TURUN YLIOPISTON
MERENKULKUALAN KOULUTUS- JA TUTKIMUSKESKUKSEN JULKAISUJA

PUBLICATIONS FROM THE CENTRE FOR MARITIME STUDIES
UNIVERSITY OF TURKU

A52
2010

EFFICIENCY OF THE ISM CODE IN FINNISH SHIPPING COMPANIES

Juha Heijari
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(eds.)

MERITURVALLISUUDEN JA -LIIKENTEEN TUTKIMUSKESKUS
KOTKA MARITIME RESEARCH CENTRE

European Union
European Regional Development Fund

Leverage from the EU 2007–2013

TURUN YLIOPISTON
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PUBLIKATIONER AV SJÖFARTSBRANSCHENS UTBILDNINGS- OCH
FORSKNINGSCENTRAL VID ÅBO UNIVERSITET

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JULKAISIJA / PUBLISHER:

Turun yliopisto / University of Turku
MERENKULKUALAN KOULUTUS- JA TUTKIMUSKESKUS
CENTRE FOR MARITIME STUDIES

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Kopijyvä Oy
Kouvola 2010

ISBN 978-951-29-4353-1

ISSN 1456-1816

ABSTRACT

Due to increasing waterborne transportation in the Gulf of Finland, the risk of a hazardous accident increases and therefore manifold preventive actions are needed. As a main legislative authority in the maritime community, The International Maritime Organization (IMO) has set down plenary laws and recommendations which are e.g., utilised in the safe operations in ships and pollution prevention. One of these compulsory requirements, the ISM Code, requires proactive attitude both from the top management and operational workers in the shipping companies. In this study, a cross-sectional approach was taken to analyse whether the ISM Code has actively enhanced maritime safety in the Gulf of Finland. The analysis included; 1) performance of the ISM Code in Finnish shipping companies, 2) statistical measurements of maritime safety, 3) influence of corporate top management to the safety culture and 4) comparing safety management practices in shipping companies and port operations of Finnish maritime and port authorities. The main results found were that maritime safety culture has developed in the right direction after the launch of the ISM Code in the 1990´s. However, this study does not exclusively prove that the improvements are the consequence of the ISM Code. Accident prone ships can be recognized due to their behaviour and there is a lesson to learn from the safety culture of some high standard safety disciplines such as, air traffic. In addition, the reporting of accidents and near-misses should be more widely used in shipping industry. In conclusion, there is still much to be improved in the maritime safety culture of the Finnish Shipping industry, e.g., a “no blame culture” needs to be adopted.

KEYWORDS

Accident, Management, Occupation, Port, Risk, Safety culture, Ship, Traffic

ABBREVIATIONS

AIBF – Accident Investigation Board of Finland
AIS – Automatic Identification System
AVI – Regional State Administrative Agencies
CIC – Concentrated Inspection Campaign
CSM – Common Safety Methods
CST – Common Safety Targets
DP – Designated Person
EEZ – Exclusive Economic Zone
EIA – Environmental Impact Assessment
EMCIP –European Marine Casualty Information Platform
EMSA – European Maritime Safety Agency
ERA – The European Railway Agency
EU – European Union
EU15 – The 15 countries (Belgium, France, Germany, Italy, Luxembourg, Netherlands, Denmark, Ireland, United Kingdom, Greece, Portugal, Spain, Austria, Finland and Sweden) that were members of the EU before the enlargement on 1st May 2004
FAII – Finnish Federation of Accident Insurance Institutions
FSA – Formal Safety Assessment
GDB – Gross Domestic Product
GISIS – Global Integrated Shipping Information System
GOFREP – Gulf of Finland Reporting System
HELCOM – The Helsinki Commission
IFWA – Investigation and Reporting of Fatal Workplace Accidents
IAEA – The International Atomic Energy Agency
IMO – International Maritime Organization
ICAO – International Civil Aviation Organization
ISM Code – International Management Code for the Safe Operation of Ships and for Pollution Prevention
ISO – International Organization for Standardization Standards
MARPOL 73/78 – International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978
MOU – Memorandum of Understanding
NPP – Nuclear Power Plant
OHSAS – Occupational Health and Safety Management System
Paris MOU – see MOU
PSC – Port State Control
ROPAX – Roll-on/roll-off (RORO or ro-ro) ships
Ro-Ro – see ROPAX
SCART – Safety Culture Assessment Team
SMM – Safety Management Manual
SMS – Safety Management System
STUK – The Radiation and Nuclear Safety Authority in Finland
SYKE – Finland's Environmental Administration
TEU – Twenty foot Equivalent Container Unit
TraFi – Finnish Transport Safety Agency
UNCLOS – United Nations Convention on the Law of the Sea
US – United States of America
VTS – Vessel Traffic Service

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1 INTRODUCTION

Juha Heijari, Kotka Maritime Research Centre

Intercontinental maritime transportation has been in continuous increase due to the globalization of markets. For example, during the period from 1995 to 2006, world maritime container traffic (measured in TEU) increased over 200% and world gross domestic product (GDB in 2007 US dollars) almost doubled in this time period (U.S. Department of Transportation, 2007). From the European point of view, the largest port handling maritime cargo (weight of seaborne goods) are Rotterdam (Netherlands), Antwerp (Belgium), Hamburg (Germany), Marseille (France) and Amsterdam (Netherlands), respectively (Amerini, 2010). Finnish ports handle approx. 3% of the European level volumes in 2007 (Amerini, 2009). The increase in handled volumes both in import and export has been (in 2006 − 2007) approximately 2.5% in Europe, but the economic downturn has downgraded shipping volumes on a global scale (Amerini, 2010).

In future prospect, shipping is expected to be the most important means of transport in intercontinental and, in many cases, in continental haulage. In Europe, the Baltic Sea and especially the Gulf of Finland has considerable importance for seaborne transportation (Kuronen & Tapaninen, 2009). The increasing export of oil from Russia constitutes a major share of volumes transported through the Gulf of Finland and the country is the European Union's most important partner (United States of America is second) measured in handled (import and export) gross weight of goods (Amerini, 2010). The increase in seaborne cargo in the Baltic Sea countries has been close to the European level (Figure 1). Furthermore, in Finnish ports, arrivals in foreign traffic have been in a constant increase for several years (Figure 1).

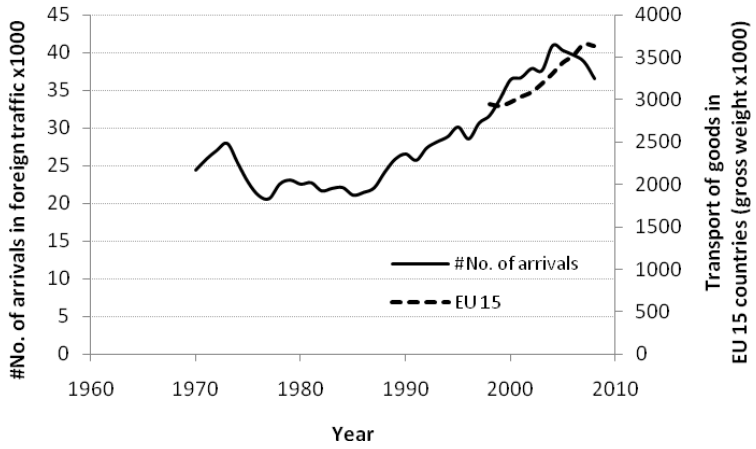

Figure 1. The number of arrivals (solid line) in foreign traffic in the Finnish ports during 1970 – 2008 (data from Statistics on Shipping between Finland and Foreign Countries, 2008) and the gross weight (dash line) of seaborne goods handled in EU 15 countries' ports during 1998 – 2008 (data from Sea transport of goods, 2010)

In relation to growing waterborne transportation, the risks for accidents increase in the vulnerable Baltic Sea and the Gulf of Finland. Transportation of oil in the Gulf of Finland accounts for 56% of total maritime goods transported (Kuronen & Tapaninen, 2009). A maritime accident, similar to the British Petroleum oil rig accident in the Gulf of Mexico on 22 May, 2010, would be catastrophic to the Gulf of Finland's economy, environment and everyday life. In order to combat against these kinds of accidents, so called "ex ante" operations are required. A few examples of opposite "ex post" operations are the cleaning of the shore of spilled oil or claims for loss of revenue from the parties responsible for the spill.

Maritime safety in the Gulf of Finland has enhanced due to several "ex ante" operations, such as acts of the International Maritime Organization (IMO) and preventive actions of the United Nations, establishment of the intergovernmental organization Helsinki Commission (HELCOM), Vessel Traffic Service (VTS) based of Automatic Identification System (AIS) and a mandatory reporting system named Gulf of Finland Reporting System (GOFREP). Even though the awareness of the increased risk for accidents has ignited several operations to prevent accidents, still approximately 22 to 34 accidents occur annually in the Gulf of Finland (Kujala et al., 2009). The current regulations, guidelines, assessments, codes etc. have to be functional and easy to implement for them to be successful in preventing accidents. The future prospects are an enhanced usability of maritime traffic surveillance and new innovations (European Union Strategy for the Baltic Sea Region, 2009). The methods (not regulatory) in proactive operations against possible accidents are, for example, the utilisation of improved global maritime surveillance (Høye et al., 2008; Coleshill et al., 2010), probability modelling of vessel collision (Monteweka et al., 2010), enhanced shipping accident investigations (Celik et al., 2010; Salmi, 2010), cross-disciplinary studies

(human factor, Bayesian networks; Kelmola et al., 2009) and functional policy instruments (Kuronen & Tapaninen, 2009).

The ro-ro ship Estonia capsized and sunk in heavy weather in September 1994. The primary reason for the accident was a failure and loosing of the ship's bow visor. Hänninen (2007) analysed the report of the investigation board thoroughly in his doctoral thesis concerning the Estonia accident. Hänninen (2007) stated that the cause of the Estonia accident was not only a technical failure of the bow visor, but also that there are major defects in the safety culture of the maritime industry.

Even before the Estonia accident occurred, deficiencies in maritime safety culture were considered as the reason for the accident of the Herald of Free Enterprise (FMA, 2007). Among other fatal accidents that occurred in the late 1980's, the accident of the Herald of Free Enterprise triggered concern about the maritime safety culture among international maritime authorities. As a result, the IMO provided an International Safety Management Code (ISM Code) in 1993.

This is the final report of project METKU "Developing Maritime Safety Culture" that was carried out in Kotka Maritime Research Centre during 2008 – 2010. One of the aims of the research project was to evaluate the impacts of the ISM Code on the maritime safety culture in Finland. The research partners were Aalto University, the University of Turku, the Centre for Maritime Studies, Kymenlaakso University of Applied Sciences and Turku University of Applied Sciences. The METKU project was funded by the European Union, Regional Council of Päijät-Häme, the City of Kotka and private companies. We investigate the abovementioned specific questions in five short concluding articles below.

The aim of the METKU project was to gather a holistic view on the development of maritime safety in the Gulf of Finland during the past decade. Our aim specifically was to analyse: 1) the impact of the ISM Code on maritime safety culture, 2) the tools for identifying risk factors for individual ships, 3) to compare other high standard safety management systems, 4) the influence of human factor in accident probability, 5) the influence of corporate top management to safety culture and 6) the need for directions and guidelines for the authority networks.

2 ANALYSIS OF THE INTERNATIONAL SAFETY MANAGEMENT CODE

Jouni Lappalainen, Anne Vepsäläinen & Ulla Tapaninen, University of Turku

2.1 Introduction

The purpose of the International Safety Management Code (ISM Code) has been to promote safety culture for the maritime industry. The fundamental philosophy of the ISM Code is the philosophy of continuous improvement. Investigating incidents is an integral component of the process of continuous improvement in safety management systems. According to IMO, learning from accidents should help to improve safety performance since the incidents can share the same underlying causes as losses. (IMO, 2008)

The purpose of the study is to recognize whether the safety culture has improved due to the ISM Code and evaluate the impacts of the ISM Code on maritime safety in Finland. The research project consists of a literature study and focused interviews which were carried out in autumn 2008 and spring 2009. The research questions are:

- Is there an established and actively working process of continuous improvement?
- Is the top management of the company committed to safety issues?
- Is there motivated and encouraged personnel onboard to actively initiate safety improvements (personnel empowerment)?

2.2 Target and structure

The target was to study the development of the Finnish maritime safety culture considering the effects of the ISM Code from the mid-1990's to the present. The work consisted of three parts: a literature review, interview studies and finally, premises of incident reporting was studied.

The purpose of the *literature review* was to provide us with a preliminary understanding of the research problem. When examining the existing literature, we tried to find out and recognize the means and methods for eliciting the changes in the organisational culture. Moreover, we tried to find out the prerequisites for a good safety culture. Earlier studies on the impact of the ISM Code have been based on quantitative methods, such as structured questionnaires, the results of which have been analysed statistically.

The purpose of the *interview study* was to collect the maritime personnel's subjective perceptions of the maritime safety culture in Finland. The results of the interviews were analysed qualitatively. A total of 94 people were interviewed in this interview study. All those who were interviewed were actively working in the Finnish shipping business. Almost all had a maritime education and maritime working experience. Every person

interviewed had worked with the ISM Code based safety management system. Almost all were Finnish citizens.

The shipping companies involved comprehensively represent the Finnish maritime industry. There were seven shipping companies involved in the study, which widely represent the Finnish shipping business. All important shipping business areas were represented. We visited 16 ships during the project. These were passenger ships, ROPAX ships and all types of cargo ships. The combined fleet of the shipping companies represents a large proportion of the total Finnish fleet. The other stakeholder organisations are involved in safety management on a daily basis. They have a comprehensive idea of the current safety culture of the Finnish shipping business due to their close cooperation with Finnish shipping companies and their personnel.

The interview study revealed that the Finnish shipping companies have not been able to fully implement the incident reporting and analysing to reach continuous improvement, which is one of the core targets of the ISM Code. Therefore, it was considered important to *closely examine the premises of incident reporting*. The aim of this study, then, was to find answers to the questions; what is IMO's standpoint on incident reporting and investigation, how can this standpoint be seen in the light of the theoretical background and can the chosen standpoint have the desired effects? In addition, the existing reporting and investigation schemes were reviewed.

2.3 Main results

2.3.1 Literature review

The literature review showed us that the ISM Code has brought a significant contribution to the progress of maritime safety during recent years (Lappalainen, 2008). Shipping companies and crews are more environmentally friendly and more safety-oriented than they were 12 years ago (Lappalainen, 2008). Othman (2003) states that most (80%) of Malaysian shipping companies have implemented their safety management systems effectively according to the requirements of the ISM Code. The member states of the Paris MoU (2008) conducted a Concentrated Inspection Campaign (CIC) which focused on the effectiveness of the ISM Code. The Paris MoU (2008) discovered that most of the shipping companies and crews on vessels understand safety and implement it. The Tokyo MoU (Tokyo MOU, 2008) conducted a CIC simultaneously with the Paris MoU. Nevertheless, the direct effects and influence of the ISM Code on maritime safety could not be specified very well. No quantitative measurements (statistics/hard data) could be found to describe the impacts of the ISM Code on maritime safety (Mejia, 2001; Anderson, 2003; IMO 2005 ReportISM, 2008). In the light of the literature review (Lappalainen, 2008), there are major shortcomings concerning effective safety management in the maritime industry.

The recent studies (Mejia, 2001; Anderson, 2003; IMO 2005, ReportISM, 2008) showed that near-misses are not perfectly reported. Some mariners are still reluctant to expose their mistakes (Withington, 2006; Anderson, 2003). The Paris MoU (2008)

reported that one of the most common deficiencies in safety management systems concerns the reporting of nonconformities and occurrences of accidents. Hence, there is still room for improvement in the reporting of deficiencies and non-conformities in the maritime industry. The proper reporting of deficiencies and non-conformities establishes a basis for continuous improvement. Furthermore, Anderson (2003) discovered that in certain cases, further analysis of, and corrective actions on the reported incidents were not properly carried out. Under these circumstances, a successful cycle of continuous improvement cannot function (Lappalainen, 2008).

Some shipping companies prefer short-term profits at the expense of maritime safety (Anderson, 2003). The Paris MoU (2008) reported as a result of the CIC that 176 ships were detained due to serious deficiencies violating the requirements of the ISM Code. The reasons for the detentions were that the maintenance of the ship and its safety equipment were badly neglected. The status of emergency preparedness was poor as well. (Paris MoU, 2008; ReportISM, 2008). Evidently, the top management is not committed to safety issues in poorly performing shipping companies (Lappalainen, 2008).

Pun et al. (2003) stated that a high turnover of labour force could prevent the establishment of a safety culture in the maritime industry. Anderson (2003) also emphasized that establishing a safety culture is not easy when the turnover of the crew is high. The British Maritime and Coastguard Agency expressed the same concern in their study in 2008. The transient nature of the workforce with a relatively long distance between the ship owner and the vessel complicate the progress of safety management (ReportISM, 2008).

We discovered that a safety culture has emerged and it is developing in the maritime industry. Even though the roots of the safety culture have been established, serious obstacles still remain to the breakthrough of safety management. These obstacles could be envisaged as cultural factors obstructing the safety process. Even though the ISM Code has been effective for over a decade, long-established behaviours based on the maritime culture of the old days still occur. (Lappalainen, 2008)

2.3.2 Interview study

We conducted a field survey which had the main target of investigating the opinions and attitudes of active seafarers employed by Finnish shipping companies. The field survey consisted of 94 interviews, which were carried out as in-depth interviews.

The Finnish maritime community felt that the top management is committed to safety management and the application of the ISM Code. The top management assured that they considered safety as a value, and their companies had taken safety issues into consideration in all of their operations. It was observed that a major proportion of the personnel working in the top management supported and encouraged their personnel by providing adequate resources for safety work and by communicating actively on safety issues. The maritime personnel mostly felt that the commitment of the management

with regard to safety issues has improved and reasonable safety initiatives have been supported by the management. The management had provided financial support and other resources for safety improvements when necessary. The common view of the maritime inspectors was that the top management of the Finnish shipping companies is highly committed to safety management. (Lappalainen & Salmi, 2009)

Majority of interviewees said that the communications of shipping companies have improved. Communications with the companies' officers have also improved, especially the communication with the DPs. Our findings show that communication between the masters of the ships and the crew has significantly improved. Some interviewed managers indicated that the personnel should more actively put forward proposals and initiatives concerning safety aspects. Furthermore, the majority of interviewed maritime inspectors said that maritime personnel are not afraid to express themselves to their superiors. (Lappalainen & Salmi, 2009)

During the studied implementation phase (1995 – 2009) of the ISM Code, the safety management system confronted resistance to change. That resistance has weakened during the last decade. The maritime personnel's safety attitudes have improved. The willingness to participate in safety training has been a good indicator of this. The groups that were interviewed had a common concern about the functioning of the continuous improvement process. The reluctance to make incident reports indicated that the continuous improvement process was not functioning properly. Many interviewees said that incident reporting should be encouraged by superiors. (Lappalainen & Salmi, 2009)

2.3.2 Utilization of incident reporting

International Maritime Organization (IMO) encourages shipping companies to have procedures to report and analyse non-conformities, accidents and hazardous situations (IMO, 2002). In its Guidance on near-miss reporting (IMO, 2008), IMO emphasises the importance of near miss reporting because "learning the lessons from near-misses should help to improve safety performance since near-misses can share the same underlying causes as losses".

In the 1930s, Heinrich (1959) introduced a theory of different incident relations. Most known of the hypotheses base on this theory is the iceberg model, whereby for every serious accident there are several less serious accidents and near miss cases. This hypothesis is widely accepted. Through the iceberg model Heinrich also presented two other hypotheses: the domino theory and identical causation hypothesis. The domino theory is an accident model, in which models how accidents originate. The identical causation hypothesis states that different incidents have same kind underlying reasons. These two theories are widely argued. Therefore it should be taken into consideration whether IMO's guidance on near miss reporting (IMO, 2008) can have the desired effects.

The main finding concerning existing incident reporting systems is that information now flows more from the ships to systems and external institutions when it should be

the other way around. Based on this, it is highly recommended that actions to spin the flow of the information be carried out (Figure 2.1).

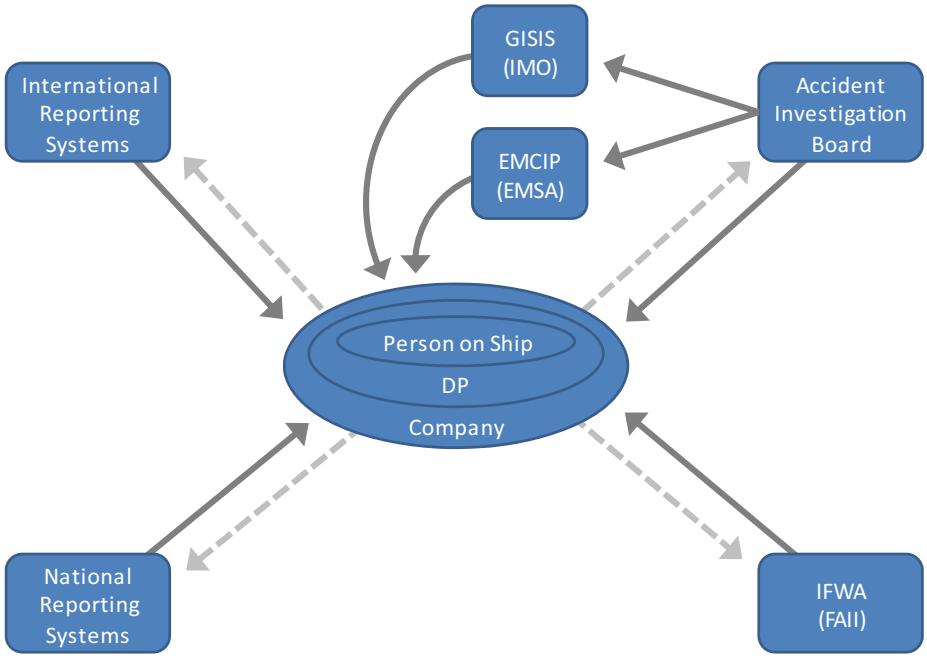

Figure 2.1 Suggested information flow between actors in maritime incident reporting

Additionally, there are already statistics and investigation reports on Finnish maritime incidents – such as serious accidents and injuries – but the statistics and reports are scattered in the databases of different interest groups. To use that already existing knowledge in safety work, it is crucial that those databases are united in one shared database. In the best scenario this collective database could gather all essential information on maritime related incidents: statistics, IWFA reports, AIBF reports, vessels' incident reports etc. In this way all the information would be easily available for those who for they are created – the seafarers. Furthermore, seafarers should be encouraged to read the incident reports and go them through with their fellow workers. The pure existence of the data does not ensure that it is used in the safety work.

The shortcoming of internal incident reporting on the Finnish ships that was revealed in the interview study (Lappalainen & Salmi, 2009) can be explained, according to literature, by the notice that there seems to be a cultural gap between the personnel onboard and the management and administration ashore. The referred studies (Sanne, 2008; Knudsen, 2009; Antonsen, 2009) can be brought together with a hypothesis of two different approaches on safety work. These are a technical approach and a social approach on safety management. The first is adopted by the management and the administration, and the latter by the seafarers. The technical approach on safety management leans on technical systems, statistics, and standardization when the social

approach leans on rules of thumb, storytelling, and seamanship. To get the best possible outcome of the incident reporting, these two approaches should be combined.

2.4 Summary

During the study we performed an interview study which was targeted at the Finnish maritime personnel, shipping companies and maritime authorities to reveal their appraisals concerning the impacts of the ISM Code. Almost one hundred representatives of the maritime industry were interviewed. We discovered that the main objective of the ISM Code has been achieved in the Finnish shipping industry.

The maritime safety has been improved and thus the risk of environmental damage has consequently been decreased. The study showed that the requirements of the ISM Code have been implemented effectively in the studied shipping companies. It is important that the top management and the personnel of the shipping companies have accepted the ISM Code as an essential safety measure. One of the main concerns is the comprehension of the philosophy of continuous improvement. Tools for continuous improvement should be developed and they should be taken into practice. The other problems include the lack of uniformity in the interpretation and implementation of the ISM Code. The wider problem in the maritime industry is the excessive bureaucracy ships have to deal with.

The results of the interview study were parallel with the results of the literature review (Lappalainen, 2008). The interview study found similar success factors and similar obstacles in the application of the ISM Code and safety management systems. The interviewees named similar gained benefits from the use of the ISM Code. Similarly, the defects and concerns matched the results of earlier studies.

Finally we studied the incident reporting more closely. The main finding concerning existing incident reporting systems was that information now flows more from the ships to systems and external institutions when it should be the other way around. There are also a technical approach and a social approach on safety management. The first is adopted by the management and the administration, and the latter by the seafarers. To get the best possible outcome of the incident reporting, these two approaches should be combined.

2.5 Further research

In our study we found out that the safety culture of the Finnish shipping industry has improved. Shipping companies and ships' crews are more environmentally conscious and safety-oriented than a decade ago. However, there is still much to be done. One of the main observations was that the technical and social aspects of safety culture should both be improved.

In the future we will study the relationship between the level of performance of the safety management system and the business competitiveness of the shipping company.

By doing this, we expect to find reasons and means to improve the safety culture on all levels of the shipping companies, e.g. improving the mariners' working conditions has a direct effect on the social well-being of workers as well as on the economic profit of the company, and even its competitive advantage. Furthermore, we encourage the international cooperation between organisations involved in enhancing maritime safety.

3 COMPARING SAFETY MANAGEMENT PRACTICES

Mirva Salokorpi & Jorma Rytkönen, Kymenlaakson ammattikorkeakoulu, University of Applied Sciences

3.1 Introduction

This chapter briefly describes the methods and results of the study where different safety management systems were compared with each other. One primary aim of this study was to compare safety management practices of shipping companies and in port operations. Moreover, analyses were carried out to recognize best practices and lessons learned among different bodies and stakeholders and different industries. Thus, wider research was performed to find out similarities in safety related ISO codes and safety management practices in governmental bodies. The main objective of the whole study was to collect good safety management practices both for ports and shipping companies. In this article, the single best practices from different branches are presented. Next, best practices for shipping companies and maritime authorities are introduced. Finally, port safety matters are discussed in the last chapter.

The research methods were literature reviews and interviews. In the maritime sector there were seven shipping companies that participated in the research. Several mariners, maritime authorities and classification company personnel were interviewed. The gathering of data from the port industry and its safety management practices was done by interviewing both port managers and employees of the company operating at the ort area. The best practices from the other branches were found by interviewing safety managers or suchlike, as well as supervisory authorities.

Three reports were produced during this study: “Comparison with safety management systems” (Kunttu, 2009), “Safety management at ports” (Salokorpi, 2010a) and “Best safety management practices for shipping companies and ports” (Salokorpi, 2010b). The reports are written in Finnish. Moreover, three bachelor´s theses were made during this study: “Implementation of Safety Management System in Ports and in Enterprises Operating in Ports” (Koivistoinen, 2009), “Notions of Authorities about Safety Management” (Juurijoki, 2010) and “Notions of Surveyors of Classification Company about Safety Management” (Hämäläinen, 2010).

3.2 Best safety management practices on a few chosen branches

The objective of the study was to gather the best safety management practices, and the most remarkable sources of information were the branches, which are known for their developed safety culture, like the aviation and nuclear power industries. Below, we present a selection of the best safety management practices in various fields. Different safety related ISO codes (like ISO 9000, 14000, etc.) were not such important sources

of information that presenting them in this article would be reasonable. The best safety management practices used in maritime or port industries are neither described, as they are after all objects of the development. About these all were written in the actual reports of the study.

3.2.1 Aviation

The improvement of safety has a long tradition in aviation industry and there have been many different safety management systems in use. Along with a new EU directive, which will be enforced in 2012, a concept of Safety Management System (SMS) created by the International Civil Aviation Organization (ICAO) will be introduced in Finland. The concept is a vast integrated system, which will fuse together all the different present systems (Finnish Aviation authority, 2009). ICAO (2008) has published a Safety Management Manual (SMM), where the whole concept is presented. In this project, the analysis and comparing only focus on the ICAO's system and the manual.

There are many best practices in the concept of SMS and it is impossible to present each one in this chapter. In addition to this short description, the concept is referred to several times in the last part of the text.

One significant best practice in the aviation industry is that safety management is seen as an elementary part of the everyday business. It is not only a duty that has to be accomplished (Finnish Aviation authority, 2009). Another good example is the guiding approach of authority and legislations to control the safety management process of service providers. The ICAO safety management system manual was designed to facilitate the implementation of SMS (Werfelman, 2008). The process of establishing a safety management system with the main principle of achieving an easy but functionally sound system is described in detail in the manual. It contains a lot of cases and examples to support the implementation of a safety management system. One good example of the thoroughness of the manual is the detailed definition of certain terms such as hazards and safety risks with good examples of consequences to illustrate the definition of the risk itself (Kunttu, 2009).

Risk management is one of the priorities in ICAO systems. The manual describes the risk identification phases well and offers support on how to recognize risks. The safety performance concept is one of the key parameters and ways to measure the real effectiveness of the safety management system onboard (Kunttu, 2009).

3.2.2 Nuclear power

Safety requirements for nuclear power plants in Finland are principally based on two laws; the Radiation Act (592/1991) and the Nuclear Energy Act (990/1987). The Radiation and Nuclear Safety Authority in Finland (STUK) has defined guidelines for management systems for nuclear facilities (The Radiation and Nuclear Safety Authority

in Finland, 2008). According to these guidelines, an integrated management (safety and quality) is required (The Radiation and Nuclear Safety Authority in Finland, 2009).

Some of the best practices in nuclear power industry are listed below (they are collected from interviews with the Radiation and Nuclear Safety Authority in Finland, 2009):

- There is international support and a special Safety Culture Assessment Team (SCART) offered by the International Atomic Energy Agency, IAEA, to evaluate and develop safety related actions. Their assistance has often proven valuable.
- The authority has set indicators which are monitored. If changes occur in the indicators, the authority will react to them accordingly.
- Risk assessment is an advanced practice of the branch. There has to be a risk assessment system based on probabilities incorporated in the systems. Root causes for nuclear accidents are identified by modelling different cases.
- There is an obligation for the nuclear power plant (NPP) operator to maintain the facilities safe at all times. For this reason they have to present a long-term development plan to the authority each year.
- Recent attention has been given to integrated management. Previously, they required that quality management and security were treated as separate entities, but now also managers should have an idea of how such an investment decision affects safety.
- Both Finnish NPP operators have safety groups, which deal with safety issues.

3.2.3 Chemical industry

Seveso Directive, which came into force in 1999, requires a safety management system complying with the Directive, where the so-called Seveso establishments are defined (where dangerous substances are present in quantities exceeding the thresholds in the directive European Commission, 2010). The legislation also requires operators to take other measures to ensure safety, but in this context, only the safety management systems in accordance with the Seveso Directive (in Finland, Annex III by decree 59/1999) are examined.

The mentioned safety management system is very similar to the other operating systems. The system differs from the others as it includes a well developed change management partition. This is the best practice in the branch according to the Finnish Safety Technology Authority (TUKES, 2009). Another best practice is the clear structure of the system. It consists of six basic elements (Figure 3.1), the “blue area”; identification and evaluation of the hazards, operational control, management of change and planning for emergencies constitute the core of the system.

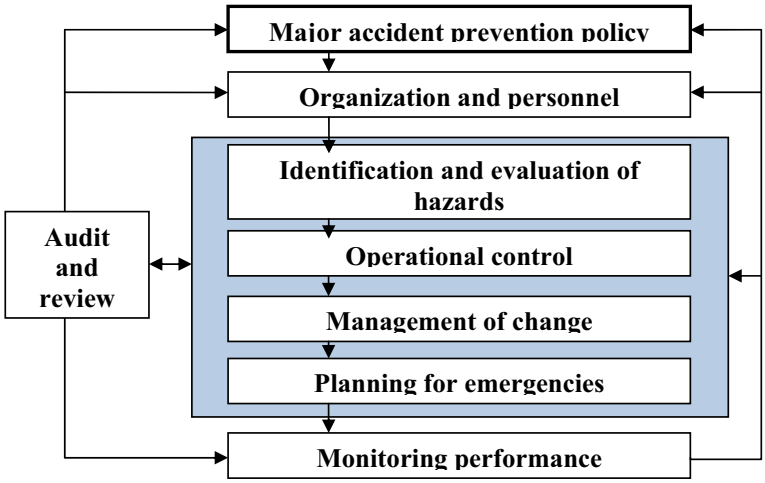

Figure 3.1 The safety management system in accordance with the Seveso Directive.

3.2.4 Railway industry

A safety management system is a general requirement in the railway industry. The requirements are set in the Railway Safety Directive (2004). The system is very similar to ones used by other industries. A few best practices of the branch are still worth mentioning.

The Safety Unit in the European Railway Agency (ERA) has done a lot of work to improve railway safety. They have developed Common Safety Targets (CSTs) (Commission Regulation 2009/352/EC) and Common Safety Methods (CSMs) (Commission Decision 2009/460/EC) to ensure that a high level of safety is maintained. To ensure that the safety targets are reached, Common Safety Indicators have also been developed. The indicators, which are tools for assessment of the safety level and the performance of the operators, have to be reported annually to the ERA by the safety authorities of the Member States.

Another good example of the quality work of the ERA´s Safety Agency is the requirement for rail transport operators to keep a record of hazards in which all identified hazards shall be registered (Commission Decision 2009/460/EC). The record is: *"the document in which identified hazards, their related measures, their origin and the reference to the organization which has to manage them are recorded and referenced*". The record makes it possible to track the progress of monitoring risks associated with the identified hazards.

3.2.5 Environment

Today, also environmental protection can be controlled by a management systems (like ISO 14001) or other equivalent processes. Although environmental protection should in general, excluding the ISM Code, kept away from safety management (Environmental Authority in Finland, 2009), the environmental management systems have a lot of similar features with other management systems, and this is a point to consider here. On the other hand, as with the ISM Code in the shipping industry, environmental management has been similarly included in the general management system also in other branches.

In Finland, all activities that may cause pollution need an environmental permit (Ministry of the Environment, 2010). When applying, the operator has to present the environmental authority with:

- an assessment of the environmental impacts of the activities,
- an assessment of the risks of the activities, proposed action to prevent accidents and actions to be taken in the event of an accident,
- an account of any environmental management systems, and
- information on the supervision and monitoring of activities, the monitoring of discharges into the environment and their impacts, and measurement methods and equipment, methods of calculation and related quality assurance (Environmental Protection Decree 169/2000, Section 9).

An operator is also required to make an environmental impact assessment (EIA) for the project of the certain size. This is to ensure that significant environmental impacts are adequately examined (Ministry of the Environment, 2010). If there are alterations in the project, the process is required to remake. EIA process is compared with a risk assessment procedure.

3.2.6 Occupational health and safety

It is a long tradition with the enhancement of occupational health and safety has a long history. Results of the work are visible on many workplaces. One good example of the results is the Finnish Zero Accidents Forum that is a voluntary network of Finnish workplaces that aims to improve occupational safety and strive towards zero accidents (Finnish Institute of Occupational Health, 2010). It has also put a great deal of work into the development of risk assessment and incident reporting tools in the field of occupational safety. The use of these tools has spread to many workplaces.

Occupational Safety and Health Administration in Finland (2008) has made a guidebook of safety management. Although the guide's emphasis is on occupational safety, there are many general basic rules of safety management introduced in the book. This is good, because on many branches where there is no statutory requirement for a

safety management system, actions to improve safety may be limited only to improving safety at work.

3.3 Best safety management practices for shipping companies

Below are listed some of the most remarkable safety management practices for the maritime sector. Several best practices have been found in this project but the following chapters do not include all of them. Much more practices are presented in the report of this study ("Best safety management practices for shipping companies and ports").

3.3.1 Hazard identification and risk management

Hazard identification, risk assessment, and risk management are the core processes of the safety management system (ICAO, 2008). For some reason, all these are absent from the ISM Code. Or conversely, they are included, because the code has been written on such a general level that it is possible to include almost anything in the code. Also the previous formulation of the paragraph about safeguards against all identified risks includes the hypothesis that a risk analysis has been made. Still, this core has not been emphasized or highlighted sufficiently. This is visible on the maritime industry: safety management systems have been used for several years, but no risk assessments have yet been made by many companies. The systems are not based on risk management.

The Maritime Safety Committee has adopted amendments to the ISM Code related to risk assessment. The amendments came to force 1 July, 2010 and now the "*company should assess all identified risks to its ships, personnel, and the environment and establish appropriate safe guards*" (Objectives, 1.2.2). Before the amendment, the text of the same paragraph was: "*the company should establish safeguards against all identified risks*". The amendment is very important, however the whole idea of the safety management system is not stated clearly enough in the code.

Good examples of best risk management practices are coming from the aviation and railway industries. ICAO's Safety Management System is based completely on risk management and these are thoroughly described and explained in the organisation's Safety Management Manual. The European Railway Agency has also made in-depth studies on the subject. Risk management assessment is a part of Commission Regulation 352/2009 on the adoption of a common safety method on risk evaluation and assessment (Figure 3.2).

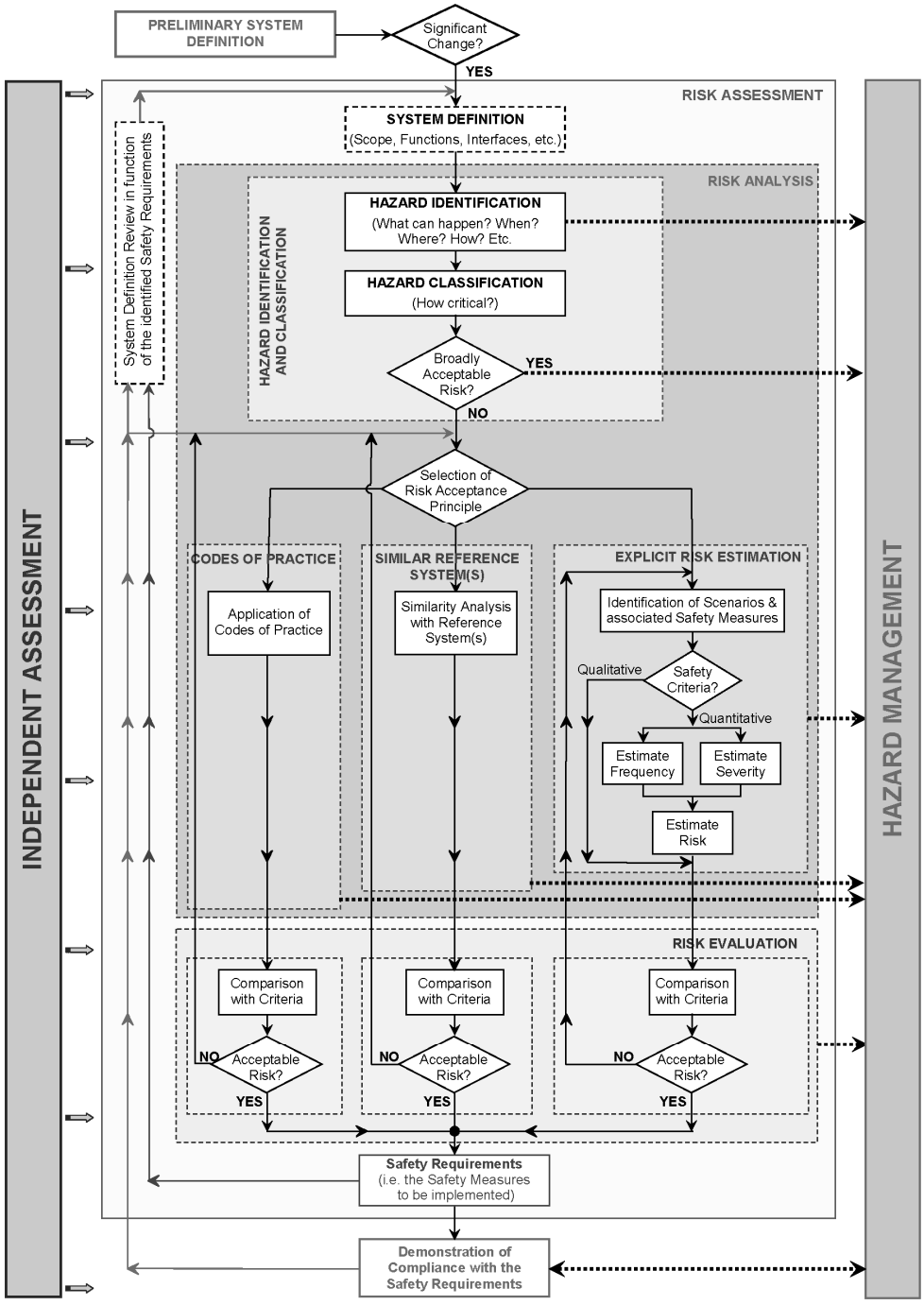

Figure 3.2 Risk management process and independent assessment (EC Reg. 352/2009)

3.3.2 Strategies of Safety Management

The basic philosophy of safety management systems is continuous improvement. The whole system has to be monitored at all times and any deficiencies that need correction must be noted. There are many effective methods of acquiring relevant and real-time information about the system's status. One of these is incident reporting. It has recently been a lot of attention in the Finnish maritime sector because there are many problems with the using of the method. In their study of maritime safety culture, Lappalainen & Salmi (2009) have found the need to enhance incident reporting.

It is very important to have a functional incident reporting system is so important, as it is important to understand that all accidents and incidents tell us of something that has already happened. If safety improvement actions are based on events that have happened, the method is reactive. This kind of method of looking back to the past is not a sufficient method of improving safety (Hollnagel, 2008). It is very important to observe, what is expected further on and identify new potential hazards. In addition to the need to make predictions, it is also important to understand that companies and operations are not stable. They are always in small, but continuous movement (Reiman & Oedewald, 2008). The environment, society, regulations, automation, equipment, works, workers, etc. are changing. The phenomenon is called practical drift. For example, if after an accident investigation it has been noted that the accident could have been prevented with some working method, it is still possible that this proven method is not utilisable after one year due to the renewal of surrounding factors. It may also be that practices have been changed, because the workers have discovered a better way compared to what the instructions have originally prescribed. To take into account and predict this continuous change, reactive and predictive methods in safety management are needed (Figure 3.3).

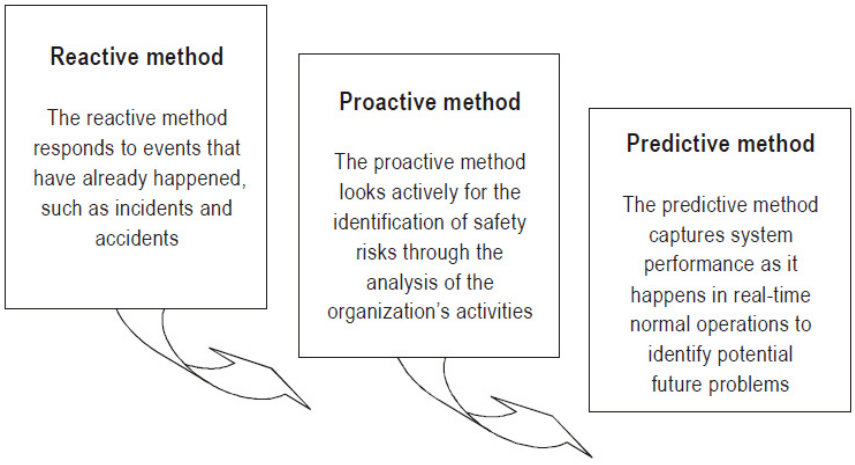

Figure 3.3 Safety Management levels according to ICAO (2008).

3.3.3 Resources for safety ensuring

Currently, according to ISM Code, there should be one designated person in a shipping company who is responsible for general safety (Designated Person, DP). Very often the DP is at the same time responsible for various other matters, like environmental protection and even technical subjects. The resources for safety management are insufficient.

In the sector of air traffic, a flight company is required to set up a safety organization, which usually consists of several persons (Gröhn, 2009). ICAO recommends that a flight company sets up a Safety Services Office, that is: "*independent and neutral from processes and decisions made regarding the delivery of services by line managers of operational units"* (ICAO, 2009, SMS Manual, 8.5.6).The office is managed by an Accountable Executive, who is: "*a single, identifiable person having final responsibility for the effective and efficient performance of the organization's SMS"* (ICAO, 2009, SMS Manual 8.4.5). The day-to-day management functions of the SMS in the Safety Services Office are the responsibility of the Safety Manager. In addition to these two persons there should be several others responsible for safety in the organisation, such as a Head of Operations and a Head of Maintenance. It should be noted that several persons are responsible for safety (and security) also in many other safety critical industries, such as railways, nuclear power plants along with many ports and port related companies.

It would be a good practice to have at least two persons in a shipping company to ensure that safety is maintained at the sufficient level. The other person could for example help the DP to investigate the nonconformities, incidents and accidents, to develop the company's safety management guidance for masters and other ship crew, to develop hazard identification, risk assessment and safety assurance – all the important matters that are currently under threat of not being dealt with due to lack of resources.

3.3.4 The management of change

Changing situations like the expansion, contraction, changes to existing systems, equipment, programmes, products and services, and the introduction of new equipment or procedures may inadvertently introduce hazards into the operation of a shipping company (or to organizations in port industry as well). It is important that the hazards that are caused by changing circumstances are systematically and proactively identified. This is an important element of the safety management system, but for some reason it is not included in the ISM Code.

Safety reviews, which are utilised in many industries, are valuable sources of information and decision making under circumstances of change. One best practice to deal with change is first to conduct a safety review (a risk analysis) before the intended change. If the review indicates that the change is too risky, the choices are to try to eliminate the risks completely or to mitigate them to a manageable level. If this is not possible, the change cannot be executed.

3.3.5 Guidance material

It has been noted in this project as well as in other studies (for example, Finnish Maritime Administration, 2007) that there is a lot of safety legislation in the maritime domain. In many mariner's opinion, the amount of regulations is so high that it is difficult to manage. Several DPs and masters have said that it is difficult to know what is expected of them. Therefore, when trying to improve maritime safety, the way is not to increase the amount of legislation and rules, but to clarify what these rules include, what are the required safety levels, and how these levels should be reached, etc. Guidance material is needed. ICAO´s SMS Manual is an excellent example of this kind of a guide.

3.4 Port safety

For shipping companies, a safety management system is mandatory due to the ISM Code. For port operators, similar requirements have not been set. Still, many port operators want to manage safety matters by using some kind of a management system. One of the most popular system for this is the OHSAS – ISO 18 000, which is an international occupational health and safety management system assessment specification. In addition, many port related companies use the same system. Several port managers and port related companies use other management systems as well, like the ISO 9001 quality management system.

The safety management level of ports and port related companies varies a lot with the size of the port and company in question. In the case of the smaller ports, we cannot even talk about safety management. For this reason, the focus of the study was on a few underlying reasons of the situation. One important notice was that among the port industry, all the safety and security matters are understood to contain three basic elements: occupational health and safety, environmental protection and security (especially ISPS related). If we look at what is included in the entire safety and security example from a corporation's viewpoint, there are: production and operation safety and security, occupational safety, environmental safety, emergency and preparedness actions, information security, crime prevention, personnel safety and security, infrastructure safety and security, safety and security of foreign activity and safety and security of contractors and subcontractors (e.g., YTNK, 2005). If we examine the subject from a port's viewpoint, ship safety, cargo securing, traffic safety (inside port area), chemical safety and railway safety can be included to the list. The abovementioned "three elements approach" to safety and security at ports is too narrow in the light of the other lists. Occupational health and safety focuses on individual employees, their working performance and working operations, and it is not enough if we are trying to prevent accidents and especially disasters or catastrophes.

Another point worth noting is the effect from Finnish terminology. In Finnish, there is only, *´turvallisuus´*, which means both safety and security. Commonly the word *´turvallisuus´* is used to mean safety and simply *´turva´* meaning security (example in Finnish legislation). Still, in many contexts, the word *´turvallisuus´* is used to mean only

security matters. For example, there is general information about different subjects on the portal of Finnish Port Association (2007) (only in the Finnish website), where one title is *´satamaturvallisuus´*. It should literally mean port safety and security, or according to the abovementioned general custom, only port safety. However, the content of the text only covers security matters, (ISPS code). When interviewing the port authorities and employees of the port related companies, this misunderstanding of the terms was evident. Although using the terms in this way is not simply wrong, it efficiently complicates work to improve safety.

Legislation concerning port operations (especially port safety related legislation) has spread out to several laws and regulations. Moreover, the official supervision of port operations has branched to several ministries. No authority has a general view about port safety. Safety supervision tasks have been left to the port authorities themselves. Still, the role of the port authority is not clear at the moment. Some say that port authorities are no longer authorities (in Finland), after most of them became public utilities, but others claim they still are. According to a study by the Ministry of Transport and Communication (2004) on the development of port operations and the reformation of port legislation, Finnish port authorities have both government and commercial tasks. All the same, the culture of action is disappearing. Ports are changing from municipal institutions, to public utilities and further to limited companies. The trend is more and more commercial, and safety supervision fits this trend poorly. Could port authorities perform their government task while they are working for the commercial corporation?

Considering the mentioned change, there is a need for legislation regeneration. Therefore a working group was set up to prepare this reform. Their investigation is expected to be completed in autumn 2010. According to some experts, it is impending that the two present port related laws will only be reversed and instead of it any new law will not be enacted. Whatever will be concluded in this legislative reform, it would be important also by legislation to clarify and determine the roles, responsibilities, obligations, and tasks of safety supervision at ports that are currently unclear.

3.5 Summary

In this study we have been investigating for the best safety management practices for mariners and port operators. There are no requirements for safety management systems for port operators and this is why the level of safety management varies greatly from one port to another. In this sense, the objects of this study were not reasoned. Instead of to trying to collect the best practices, it was actually more important to chart the condition of port safety and study the backgrounds. The roles, responsibilities, rights and tasks in port safety should be determined unambiguously. It is also recommended, that a model of safety management system for port authorities is established. Recommendations for mariners are related to risk and change management, strategies of safety management and resources for ensuring safety. Maritime authorities are expected to produce more guidance material for safety management. Safety management practices are developed on many domains. The safety culture is very advanced in some

industries, like aviation and nuclear power. There are plenty of lessons to be learned from these cultures!

4 MARITIME SAFETY PERFORMANCE INDICATORS

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4.1 Introduction

The purpose of this study was to find out methods that are used for safety assessment and "measurements" in maritime safety management with special interest in key figures. This research, which included a review on the use of such safety indicators in other industries as well, was divided into four main phases:

- Safety measuring methods in maritime and other industry branches, (Jalonen & Salmi, 2009),
- Accident analysis concerning the effects of the International Safety Management Code (= ISM Code) on accidents of Finnish vessels and foreign vessels in Finnish coastal waters, (Kiuru & Salmi, 2009),
- An interview study related to the impacts of ISM Code on Finnish shipping companies (Lappalainen & Salmi, 2009),
- Statistical analysis, analyses of data of incidents, accidents, near-accidents, and violations acquired from the administration and from private companies, (Salmi, 2010)

A review (Sariola, 2010) that makes a survey of the liabilities for the vessel source pollution on the Gulf of Finland was considered important in this context, too. In this review (Sariola, 2010) the administration's opportunities (and available tools) for making interventions e.g. in oil pollution or other violation cases are also clarified.

4.2 Safety performance indicators

Accident statistics can be considered as evidence of the state of (or actually of the lack of) safety performance. They have been used for long e.g. by administrations to monitor the status of maritime safety and possible changes on the safety. This traditional approach of evaluating safety afterwards by the number of past accidents or incidents is practical and easily understood. However, it is a lagging indicator and it includes some deficiencies. It does not give any indication of the safety performance in the future, neither does it give much support to efforts to improve safety in an efficient way, unless the statistics are connected to proper accident investigation, analysis of accident causes and consequences, risk analysis and cost-benefit analysis.

If the safety status is characterized only by a high rate of accidents, a rising or diminishing trend in the accident or incident (= near accident) frequency may be understood as an indicator of a change. However, the less accidents or incidents there are the more pronounced natural deviations from a general trend will probably be and

the more difficult it will be to utilise accident statistics as a tool for safety management. The risk may not be zero even after ten years without accidents. Thus, additional tools and more detailed, different measures of safety (or risk) for efficient safety management are required.

The literature review (Jalonen & Salmi, 2009) was concentrated in the use of statistical, safety-related data and indicators in maritime safety management as well as in some other industries.. The importance of safety performance indicators in safety management has been emphasized in other industries, in chemical and nuclear industry, as well as within other modes of transportation. Safety indicators, especially the leading and lagging safety performance indicators, have recently been in the focus of debate and discussion in the context of process industry, see e.g. (Hopkins, 2009a) and (Hopkins, 2009b). That debate related to different concepts, terminology, scientific theories and practice made it apparent that the applications of this approach still needs to be under investigation (Sgorou, 2010), so it is no wonder that even the (actual) rates and statistics of near misses may sometimes be considered to belong to the group of lagging indicators. However, this debate (Hopkins, 2009b) clearly demonstrated that the leading indicators are a topical issue in safety management.

Irrespective of the difficulties and debates concerning the terminology and concepts related to leading and lagging safety performance indicators, it is clear that more emphasis should be placed on methods that can be used for accident prevention. Therefore, the use of leading safety indicators for monitoring and controlling the status of safety performance and its changes is rational. Various descriptions and recommendations on their use have been published, for instance see the reference lists in (Jalonen & Salmi, 2009; Khan et al., 2010). It is believed that leading indicators can also be developed for the use of the maritime sector with reasonable efforts.

General factors affecting safety and various indicators that are already in use or under development were studied within all four transportation branches (aviation, sea, rail and road), the offshore industry and other industries, e.g., the process industry. The following issues were brought into focus in the literature review (Jalonen & Salmi, 2009):

- the “free flow of information” is one fundamental factor enabling proactive risk reduction
- a “blame free” reporting culture is important to ensure a flow of reliable information
- leading safety performance indicators that form an early warning system, i.e. a proactive safety management system, should be used/taken into use by the maritime administration, and by shipping companies, in addition to the already used lagging indicators (e.g., accident statistics)
- feasible sets of additional safety performance indicators should be developed/selected/used by all actors in the system on its various levels (and sectors) to facilitate comprehensive safety assessments in the continuous process of safety management.

The "free flow of information" means that various decision-makers on various levels of the system, having different capabilities in relation to their knowledge, numerous practical abilities and economical possibilities will have access to all real data and information in the system that is necessary for their decisions and/or actions. Correct decisions concerning a system can hardly be made without sufficient data and reliable information. A "blame free" reporting culture is one prerequisite for reliable reports. If reports are written (or not written at all) in the fear of a punishment, some distortion e.g. in the incident reports is always possible. If the accident and incident reports are not reliable, the effects of the distortion extend to the statistics and possibly even to other documents. Distorted information will increase the risk of bad or less efficient decisions. Therefore, there is a strong need for good quality accident investigation reports.

4.3 Accident analysis

A combination of accident investigation and the use of the analysis and synthesis of accident reports to give support to organisational learning may be among the best ways to achieve better results in accident prevention. The accident analysis carried out in this study (Kiuru & Salmi, 2009) was based on over 90 recent accident reports published by the Accident Investigation Board of Finland (AIBF). In this study Kiuru & Salmi (2009) ended up with the following conclusions:

- accident analysis and statistics can be used as indicators for risk, but quantitative results should go through qualitative validation before use.
- the overall accident risk in Finnish shipping and on Finnish coastal waters in general has decreased within the ISM-period.
- the average severity of accidents is increasing.

The shift towards more severe accidents identified in this report was explained at least partly by the general development of risk management towards being targeted more on occupational safety within the industry. This was assumed to have lead to a considerable reduction of minor accidents. While occupational safety has taken great leaps towards a safe working environment, the safety development in vessel traffic safety has been slow.

In the accident analysis (Kiuru & Salmi, 2009) it was further suggested that:

- a significant part of marine accidents is predictable.

This can be explained by the following reasoning: due to malfunctioning safety management many vessels sail with obvious and present risk factors, while taking conscious risks in their daily traffic and in the worst case trying to hide these obvious endangering elements (Kiuru & Salmi, 2009).

- most of the positive impact brought by the ISM Code is focused on deficiencies connected to the ISM or to human factors. However, deficiencies related to these matters are also factors that still cause most accident risks.

This means that the direction of the current development in international maritime legislation and administration is good and successfully targeted, but there is still much development work to be done within this field. Maintaining this positive development is closely connected to the successful implementation of the new safety culture.

- the rapid development of technology has surely improved safety, but at the same time this has developed new threats concerning the complexity of equipment. These threats should be taken into account when plans for new ships and their maintenance are made and also considered in the planning of maritime education.

4.4 Interview study

The interview study, reported in (Lappalainen & Salmi, 2009), and partly reviewed in Chapter 2, was carried out with target groups consisting of seafarers, companies and other organisations representing the major sectors of Finnish maritime industry. The following main conclusions could be made based on this study (Lappalainen & Salmi, 2009):

- attitudes towards safety have improved both on management level and among seafarers during the past 15 years.

The positive change in attitudes can be seen in the management's support, safety equipment and moral, for safety and security issues. Seafarers reveal their changed attitudes by following and complying with safety measures, rules and regulation most of the time. Both the management and the personnel feel that safety is a part of their day to day work.

- the influence of the ISM Code was considered mainly positive, but the growing bureaucracy was pointed as a major defect.

Major benefits of the ISM were perceived to be, the better organisation of operations, clarified roles and responsibilities of maritime personnel, and the systematic approach to safety management, which lead to helping personnel to assimilate instructions and safe working methods. Seafarers also considered that the coming of the ISM Code forced companies to participate and to take responsibilities concerning safety.

- the interviews highlighted the following major lack in the current situation of safety development: The gathering of safety information concerning near-accidents, incidents and violations is still suffering from the reluctance of seafarers to report their own mistakes.

This missing information is hindering efforts that could be made to prevent future incidents and accidents. Some reasons for this trouble causing behaviour are: the old blame culture still exists at least in the seafarers minds; clear reporting limits are not established; seafarers do not understand, or in other words, are not correctly explained the importance of this information (Lappalainen & Salmi, 2009). Thus, a crucial element of organisational learning, incident reports that could facilitate learning from the mistakes and success stories of others within the own organisation and an even

wider scale, seems to be rather poorly developed in the Finnish system. However, the old method of the development of traditional seamanship with long careers and gradual promotions naturally includes unofficial methods to disseminate practical seamanship to the younger ones without any formal reports.

Based on the findings (Lappalainen & Salmi, 2009), the under-reporting of maritime incidents seems to be evident. However, the avoidance of superfluous paperwork may be a characteristic of many experienced mariners without being an undisputed proof of a lack of good seamanship skills (Knudsen, 2009; Antonsen, 2009). Therefore, the development of a fully working incident reporting system is a big challenge for the safety management in the context of seafaring.

4.5 Statistical analysis

The statistical analysis, see (Salmi, 2010), was based mainly on three data sources: a) incident reports registered by the Finnish VTS-centre between the 1st of November 2002 and August 2009, b) HELCOM accident statistics in the period 2002 − 2008 and c) Paris MOU PSC data. The VTS-reports were scrutinized and by focusing on the vessels in these incident reports were compared to those in HELCOM accident statistics. Thus, the following conclusions could be made:

- comparison of the VTS-reports and accident statistics already proves that the general targeting of the VTS-reporting is efficient and that it can be used as it is for identifying accident prone vessels
- these accident prone vessels often reappear both in the accident statistics and VTS-reported contraventions, which leads to the conclusion that the comprehension of safety risks and risk management are insufficient. Thus the development of safety culture has been inadequate.
- the number of non-reporting vessels decreased approximately by one third each year in the period 2004 – 2008, and in the same time period the precision of the applied approach of using VTS reports to target accident prone ships raised by two thirds.

These findings are congruent with previous conclusions, see (Kiuru & Salmi, 2009), that the overall accident probability in Finnish shipping and coastal waters has decreased during the late ISM period.

- the influence of safety culture to accident susceptibility is obvious. This conclusion is supported by the reported scrutiny of VTS (with accident data).
- the decreasing proportions of reports of the so-called “Zombie” vessels (vessels that do not fulfil their reporting obligations and/or do not give response via standard communication channels) and of the accidents of “Zombie” reported vessels can be seen as direct influence of a general trend of improving safety culture onboard.

Further findings in (Salmi, 2010) included the following:

- relative portions of different vessel types in VTS reporting have remained approximately at the same level during the observed period of time (2004 – 2008).

- the of number of tanker accidents seemed to be decreasing. This could be due to reinforcing self regulation of safety matters in the oil and gas industry.

However, especially with tankers, it is probably impossible to distinguish the effects of ISM from the effects of the safety conscious customers' requirements. Vessels of certain type and age flying under certain flags can be considered more accident prone than others, but Salmi (2010) continued the categorizing even further by comparing companies behind these vessels and ended up to the following conclusion:

- all companies indicated behind VTS reported vessels in 2007 were of European origin. Thus, with the administration's common goal of a safe Baltic Sea, they could all be forced to change their company policies towards a safer direction by national laws and regulations, without the need for IMO acceptance.

VTS reported vessels (in 2004 – 2008) with accidents in HELCOM statistics after the VTS-reporting were also cross-examined with Paris MOU PSC data by Salmi (2010). The following result was obtained:

- by targeting vessels with 3 to 4 true deficiencies (see below) approximately half of the accident prone vessels could be pre-identified. When vessels with fewer deficiencies, but with deficiencies concerning charts and route planning will be added to this group, most of the future accident vessels can be pre-identified.

Most significant deficiencies that could be used for targeting accident-prone vessels by reflecting safety cultural aspects presented in former reports (Kiuru & Salmi, 2009; Lappalainen & Salmi, 2009) were considered in (Salmi, 2010) to be as follows:

1. ISM related deficiencies
2. Missing charts and nautical publications
3. Missing/nonconformity of passage plan
4. Missing/technical problems of navigational aids and communication equipment (radar, radio etc.)

The effort made by Paris MOU countries by using PSC (Paris MOU, 2009a and b), is huge and surely has a positive effect on diminishing accidents in maritime traffic. However, by reading the reports of PSC, it can also be noted that:

- missing charts, nautical publications and navigational aids do not seem to be a sufficient reason for detention

and

- vessels with constant list of over 10 PSC deficiencies are sailing years without detentions or banning

The cross-examination of the VTS reports, HELCOM accident statistics, Port State Control reports and AIS data of traffic flows resulted in the conclusion that the direct use of VTS reports as indicators to target accident prone vessels with adequate precision seems to work well. The risk of accident for these vessels is one and a half to two times higher than the risk for an average vessel sailing on the Gulf of Finland. It was also

noted in (Salmi, 2010) that the average accident probability on the Baltic Sea is rather high, 1 to 2%, which leads to the conclusion that the difference between safe vessels and average vessels is significant.

4.6 Liabilities of the vessel and administrative tools

Maritime safety, sea rescue and prevention of marine pollution are directed by legislation, international treaties, orders and directions. The coastal states along the Gulf of Finland, Estonia, Finland and Russia, are fundamental actors when the development and the efficiency of the executive actions and their control based on the administrative tools are considered. All also have many interests on safety and environment issues. Therefore, a review on the current administrative tools and on the liabilities for the vessel was considered necessary. This sub-chapter presents a summary of the review (Sariola, 2010), which was carried out within the WP1-framework of METKU-project.

UNCLOS, MARPOL 73/78 and the Helsinki Convention are the most important treaties relating to the sea environment and pollution internationally. Additionally, there are also several other international conventions and treaties, EU Directives and national legislation, brought into force by acts and decrees in Finland. The most recent EU Directives are included in the Erika III- package approved by the European council in March 2009.

In addition to conventions and legislation, the national rescue organisation, shipping company culture and the activeness of the captain are in an important role when it comes to oil prevention and accident management. The courses of action of the states and shipping companies have an important role.

The activeness of the shipping companies reflects to the classifications, insurances, as well as to accident announcements and management. The captain is responsible for the whole vessel and the crew and therefore has an influence on the activities on board. In addition to the instructions given by the shipping company and following the agreed course of action, the captain's duty is to act in the best possible manner to prevent the vessel or cargo from damaging the environment. One important preventive action is a duly made announcement of the accident.

The vessels and the shipping companies operating continuously on the Gulf of Finland often have a more ambitious course of action than the legislation and treaties require. Their less ambitious competitors are also aware of the circumstances on the Gulf of Finland. Therefore it is essential to pay attention to the control and management of the vessels that have a lower safety level and the shipping companies and classification societies, which are responsible for these vessels. Otherwise, the risk of violations and e.g. loss of environmental safety will increase. The supervision can be carried out by the flag state, the coastal state and the port state. The flag state, coastal state and port state have an essential role in the prevention and solving of the accidents. The flag state has a right to intervene at high sea, the port state has a right to control traffic and ship safety, and the coastal state has a right to intervene in outrageous pollutions.

The prevention of pollution in connection to marine rescue is demanding action. It is directed by national legislation and internationally accepted guidelines relating to marine rescue. The vessel-source oil damage prevention is managed by e.g. the Finnish Border Guard, rescue services, SYKE and AVI. The Finnish Border Guard is responsible for accident management and rescue.

The Gulf of Finland area cooperation plan that was completed on the year 2007 is followed by a new plan: a cooperation plan for the vessel-source oil and chemical pollution prevention on the Gulf of Finland. The regional rescue services are responsible for the management of the accidents on the territorial waters. If the accident occurs on the EEZ or at the high seas, SYKE is responsible for the management. In spite of the instructions, the division of responsibilities is not clear between the rescue services and SYKE. In practice, operation management is agreed upon when they are aware of the location, weather conditions and environmental aspects.

The safety of the marine traffic and the oil prevention on the Gulf of Finland are important when developing the future actions. International cooperation between the states on the Gulf of Finland and the Baltic Sea and continuous cooperation between shipping companies are essential. Oil prevention on the Gulf of Finland is managed mainly by Finland. Despite of the long term cooperation between Estonia and Russia, the administrative, legislative and cultural differences are complicating the practical work. Therefore, it is important to pay attention to the cooperation between all involved parties, including the shipping companies. It is important to concentrate on improving the possibilities for successful cooperative action because of the increasing risk of serious oil damage on the Gulf of Finland.

4.7 Recommendations

Based on the presented findings it is recommended that Baltic Sea states cooperatively start to build VTS reporting systems that will cover the whole Baltic Sea. Corrective actions need to be chosen in good cooperation between the maritime administrations of all Baltic states. Actions are still required to eliminate or decrease the risk caused by non-safe vessels. These actions are recommended to be both supportive and restrictive, but they need to be effective enough to facilitate continuous improvement in maritime safety.

This study has demonstrated that accident prone shipping companies can be identified by the simultaneous use of PSC and VTS reports. We believe that with this approach, the maritime administrations can focus their efforts on the most accident prone ships, either by simultaneously enforcing and supporting them and the companies behind them to truly follow the obligations set in the ISM Code, or by removing them from traffic where risky behaviour cannot be accepted.

If this recommendation can be accepted, and it proves effective (as expected), the main emphasis can be shifted towards self-regulation and more supportive actions in the

future. The administration should seek for the best practices on giving support to the continuous process of safety assessments and improvements in safety management within their administrative territory. The development of safety management and safety culture should enhance incident reporting, which will further facilitate the improvement of safety at sea.

4.8 Future actions

While accident prone companies can be identified and information indicating missing safety culture can be recognized, this report still stayed on a rather general level by describing the effects of safety culture on safety. Thus it would be important to further use more precisely targeted information and by studying the influence of cultural factors onboard the accident prone vessels, learn to recognise and to model safety culture so that it could be implemented in future probabilistic accident/traffic models.

One important challenge is to find a well-reasoned model for allocating resources in a suitable way. Validated accident models, FSA, risk assessments and cost-benefit analyses can be used for this purpose. After hazard identification and risk modelling, a suitable system of risk-based safety indicators could be generated for the administration and also e.g. for separate shipping companies. Therefore, it is recommended that the next steps in the continuous improvement will include further studies related to the maritime risk models that could serve the needs of safety management on its various levels.

“Prevention is better than cure” is a widely accepted idiom. However, the recent offshore oil spill catastrophe in the Gulf of Mexico has reminded us of the fact that a holistic view on safety is needed. When prevention fails, preparedness, even to the worst case scenarios, is important. Therefore, it is also essential, that the new systems of safety performance indicators will cover all relevant areas within the unique and challenging scope of maritime safety.

5 INFLUENCE OF TOP MANAGEMENT ON SAFETY CULTURE

Pekka Räisänen, Turku University of Applied Sciences

5.1 Introduction

The role of the company's top management in the implementation of safety culture and best safety practices in the Finnish shipping industry were studied by the Ship Laboratory at Turku University of Applied Sciences. The research consisted of three parts: literature survey (Räisänen, 2009), interviews and interactions on key risks as experienced by the top management, and further actions on a key risk, the occupational safety.

The research for finding the key risks was carried out through interviews and interactions with a sample of top managers of Finnish and Åland shipping companies during 2009 and 2010. During the interactions to study the key risks, interviews were conducted, suggestions of improvement were made and possibilities of cooperation and benchmarking within the industry were studied by the researcher. The interviewees were selected mainly from ten volunteering companies within the Finnish Shipowners' Association. Twenty-seven persons participated in the interactions. They held positions in general management, operations, technical management and human resources of ten shipping companies; ESL Shipping, Finnlines, Langh Ship, Neste Oil, Prima Shipping, Rederi AB Eckerö, Rettig Group Ltd Bore, Tallink Silja, VG-Shipping, and Viking Line. Of these, eight were at the highest position of responsibility concerning shipping in their respective organizations.

Of the key risks found during the interactions, benchmarking and the sharing of information were found to be easiest in occupational safety. An analysis was carried out to find the safety level of the participants. The study covered 1145 work accidents onboard during the years 2005 – 2009 totalling 24 million work hours on 55 vessels. The number of work accidents was compared to information from international shipping and oil business, as well as to some general data published by the Finnish Federation of Accident Insurance Institutions (FAII).

5.2 Literature survey on the influence of top management on safety culture

As a background for the interaction with the shipowners, a literature survey on safety culture (Räisänen, 2009) was carried out. We found out that questionnaire surveys and case studies are commonly used methods. They can help to discover risk behaviour of persons in an organization, which are often enabled or augmented by latent conditions in the workplace (Reason, 1997). The latent conditions can be physical or organizational, and are affected by the actions of the top management. In addition to directly contributing to the motivation of the workforce, the top

management has budgetary power over the safety expenditures e.g., the implementation and development of safety management systems. The top management is also important factor affecting the risk-taking of employees as it both creates and controls the environment in which accidents occur (Molenaar et al., 2002) but also influences employee safety attitudes, which correlate strongly with safety behaviour (Håvold, 2005). Similarly, the interest and commitment of the management increases the involvement of the employees, and thus contributes to the improvement of safety conditions.

Assessment of safety culture is needed to establish the safety level that enables benchmarking for predicting the outcome of proposed safety interventions and for the follow-up of improvements. The assessment concerns the social behaviour of organisational members in the process of maintaining safety, which is not easy to measure. One obvious type of evidence that can be used to measure safety, are the accidents and incidents, but unfortunately this method does not come without problems. The number of accidents may be too low for statistical reliability, and smaller incidents and near misses are difficult to recognise (Håvold, 2000), or may be a result of incentives (Fernández-Muñiz et al., 2007) such as bonuses for a good safety record, which leads to non-reporting (Håvold, 2000), or an accident-free period of time may suppress the eagerness for reporting. Small incidents may remain unreported, if negative consequences threaten the reporter. Accident rates increase if reporting is improved, which leads to false conclusions about deteriorating safety conditions. Therefore, a broader spectrum of factors and tools may be needed for the assessment of the safety culture in shipping. Some were found from literature and summarized in the interim report (Räisänen, 2009).

5.3 Key risk categories and development areas

The views of top managers of Finnish shipping companies on risks of their industry are important, as they help to focus research efforts. On the basis of the interactions of this research, eight key risk categories were formed: general management; human resources; seamanship and navigation; fire and technology risks; special risks of passenger vessels; systematic maintenance; securing of cargo; and occupational safety onboard.

5.3.1 General management

In the interviews with the top managers, the effects of company ownership and shareholders' interests to operations of the top management were inquired. The reported effects on safety work were very variable, depending on the background of the owners and their style of working with the operational management. Many top managers reported a neutral attitude for safety, rendering it as an "operational issue" that is not relevant for investors. However, in cases where investors were reported to affect the work of operational management, it was found that the owners can have a

significant positive or negative effect on safety e.g., attitudes towards safety in a shipping company or safety investments.

Risks in profitability and the fact that many issues are decided outside the company limit the possibilities of the management to develop operations. Especially uncompetitive manning costs, flag state regulations that make flying foreign flags beneficial, changes in tax-free sales and environmental issues were mentioned during the interactions.

Safety reviews are compulsory onboard but currently their style and number vary with flag administration. Therefore, when the interviewees were asked about the effects of the ISM Code (International Safety Management Code, i.e. International Management Code for the Safe Operation of Ships and for Pollution Prevention by the International Maritime Organization) and the operation of flag states, many of them mentioned the need for harmonization of interpretations between flags and port states, so that only one interpretation would be used by all, saving the cost of multiple visits for all parties. This would also save the resources of the flag and port states.

5.3.2 Human resources

In all interviews, the views of the top managers of the companies involved in the research were clear about the importance of human resources and their risk management. Human resources affect the economical risk, and manning costs determine the profitability in many company's operation.

The managers were acutely aware of the risks related to recruiting. In Finland, acquiring suitable deck and machinery personnel were recognized as a future risk, as the current personnel are near their retirement age. The managers also emphasized the need for managing the risks that are due to language and cultural differences between different nationalities onboard. Further, the large workload of some key persons onboard, such as chief mates, was recognized as risk in some companies.

5.3.3 Seamanship and navigation

The interviewed managers of the shipping companies were very well aware of possible risks in seamanship and navigation, and the importance of their risk management was never questioned. In many fields of seamanship and navigation forms of collaboration between competitors and the authorities were apparent, e.g. joint emergency exercises. Some comments were recorded on the past work of Finnish Maritime Administration (currently Finnish Transport Safety Agency, Maritime Sector) in safety issues. In general the comments were positive, but wishes for increased capacity in proactive and advisory services were recorded.

5.3.4 Fire and technology risks

Fire risk was well known to the interviewees. Machine room fires and fires of non-marine equipment, such as blowers, coffee-machines, computers and copying machines were mentioned. For ferries, the electric equipment in old cars can cause problems, especially in the summertime, when the traffic of "summer-cars" is at its busiest. The management of these risks is obviously necessary, and are dealt with a systematic approach in some companies.

5.3.5 Special risks of passenger vessels

Special risks that apply mostly to passenger vessels were mentioned in the interviews. Risks of bad publicity can affect the revenue of the company, but also the industry as a whole for instance, the effect of major incidents to the volume of passenger traffic. Another risk that was specifically mentioned was the risk of security procedures onboard passenger vessels, choosing suitable methods that depend on the client and his/her actions.

5.4 Systematic maintenance

Systematic maintenance was one of the three key development areas that the interviewees found most important. The interviewees with technical and navigational background had rather similar views on which systems are the most critical onboard. Particularly the main engine, the auxiliary engines, the bow thrusters, the steam production equipment (with heavy fuel oil), the searchlights, the electronic charts, the automation systems, the navigational systems, the rudder, the steering systems, and the stern tube (maintenance and protection) were mentioned. Depending on the arrangement and duplicity of vessel systems, any of these can cause serious consequences. Likewise, effort is needed for the training of operators. For some smaller operators, the benefits of database systems may not be as obvious as for the larger ones, as fully manual systems are also used for systematic maintenance.

Preventive maintenance and intelligent diagnostics were considered by many of the interviewees to offer possibilities for the future. High manning costs onboard, complex systems, and less experienced recruits may steer the development towards the remote sensing of systems from ashore, which calls for new arrangements in the maintenance in shipping. In addition, the increased amount of electronics has lowered the ability of crews to solve problems onboard. Using remote sensing in maintenance could be a topic for further research. Moreover, research in the interference effects of electronics and electricity generation would be useful. Considering cargo, there are also problems to be solved in the transport of scrap

metal, which tends to cause damages to the cargo area, as well as in training the crews in the use of computers.

5.5 Securing of cargo

Lateral shifts in cargo can cause large listing angles, and the second safety development area that came up during the interviews concerned the securing of cargo, especially in ro-ro- and box transport. The crew cannot normally influence the securing of cargo inside containers and trailers, and the securing ashore may be carried out by persons who have no experience of the demands of sea transportation. The trailers can be entered only if there is reason for concern: e.g. something is sticking out, the suspension is fully down or leaks are present. Moreover, the lashings by the crew may be insufficient, or the large forces while travelling the seaway may present problems. Current ten-ton lashings are more difficult to draw to full tension manually than the older six-ton cargo lashings, which may actually lower the safety because after a while the sailors may tension them less than before. For bulk transport, varying internal friction of the cargo, due to e.g. specification or water content may present challenges.

Development ideas were based on improving the availability of information in the cargo delivery chain. The first step for container and trailer traffic could be a simple information poster of marine cargo stowage for land-based people who do not know the requirements at sea. This might be a simple poster with striking photographs of trailers heeled and listed so that their sideways component of gravity of acceleration equals to the specified lashing loads. Further refinement with simple container loading manuals could be managed similarly to the bulk cargoes, where a simple manual of the most common cargoes for the ship is used with further references in the Internet.

5.6 Occupational safety onboard

The third safety development area that emerged during the interviews concerns the occupational safety onboard. Lethal injuries are not unknown in the industry as a whole. Typical causes are drowning, falling from height, and projectiles from breaking equipment. Breaking ropes, cold water and sudden shifting of cargo pose additional hazards. Also non-lethal injuries from various sources e.g. from working with machinery (e.g. lathe), ropes or jamming of body extremities are common. For passenger vessels, risks in galleys are particular.

In addition to personnel injury and the associated grief, the companies suffer of the direct and secondary costs of accidents. One special consequence of safety problems in the maritime industry is also the difficulties in recruiting the best personnel, few top recruits will want to work in a company with a questionable safety record. In many interviews the level of occupational safety in the industry was assumed to have a direct relationship with general marine safety. This is an interesting

assumption that merits further research as occupational incidents are well documented by the Finnish shipowners and the authorities.

5.7 Results of the benchmarking study of occupational safety

Significant development possibilities were found in the benchmarking study of occupational safety statistics. Currently, statistics are being collected by the insurance companies and authorities, which communicate them to the ship operators. Common benchmarking standards have so far been rather limited. Consequently, prominent topics of safety culture development were found in metrics and sharing experiences: occupational safety statistics, such as Lost Time Incident Frequency, and sharing lessons learned from accidents. The development in the future should make use of the knowledge on models of safety culture in the chemical, oil and gas industries. While strictly keeping the application in practice and the limitations in budgets in mind. As a result, a confidential exchange and analysis of occupational safety incidents between shipowners was started. In the light of the experiences from other industries this should provide significant improvement, not only in occupational safety, but also in general maritime safety.

There were two types of results: 1) general results of all work accidents onboard and 2) results that relate the work category and respective working hours to each other. From the general results, the level of the Finnish shipping industry can be compared to other industries and foreign shipping as some comparable information is available. The results in work categories can be used e.g. to find the most accident-prone tasks on board. The results shown in the two following graphs relate to the whole of the data. In addition, further comparisons between workgroups and companies were carried out, which produced a set of 50 comparative graphs. We found that for passenger traffic, useful information could be obtained for 11 work categories onboard. For cargo vessels, four work categories were found to be sufficient (Table 5.1).

Table 5.1 Work categories used in the analysis

Passenger vessels	Cargo vessels
Cabin attendants	Deck and engine personnel
Cruise and program hosts	Deck/engine officers
Deck and engine personnel	Galley personnel
Deck/engine officers	Other
Engine repairmen	
Galley personnel	
Security personnel	
Shop assistants/sales personnel	
Storage personnel	
Waiters	
Other	

When the general results of the industry (1) are compared to the published statistics of oil industries or a tanker company, it can be noted that there seem to be good possibilities for safety development. It can also be noted that the official statistics of work accidents in waterborne traffic can give a too optimistic picture of safety onboard, as the office workforce is included in the statistics.

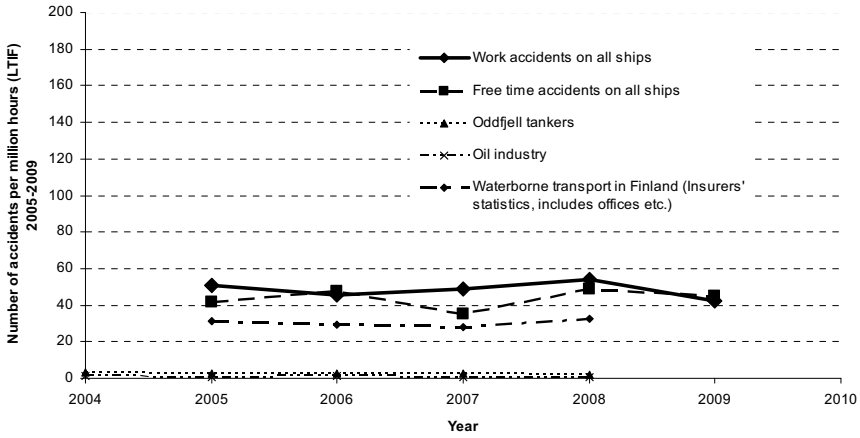

Figure 5.1 Accidents per million working hours onboard for some Finnish shipping companies 2005 – 2009.

We found significant differences between the companies when accidents in different work categories were compared. For deck/engine officers and deck/engine personnel the accident rate in the varied so that the most advanced companies had half of number of accidents compared with the least advanced. For galley personnel, the differences were even larger. It should be noted, however, that the number of accidents and the

hours in some work categories were rather low for proper statistical significance. For practical development work, they can be deemed to sufficient.

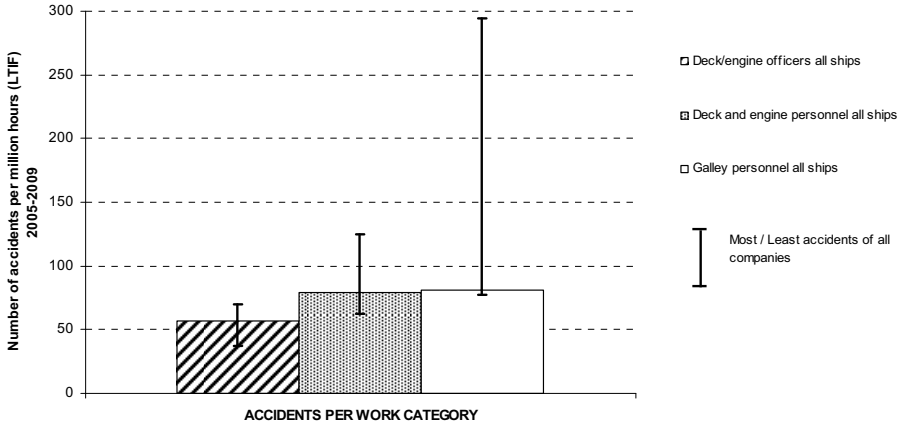

Figure 5.2 Accidents per work category per million working hours, all vessels 2005–2009.

5.8 Summary

The view that safety culture is a dominant factor in the safe operation of complex technological systems has been accepted after the Chernobyl incident. The factors which influence the safety culture can be distilled from organisational studies, which often are questionnaire surveys. Information is also gained from working safety professionals who typically use case reviews. Typical recurring factors in surveys have been positive attitudes toward safety, management commitment, supervisor competence, and the priority of safety over production. Of these, management commitment has been studied in more detail, as the organization's perception of its safety culture is crucial, and the management creates it through visions, values, measurement, rewarding and daily decisions. An assessment of safety culture is needed to establish a safety level for benchmarking, for predicting the outcome of proposed safety interventions and for the follow-up of improvements.

There are good possibilities for improving safety among the Finnish ship operators. During the interactions with the ten volunteering companies, the attitudes in the industry were found to be very positive towards the development of risk management. Eight key risk categories were identified. These were: general management; human resources; seamanship and navigation; fire and technology risks; special risks of passenger vessels; systematic maintenance; securing of cargo; and occupational safety onboard. Of these, three were further selected as key areas

for development: systematic maintenance, the securing of cargo, and occupational safety onboard

In particular, the accident rates of the participants from years 2005 – 2009 were analysed. They were found to be larger than in the oil industry, known for its very low accident rates, which is not surprising. However, this benchmark provides a good starting point for general safety development. Further, the differences between work categories of some companies were also found to be significant, which provides a good starting point for mutual development of safety details. In particular, we believe that the work safety of deck/engine personnel and galley personnel for all ships, as well as security personnel for passenger vessels will benefit of safety benchmarking and consequent development. The vessel type related information that was developed for the companies during the analysis will provide a good starting point for further development.

6 NETWORK TYPE SAFETY MANAGEMENT AMONG AUTHORITIES

Hilkka Dufva & Juhani Pekkola, Kymenlaakson ammattikorkeakoulu, University of Applied Sciences

The study "*Network type Safety Management among authorities*" is one part of the METKU-project "*The Development of Maritime Safety Culture*" partly funded by the European Regional Development Fund. The project is managed by the Kotka Maritime Research Centre. The Health Care unit in the Kymenlaakson ammattikorkeakoulu, University of Applied Sciences has taken the responsibility for the study "*Network type Safety Management among authorities*" during the years 2008 – 2010.

Authorities in this study were: The Finnish Boarder Guard, Finnish Coast Guard, Port Authorities, Rescue Services in Finland, Health and Social Care Services, Police, authorities taking the responsibility for the Communications and the Ministry of Environment. The Evangelical Lutheran Church of Finland has been regarded as an authority too. The material is collected from reports of Accident Investigation Board in Finland, articles in Linda data archive and by using free search concerning co-operative models among authorities. In addition email based survey (N=72) and 15 theme interviews among authorities on various levels were done.

One of the main results of the study is that the co-operation among authorities is determined by accidents and by joint concern about the threats for the safety among the population. The authorities introduce experiments for co-operation and continue it systematically and even with joint strategies. One can notice that authorities in small clusters anticipate the threats, plane and organize exercises in order to train joint actions. Many authorities noticed further need for co-operation, but the real co-operation took place in meetings, in some cases occasionally. The back bones in co-operation are personal connections among colleagues working together during tens of years.

The problems among the authorities are overlapping activities, discrepancy in rules and guidelines, variety's in the structures of in management organizations, the lack of time and scarce economical and human resources. Additional problems are insufficient information about the tools, actions and organizational culture of other authorities as well as lacking information activities and policies for secret / not public information.

Authorities for the sea: Finnish Navy, The Finnish Boarder Guard, The Finnish Transport Safety Agency (Trafi) work together in excellent co-operation. Ashore Rescue Services and Health Authorities have a joint tradition in co-operation since 100 years. Based on the interviews carried out in the study, one can see that authorities for the sea are not fully aware about the actions and tools used by authorities ashore. Authorities ashore are not able to anticipate the consequences of maritime accidents like social actions needed, accommodation and emergency help. On national level there are

considerations about multiple independent and individual policies among municipal authorities with various applications concerning safety regulations. Regional authorities could criticize the principles in various vertical and specified organizations, that are not in line with each other.

7 CONCLUSIONS AND DISCUSSION

Ulla Tapaninen, University of Turku & Juha Heijari, Kotka Maritime Research Centre

Due to increasing waterborne transportation in the Gulf of Finland, the risk of a hazardous accident increases and therefore manifold preventive actions are needed. The ro-ro ship Estonia capsized and sunk in heavy weather in September 1994. The primary reason for the accident was a failure and loosing of the ship's bow visor. Hänninen (2007) analysed the report of the investigation board thoroughly in his doctoral thesis concerning the Estonia accident. Hänninen (2007) stated that the cause of the Estonia accident was not only a technical failure of the bow visor, but also that there are major defects in the safety culture of the maritime industry. Even before the Estonia accident occurred, deficiencies in maritime safety culture were considered as the reason for the accident of the Herald of Free Enterprise (FMA, 2007). As a result, the International Maritime Organization (IMO) has set down plenary laws and recommendations which are e.g., utilised in the safe operations of ships and pollution prevention. One of these compulsory requirements, the ISM Code, requires proactive attitude both from the top management and operational workers in the shipping companies. In this study, a cross-sectional approach was taken to analyse whether the ISM Code has actively enhanced maritime safety in the Gulf of Finland. The analysis included; 1) performance of the ISM Code in Finnish shipping companies, 2) statistical measurements of maritime safety, 3) influence of corporate top management to the safety culture and 4) comparing safety management practices in shipping companies and port operations of Finnish maritime and port authorities.

This study comprised of several extensive literature reviews, interviews of almost two hundred maritime professionals ranging from the ordinary seamen to the top management of shipping companies and representatives of maritime authorities, and several statistical analyses. The results of these multiple studies are summarized in this report.

The main results found were that maritime safety culture has developed in the right direction after the launch of the ISM Code in the 1990´s. However, many concerns still remain and improvements are needed. One of the main concerns is the understanding of the philosophy of continuous improvement. Tools for continuous improvement should be developed and they should be taken into practice. The other problems include the lack of uniformity in the interpretation and implementation of the ISM Code. The wider problem in the maritime industry is the excessive bureaucracy that the ships have to deal with. The existing incident reporting systems is that information now flows more from the ships to systems and external institutions when it should be the other way around. Recommendations for mariners are related to risk and change management, strategies of safety management and resources for ensuring safety. Maritime authorities are expected to produce more guidance material for safety management On the other hand, there are good possibilities for improving safety among Finnish ship operators.

During the interactions with the ten volunteering companies, the attitudes in the industry were found to be very positive towards the development of risk management

Statistical analysis shows that the overall accident risk in Finnish shipping and in Finnish coastal waters in general has decreased within the ISM period; the average severity of accidents is increasing; and a significant part of marine accidents is predictable. It has been demonstrated within this study that accident prone shipping companies can be identified by the simultaneous use of PSC and VTS reports. We believe that with this approach, the maritime administrations can focus their efforts on the most accident prone ships, either by simultaneously enforcing and supporting them and the companies behind them to truly follow the obligations set in the ISM Code, or by removing them from traffic where risky behaviour cannot be accepted.

Overall, it can be stated that the old management culture in shipping i.e., a risk taking attitude that focuses on considerable economic result has no place on the Baltic Sea any longer. The concept of social responsibility has also reached shipping companies. Risk-taking heroic operations are no longer required or even allowed, only well-defined processes where the safety of all the operations are guaranteed can be allowed. The time of courageous seamen is over; maritime business is becoming safe.

In the future, we will continue to study the relationship between the level of performance of the safety management system and the business competitiveness of the shipping company. Furthermore, we will emphasise the importance of international cooperation between organisations, which are eager to develop maritime safety. The next steps in the continuous improvement will include further studies related to the maritime risk models that could serve the needs of safety management on its various levels.

ACKNOWLEDGEMENTS

This study was funded, in part, by the European Union's European Regional Development Fund (project *Merenkulun turvallisuuskultuurin kehittäminen*, METKU A30074), the City of Kotka grant, and the following companies: Aker Arctic Technology Inc, Arctia Shipping Ltd, Kristina Cruises Ltd, Finnlines Plc and the Port of Helsinki grants. We thank the personnel working in the cooperating organisations at Aalto University School of Science and Technology (formerly Helsinki University of Technology), Kymenlaakso University of Applied Sciences, Turku University of Applied Sciences, Kotka Maritime Research Centre, The Regional Council of Päijät-Häme for acting as a financing authority, The Regional Council of Kymenlaakso for their valuable assistance, the management group of the project and especially project Chairman Mr. Risto Repo. Publications produced during the project's lifespan can be found in Appendix I.

REFERENCES

Amerini G. 2010. *Maritime transport of goods – 2nd quarter 2009*. Eurostat, Data in focus, 17/2010. ISSN 1977-0340.

Amerini G. 2009. *Maritime transport of goods and passengers 1997-2007*. Eurostat, Data in focus, 20/2009. ISSN 1977-0340.

Anderson P. 2003. *Cracking the Code – The Relevance of the ISM Code and its impacts on shipping practices*, The Nautical Institute, London.

Antonsen S. 2009. The relationship between culture and safety on offshore supply vessels. *Safety Science*, 47: 1118-1128.

Celik M, Lavasani SM, Wang J. 2010. A risk-based modelling approach to enhance shipping accident investigation. *Safety Science*, 48: 18-27.

Coleshill E, Cain J, Newland F, D'Souza I. 2010. NTS—A nanosatellite space trial. *Acta Astronautica*, 66: 1475-1480.

Commission Decision of 5 June 2009 on the adoption of a common safety method for assessment of achievement of safety targets (2009/460/EC).

Commission Regulation (EC) No 352/2009 of 24 April 2009 on the adoption of a common safety method on risk evaluation and assessment.

Environmental Authority in Finland. A personal notification by interviewing study on 26 November 2009. Tampere.

Environmental Protection Decree 169/2000.

European Commission, 2010. *Chemical Accidents (Seveso II) – Prevention, Preparedness and Response*. in EU portal (http://ec.europa.eu/environment/seveso/index.htm). Read on 27 July 2010.

European Union Strategy for the Baltic Sea Region, COM (2009).

Fernandez-Muniz B, Montes-Peon JM, Vazquez-Ordas CJ. 2007. Safety culture: Analysis of the causal relationships between its key dimensions. *Journal of Safety Research*, 38(6): 627-641.

Finnish Aviation Authority. 2009. A personal notification by interviewing study, 24 November 2009. Helsinki.

Finnish Institute of Occupational Health. 2010. *The portal of the Institute*. (www.ttl.fi/en). Read on 30 July 2010.

Finnish Maritime Administration. 2007. *Improving Co-operation on the Bridge*. Preliminary study. Merenkulkulaitoksen julkaisuja 7/2007. Helsinki.

Finnish Port Association. 2007. *The portal of the Association*. www.finnports.com. Read on 29 July 2010.

Gröhn, Juha, 2009. (VP Finnair's operational risk management) A personal notification by interviewing study. 16 September 2009, Helsinki.

Heinrich HW. 1959. *Industrial accident prevention – A scientific approach*. 4th edition. McGraw-Hill Book Company, New York.

Hollnagel, E. 2008. Risk + barriers = safety?. *Safety Science*, 46: 221-229.

Hopkins A. 2009a. Thinking about process safety indicators. *Safety Science*, 47(4): 460-465.

Hopkins A. 2009b. Reply to comments. *Safety Science*, 47(4): 508-510.

Hämäläinen R. 2010. "Luokituslaitosten tarkastajien näkemyksiä turvallisuusjohtamisesta merenkulkualalla" (Notions of Classifications companie´s personnel about safety management on maritime industry). Bachelor´s Thesis (manuscript). Kymenlaakson ammattikorkeakoulu, Kotka. In Finnish.

Hänninen H. 2007. *Negotiated Risks: the Estonia Accident and the Stream of Bow Visor Failures in the Baltic Ferry Traffic*. Helsinki school of economics, Helsinki.

Høye GK, Eriksen T, Meland BJ, Narheim BT. 2008. Space-based AIS for global maritime traffic monitoring. *Acta Astronautica*, 62: 240-245.

Håvold JI. 2007. National cultures and safety orientation: A study of seafarers working for Norwegian shipping companies. *Work & Stress*, 21(2): 173-195.

IMO (2002). *International Safety Management (ISM) Code*. International Maritime Organization, London.

IMO (2005), *Role of the Human Element – Assessment of the impact and effectiveness of implementation of the ISM Code*, International Maritime Organization, MSC 81/17

IMO 2008. MSC-MEPC.7/Circ.7./ *Guidance on near-miss reporting*/. International Maritime Organization, London

International Civil Aviation Organization. 2008. Safety Management Manual (SMM). 2nd edition. Doc 9859, AN 474.Kunttu, T. 2009. Turvallisuusjohtamisjärjestelmien vertailu. A research report. Kymenlaakson ammattikorkeakoulu, Kotka.

Interviews in ten shipping companies operating in Southern Finland: ESL Shipping, Finnlines, Langh Ship, Neste Oil, Prima Shipping, Rederi AB Eckerö, Rettig Group Ltd Bore, Tallink Silja, VG-Shipping, and Viking Line.

Jalonen R, Salmi K. 2009. S*afety Performance Indicators for Maritime Safety Management*. Helsinki University of Technology, TKK-AM-9, Espoo.

Juurijoki L. 2010. Notions of Controlling Authorities of Safety Critical Oganizations about Safety Management. University of Applied Sciences, Seafaring and Logistics, 101 pp, Kotka (Thesis, abstract in English).

Khan F, Abunada H, John D, Benmosbah T. 2010. Development of Risk-Based Process Safety Indicators. *Process Safety Progress*, 29(2): 133-143.

Kiuru H, Salmi K. 2009. *Accident Analysis; The Tool for Risk Evaluation*, Helsinki University of Technology, TKK-AM-11, Espoo.

Klemola E, Kuronen J, Kalli J, Arola T, Hänninen M, Lehikoinen A, Kuikka S, Kujala P, Tapaninen U. 2009. A cross-disciplinary approach to minimizing risks of maritime transport in the Gulf of Finland. *World Review of Intermodal Transportation Research*, 2(4): 343-363.

Knudsen, F. (2009). Paperwork at the service of safety? Workers' reluctance against written procedures exemplified by the concept of 'seamanship'. *Safety Science*, 47: 295-303.

Koivistoinen A. 2009. Implementation of Safety Management System in Ports and in Enterprises Operating in Ports. Kymenlaakso university of applied sciences / Logistic. (Abstract in English)

Kujala P, Hänninen M, Arola T, Ylitalo J. 2009. Analysis of the marine traffic safety in the Gulf of Finland. *Reliability Engineering & System Safety*, 94 (8): 1349-1357.

Kunttu T. 2009. *Turvallisuusjohtamisjärjestelmien vertailu*. A research report. Kymenlaakson ammattikorkeakoulu, Kotka.

Kuronen J, Tapaninen U. 2009. *Maritime safety in the Gulf of Finland - Review on policy instruments*. Publications from the Centre for Maritime Studies, University of Turku, A49, 1-85.

Lappalainen J. 2008. *Transforming Maritime Safety Culture*. Publications from the Centre for Maritime Studies, A46/2008, Turku

Lappalainen J, Salmi K. 2009. *Safety Culture and Maritime Personnel's Safety Attitudes*. Publications from the Centre for Maritime Studies, A48/2009, Turku.

Mejia M. 2001. *Performance Criteria for the International Safety Management (ISM) Code.* Proceedings of the 2nd General Assembly of IAMU International Association of Maritime Universities 2 / 5 October 2001 – Kobe, Japan

Ministry of the Environment, Finland. 2010. The portal of the Ministry. (http://www.ymparisto.fi). Read on 27 July 2010.

Ministry of Transportation and Communication. 2004. *Satamatoimintojen kehittäminen ja satamalainsäädännön uudistaminen*. Liikenne- ja Viestintäministeriön julkaisuja 65/2004. Helsinki.

Molenaar K, Brown H, Caile S, Smith R. 2002. Corporate Culture. *Professional safety*, 47(7): 18.

Montewka J, Hinz T, Kujala P, Matusiak J. 2010. Probability modelling of vessel collisions. *Reliability Engineering and System Safety*, 95: 573-589.

Nuclear Energy Act 990/1987 (Finnish legislation).

Occupational Health and Safety Administration, 2008. *Turvallisuusjohtamine*n. (in Finnish) Työsuojeluoppaita ja ohjeita 35. Tampere.

Othman MR. 2003. *Effectiveness of Safety Management Systems (SMS) BY Malaysian Shipping Companies in Compliance to the International Safety Management (ISM) Code*. http://www.ismcode.net/research_projects/wmd_2003_paper.pdf

Paris MoU (2008). Evaluation CIC on ISM in 2007, Paris MoU on Port State Control, Port State Control Committee 41st session, 19-23 May 2008 Loutraki, Greece

Paris MOU. 2009a: Annual reports.
http://www.parismou.org/ParisMOU/Organisation/Annual+reports/default.aspx. (April 13th 2010).

Paris MOU. 2009b: Port State Control, inspections database
http://www.parismou.org/ParisMOU/Inspection+Database/Basic+Search/xp/menu.4575/default.aspx (April 13th 2010).

Pun K-F, Yam RCM, Lewis WG. 2003. Safety management system registration in the shipping industry. *International Journal of Quality & Reliability Management*. 20(6): 704-721.

Radiation Act.592/1991 (Finnish legislation).

The Radiation and Nuclear Safety Authority in Finland. 2009. A personal notification by interviewing study on 8 December 2009. Helsinki.

The Radiation and Nuclear Safety Authority in Finland, STUK. 2008. YVL 1.4 Management systems for nuclear facilities, 9 January 2008. Regulatory Guide for nuclear safety.

The Railway Safety Directive. Directive 2004/49/EC of the European Parliament and of the Council of 29 April 2004on safety on the Community's railways.

Tokyo MOU. 2008. Outcomes of the Tokyo MOU concentrated inspection campaign (CIC) on ISM. http://www.tokyo-mou.org/press%20release%20ISM.pdf

Reason J. 1997. Managing *the Risks of Organizational Accidents*. Ashgate Publishing Company. Brookfield, Vermont.

Reiman, T & Oedewald, P. 2008. *Turvallisuuskriittiset organisaatiot*. Onnettomuudet, kulttuuri ja johtaminen. Edita, Helsinki.

ReportISM, May 2008, http://www.consultism.co.uk/ReportISM_May_2008_PDF.pdf

Räisänen P. 2009. *Influence of Corporate Top Management to Safety Culture – A Literature Survey*. Reports from Turku University of Applied Sciences, Turku.

Safety Technology Authority, (TUKES) in Finland. 2009. A personal notification by interviewing study on 21 October 2009. Helsinki.

Salmi K. 2010. *Targeting Accident Prone Ships by Their Behaviour and Safety Culture*. Aalto University School of Science and Technology, TKK-AM-14, Espoo.

Salokorpi M. 2010a. *Turvallisuusjohtaminen satamissa (Port Safety)*. Tutkimuksia ja raportteja. B-sarja (in press). Kymenlaakson ammattikorkeakoulu, Kotka (in Finnish).

Salokorpi M. 2010b. *Parhaita turvallisuusjohtamiskäytäntöjä merenkulkijoilla ja satamatoimijoille (Best safety management practices for mariners and ports)*. Tutkimuksia ja raportteja. B-sarja (in press). Kymenlaakson ammattikorkeakoulu, Kotka (in Finnish).

Sanne JM. 2008. Incident reporting or storytelling? Competing schemes in a safety-critical and hazardous work setting. *Safety Science* 46, 1205–1222.

Sariola L. 2010. Review on the main conventions and legislation of the sea environment and the sea rescue – liabilities for the vessel source pollution on the Gulf of Finland. Kotka Maritime Research Centre publication series.

Seveso Directive II. Council Directive 96/82/EC of 9 December 1996 on the control of major-accident hazards involving dangerous substances.

Sgourou E, Katsakiori P, Goutsos S, Manatakis Em. 2010. Assessment of selected safety performance evaluation methods in regards to their conceptual, methodological and practical characteristics. *Safety Science*, 48: 1019-1025.

Statistics on Shipping between Finland and Foreign Countries. 2008. Statistics from the Finnish Maritime Administration, 5/2009.

Sea transport of goods. 2010. Eurostat. http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&plugin=1&language=en&pcode=ttr00009 (18/June/2010).

U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, Maritime Trade & Transportation, 2007.

Werfelman, L. 2008. *Piece by Piece*. AeroSafety World, January 2008, pp. 14-19.

Withington S. 2006. ISM – What has been learned from marine accident investigation? Source: http://www.he-alert.com/documents/published/he00475.pdf

YTNK, 2005. Yritysturvallisuuden osa-alueet. (a network publication). Yritysturvallisuus EK. (www.ek.fi/ytnk08/fi/yritysturvallisuus.php).

APPENDICES

I. List of publications produced during the METKU research project

Appendix I

1. Utilization of incident reporting in the Finnish maritime industry. 2010. Anne Vepsäläinen, Jouni Lappalainen. University of Turku, Publications from the Centre for Maritime Studies A53.

2. Incident reporting and continuous improvement: poor utilisation of safety measures in maritime industry. 2010. Jouni Lappalainen, Kim Salmi, Pentti Kujala, Ulla Tapaninen. The 5th International Conference on Collision and Grounding of Ships, June 14th - 16th 2010 Espoo, Finland. Sören Ehlers, Jani Romanoff (eds.). Aalto University, School of Science and Technology, Faculty of Engineering and Architecture, Department of Applied Mechanics. Series AM 16, Espoo.

3. Network type Safe Management among authorities (Turvallisuusjohtaminen moniammatillisessa viranomaisverkostoissa)". 2010. Hilkka Dufva, Juhani Pekkola. In the publication series of the Kymenlaakso University for Applied sciences.

4. Possibilities of Safety Management, and Observations of Workplace Safety in Finnish Shipping Industry. 2010. Pekka Räisänen. Turun ammattikorkeakoulu. Reports from Turku University of Applied Sciences, Turku

5. Notions of Controlling Authorities of Safety Critical Oganizations about Safety Management. 2010. Lauri Juurijoki. University of Applied Sciences, Seafaring and Logistics, 101 pp, Kotka (Thesis, abstract in English).

6. Targeting Accident Prone Ships by Their Behaviour and Safety Culture. 2010. Kim Salmi. Aalto University, School of Science and Technology, Faculty of Engineering and Architecture, Department of Applied Mechanics. Series AM 14, Espoo.

7. The main conventions and legislation of the sea environment and the sea rescue — Liabilities for the vessel source pollution on the Gulf of Finland. 2009. Laura Sariola. Helsinki University of Technology. Faculty of Engineering and Architecture. Department of Surveying, 1-92 pp (Master's thesis, abstract in English).

8. Notions of Classifications companie´s personnel about safety management on maritime industry. Hämäläinen R. 2010. (Luokituslaitosten tarkastajien näkemyksiä turvallisuusjohtamisesta merenkulkualalla). Bachelor´s Thesis (manuscript). Kymenlaakson ammattikorkeakoulu, Kotka. In Finnish.

9. Jenni Kuronen, Jouni Lappalainen, Ulla Tapaninen. 2010 ”Evaluation of the ISM Code in the Finnish companies” in the International Maritime Conference 2010, Mariehamn 15 April 2010. (oral presentation, unpublished).

10. Accident analysis; The tool for risk evaluation. 2009. Heini Kiuru ja Kim Salmi. Helsinki University of Technology. Faculty of Engineering and Architecture. Department of Applied Mechanics. Series AM, Espoo.

11. Implementation of Safety Management System in Ports and in Enterprises Operating in Ports. 2009. Annika Koivistoinen. Kymenlaakso university of applied sciences / Logistic. (Abstract in English)

12. Safety culture and maritime personnel´s safety attitudes - Interview Report. 2009. Jouni Lappalainen & Kim Salmi. Turun yliopisto, University of Turku Centre for Maritime Studies, A48.

13. Maritime personnel's safety attitudes. 2009. Jouni Lappalainen, Ulla Tapaninen. University of Turku Centre for Maritime Studies. IAME2009 conference, “Understanding Shipping Markets”, Copenhagen the 24th – 26th of June 2009 (oral presentation, unpublished).

14. Influence of Corporate Top Management to Safety Culture – A Literature Survey. 2009. Pekka Räisänen. Turun ammattikorkeakoulu. Reports from Turku University of Applied Sciences 88, Turku.

15. The ISM Code and Continuous Improvement. 2009. Jouni Lappalainen. Paper presentation in the International PhD Seminar - Maritime Economics and Management - 30th November-2nd December 2009, Svendborg International Maritime Academy, Svendborg, Denmark. (oral presentation, unpublished).

16. Turvallisuusjohtamisjärjestelmien vertailu – Tutkimusraportti. 2009. Timo Kunttu. Kymenlaakson ammattikorkeakoulu, Merenkulku ja logistiikka.

17. Safety performance indicators for maritime safety management - Literature review. 2009. Risto Jalonen ja Kim Salmi. Helsinki University of Technology. Faculty of Engineering and Architecture. Department of Applied Mechanics. Series AM, Espoo.

18. Tutkimusjulkaisu 2009. Pekka Malvela (toim.), Kymenlaakson ammattikorkeakoulun julkaisuja, Sarja B.

19. Transforming Maritime Safety Culture - Evaluation of the impacts of the ISM Code on maritime safety culture in Finland. 2008. Jouni Lappalainen, Publications from the Centre for Maritime Studies, A46 University of Turku, Turku

20. Improving operations in maritime transport - Comparing maritime safety standard to quality and environmental standards. 2008. Jouni Lappalainen. Poster presentation in NOFOMA 2008, Jun 4-6, Helsinki.

21. Influence of corporate top management to safety culture - A literature survey. 2008. Pekka Räisänen, Turku University of Applied Sciences, Ship Laboratory.

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