost-effectiveness? For example, issues related to the removal of overlap and repetition from operations, ship reporting or vessel inspections.

5. Should the allocation of costs be somehow developed, for example by allowing a responsible actor to pay less? Could you please provide some examples how, for example, fairway and port dues could be developed?

6. Do you believe that the costs of new accident prevention measures have usually been researched sufficiently before their implementation? How the costs of accident prevention measures could be measured/evaluated? Which costs should be noticed in the calculations?

7. If some new costs would be set, how could their composition be clarified to paying actors in a manner that would make the disbursement feel reasonable?

8. Would it influence vessel traffic arriving to Finnish ports if port and fairway dues were raised? Would companies shift their operations to other routes and ports where fees are not as high?

9. Fairway dues have recently been raised but pressure for further raises does exist. What kind of effects would raising fairway dues have? What kind of alternative methods could be used for easing the pressure for raising dues? For example using tax revenues to cover infrastructure costs of maritime transportation.

10. What kind of effect would the following functions have on maritime safety and formation of costs?
    a) Increasing the significance and possibility of national and regional decision-making
    b) Increasing the mandate of vessel monitoring and VTS-centres
    c) Crew training (especially which themes?)

Particularly Sensitive Sea Area, PSSA

The Baltic Sea was designated as a Particularly Sensitive Sea Area (PSSA) in 2005. The PSSA designation always includes Associated Protective Measures (APMs) that aim to improve safety in the sea area. In the future, for example some parts of Traffic Separation Schemes that already exist but are not a part of the Baltic Sea PSSA could be added to APMs.

11. IMO is the highest decision-making organ related maritime safety issues. IMO does not favour regional or local decision-making. Does PSSA-status work as a possibility for regional decision-making in the Baltic Sea? Is there a need for more extensive regional decision-making?

12. How well-known is the designation nowadays or the APMs related to it? Are seafarers aware that they are sailing in an area designated as a PSSA or are they more likely to act accordingly to APMs as a part of vessel's ordinary safety activities?

13. Do you believe that designating the Baltic Sea as a PSSA has improved the level of maritime safety? In what way? What is the common ambience related to the PSSA-status, does the industry find the status important for safety?

14. What kind of costs do APMs related to the PSSA-status cause? Do you consider these costs to be high? (For example equipment acquisitions or working hours used for reporting if it takes excessively time from other tasks could be considered as costs.)

15. How could the significance of the PSSA as a maritime safety improving status be increased? Should the status concept be, for example, branded more to a direction where it would work as a public "face" of maritime safety so that interest groups (for example companies, seafarers, media, public) would pay more attention to the state of the Baltic Sea and to the safety related questions of maritime traffic?

Gulf of Finland Reporting, GOFREP

According to the questionnaire conducted by Kuronen and Tapaninen (2010), GOFREP has been considered to increase safety in the sea area significantly, but the respondents of the survey do not believe that the reporting system has a high potential to improve the level of safety more if it was further developed in the future. Some of the respondents claimed that reporting takes a considerable amount of time on the bridge.

16. What would be the best way to develop the GOFREP in order to increase safety and efficiency: Making ship reporting compulsory also to smaller vessels (lowering the current level of 300 DWT), crew training, decreasing reporting requirements in order to save time, utilising the information collected with GOFREP, making the reporting system common internationally or something else?

17. In the Gulf of Finland, the GOFREP has been developed to meet the requirements of the sea area. Development for reporting systems covering wider sea areas is continuous. Are international reporting systems more likely to provide added value or extra work and costs compared to the current GOFREP? (Added value can, for example, be related to utilising collected information and improving the safety level. Alternatively obligations to report to a higher level, equipment and maintenance costs and the need for training may increase).

18. So far GOFREP has been developed to a direction desired only by a few countries. Can possible requirements made by international systems harm the so far independently made research and development activities? Can a comprehensive marine traffic database end up being a security threat?

19. According to a questionnaire research conducted by Kuronen and Tapaninen (2010), some of the seafarers find reporting burdening. Do you find these statements justified and how could it be possible to ease the workload caused by reporting?

20. Ship reporting and AIS-information's primary purpose is to improve maritime safety. Added to this, the data collected from the vessels can be used for research that aims at developing existing systems. Do you think that data related to ship reporting and AIS-information is efficiently used for research purposes? Do you find that there is a certain theme that should be further researched in the future?

Vessel Traffic Service, VTS

According to the research conducted to experts of maritime industry by Kuronen and Tapaninen (2010) some of the respondents considered that the operation of VTS-centres does differ and that some of the VTS-centres in the Baltic Sea could operate more actively than they do at the moment.

21. In the survey by Kuronen and Tapaninen (2010) respondents emphasised the importance of efficient data transferring related to weather and other conditions at sea. Do you think that in the future VTS-centres should be the actor providing even more of this information than they do now, or would it be better to further develop some other method to exchange information (for example an internet based application)?

22. Do you find that there is room for improvement in the VTS-centres' activity to send navigation data to vessels, or is the question rather about seafarers having greater expectations than what is written as the basic mission of VTS?

23. Should the authority of VTS operators be increased and the VTS developed to resemble air traffic control? What kind of influence would increasing authority have in the VTS-centres or in vessels?

24. Is the operation of VTS-centres efficient at the moment? (Amount of centres, location, workload, cooperation) Have some positive results already been perceived with the current placement of centres? There have been plans to reduce the number of VTS-centres to three (Helsinki, Turku and Lappeenranta) during the current year. Is believed that reductions of ten working years will be reached with the reduction of the number of VTS-centres. How are these reductions going to affect shipping companies?

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