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MERITURVALLISUUDEN JA -LIIKENTEEN TUTKIMUSKESKUS
KOTKA MARITIME RESEARCH CENTRE
MERI KOTKA

TKK

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TURKU UNIVERSITY OF APPLIED SCIENCES

Kymenlaakson ammattikorkeakoulu
University of Applied Sciences

Leverage from the EU 2007–2013

European Union
European Regional Development Fund

REPORTS FROM TURKU UNIVERSITY OF APPLIED SCIENCES 105

Turku University of Applied Sciences
Turku 2010

ISBN 978-952-216-181-9 (printed)
ISSN 1457-7925 (printed)
Printed by Tampereen Yliopistopaino Oy – Juvenes Print, Tampere 2010

ISBN 978-952-216-182-6 (PDF)
ISSN 1459-7764 (electronic)
http://julkaisut.turkuamk.fi/isbn9789522161826.pdf

SUMMARY

Räisänen, Pekka
Influences of corporate top management to safety in certain shipping companies in Finland and Åland
Reports from Turku University of Applied Sciences 105
28 p.
Turku: Turku University of Applied Sciences, 2010

ISBN 978-952-216-181-9 (printed)
ISSN 1457-7925 (printed)

ISBN 978-952-216-182-6 (PDF)
ISSN 1459-7764 (electronic)

Safety management of maritime traffic close to Finland was studied in Turku University of Applied Sciences. The research consisted of three parts: literature survey, interviews and interactions regarding key risks as experienced by the top management, and the analysis of empirical data on occupational safety statistics. This publication is a compendium of the subproject reports.

In the literature survey, the influences of corporate top managers to safety of shipping were studied. The factors influencing safety can be distilled from organizational studies, which often are questionnaire surveys. Typical recurring factors in these surveys have been found to be positive attitudes to safety, management commitment, supervisor competence, and prioritizing safety over production. In the literature survey, also alternatives for assessment of safety were studied from the point of view of shipping industry.

During interactions with the ten volunteering companies, the attitudes towards the development of risk management in the industry were found to be very positive. 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. For all key risk categories, further development and research topics were identified. Of these, the occupational safety onboard was studied in even further detail.

In particular, the accident rates of the participants from years 2005–2009 were analyzed. They were found to be larger than in the oil industry, which is not surprising, as it is known for its very low accident rates. However, this benchmarking provides a fruitful starting point for general safety development. Further, the differences between occupational groups of some companies were also noted as significant, which provides a good starting point for mutual

development of safety details. Particularly, the work safety of deck/engine personnel and galley personnel for all ships, as well as security personnel for passenger vessels, will surely benefit from safety benchmarking and consequent development. The information relating to vessel types that was compiled for the companies during the analysis will also aid in further development.

During the interactions with the shipowners, benchmarking and sharing of information were suggested for all key risks. Co-operation was found to be easiest in regard to occupational safety. An analysis was carried out to map out the safety levels of the participants. The study comprised 1145 work accidents onboard during the years 2005–2009, totaling in 24 million work hours on 55 vessels.

The project was funded by the European Union's European Regional Development Fund, the Regional Council of Päijät-Häme, and the participants from the industry.

TIIVISTELMÄ

Räisänen, Pekka
Yrityksen ylimmän johdon vaikutus turvallisuuteen joissakin mannersuomalaisissa ja ahvenanmaalaisissa varustamoissa
Turun ammattikorkeakoulun raportteja 105
28 s.
Turku: Turun ammattikorkeakoulu, 2010

ISBN 978-952-216-181-9 (painettu)
ISSN 1457-7925 (painettu)

ISBN 978-952-216-182-6 (PDF)
ISSN 1459-7764 (elektroninen)

Merenkulun turvallisuusjohtamista tutkittiin Turun ammattikorkeakoulussa. Tutkimus koostui kolmesta osasta: kirjallisuustutkimuksesta, yritysten keskeisten riskien kartoittamisesta vuorovaikutuksessa varustamoyritysten johdon kanssa sekä työturvallisuusanalyysistä. Tämä julkaisu on lyhennelmä projektin raportoinnista.

Kirjallisuustutkimuksessa kartoitettiin yritysten ylimmän johdon vaikutuksia merenkulun turvallisuuteen. Turvallisuuskulttuuriin vaikuttavia seikkoja voidaan löytää organisaatioiden tutkimuksista, jotka perustuvat useimmiten kyselyihin. Näissä on havaittu tyypillisiksi turvallisuuteen vaikuttaviksi tekijöiksi positiiviset turvallisuusasenteet, johdon sitoutuminen, työnjohdon pätevyys ja turvallisuuden asettaminen tuottavuuden edelle priorisoinneissa. Kirjallisuudesta löydettiin myös tapoja mitata ja arvioida turvallisuutta, ja niiden käyttökelpoisuutta arvioitiin merenkulun kannalta.

Tutkimukseen osallistuneissa kymmenessä yrityksessä havaittiin erittäin positiivisia asenteita riskienhallinnan kehitystyölle. Kahdeksan pääriskikategoriaa tuli esille: yleisjohtaminen; henkilöstö; merimiestaito ja navigointi; palo- ja teknologiariskit; matkustajalaivojen erityisriskit; systemaattisen huollon riskit; lastinkiinnitys; sekä työturvallisuus laivalla. Kaikista riskikategorioista löytyi tulevaisuuden kehitys- ja tutkimuskohteita. Erityisesti työturvallisuutta tarkasteltiin erikseen laajemmin.

Osanottajien työtapaturmien taajuutta vuosina 2005–2009 analysoitiin. Niiden havaittiin olevan suurempia kuin öljyteollisuudessa, kuten voitiin olettaakin. Tämän nähtiin toimivan hyvänä vertailuarvona tulevaisuuden kehityshankkeissa. Havaittiin myös, että erot yhtiöiden välillä olivat suuria eri ammattiryhmissä, mikä antaa hyvän lähtökohdan turvallisuusyksityiskohtien kehittämistyössä. Erityisesti kansi-, kone- ja keittiöhenkilökunnan sekä matkustajalaivojen turval-

lisuushenkilökunnan uskottaisiin hyötyvän tulevaisuuden kehittämistoimista. Kehitetyn laivatyyppikohtaisen tiedon uskotaan tarjoavan hyvän lähtökohdan tulevalle kehitystyölle varustamoissa.

Tutkimuksen aikana havaittujen keskeisten riskien yhteisiä vertailuja ja tiedonvaihtoa ehdotettiin varustamoille. Kävi ilmi, että helpointa niiden vertailu ja tiedonvaihto oli työturvallisuuden suhteen, jota analysoitiin osanottajien turvallisuustason kartoittamiseksi. Aineisto koostui 1145 työtapaturmasta vuosina 2005–2009, mikä vastasi 24 miljoonaa työtuntia 55 aluksella.

Projektin rahoittivat Euroopan Unionin Euroopan aluekehitysrahasto, Päijät-Hämeen liitto ja alan toimijat.

CONTENTS

1 INTRODUCTION

Safety management of maritime traffic close to Finland has been studied in the EU funded METKU project (Heijari & Tapaninen 2010). There were five subprojects, one of which concerned the role of the companies' top management in safety practices of the Finnish shipping industry. The research consisted of three parts: literature survey, interviews and interactions regarding key risks as experienced by the top management, and the analysis of empirical data on occupational safety statistics. The research was carried out in the Ship Laboratory at Turku University of Applied Sciences.

This publication is a compendium of the subproject reports. The literature survey (Räisänen 2009) is abridged to chapters 2 and 3. The empirical part of the research was described by Räisänen (2010), and a revised version is presented from chapter 4 onwards.

2 SAFETY CULTURE AND COMPANY TOP MANAGEMENT

The view that safety culture is a dominant factor in safe operation of complex technological systems has been accepted after the Chernobyl incident. Many opinions exist of the appropriate definition of "safe", though, and safety culture can be viewed from many angles. Typically, the organizational environment close to safety managers provides most of the research material, and consequently the middle management view dominates the field. Similarly, the employee perspective is strong in the internal material of the organizations, especially in relation to work instructions and safety management documentation. From the top management viewpoint, a lesser amount of practical information is available.

On board ships the organization structure is hierarchic due to tradition and the need for clarity in emergency operations. Therefore, safety considerations depend strongly on the actions of the masters and the officers of the ships, and their interactions with the land-based organization. Few published documents on effects of safety culture exist for shipping, although it is one of the riskiest industries in the world (Håvold 2005). One typical feature of shipping is that ships are manned with crews of multiple nationalities, and much of it is carried out in international settings, outside national legislations. These issues complicate the communication and interactions within the ships, between them, and with the land-based stakeholders. Håvold (2005) emphasizes the effects of national culture, which is less prominent in relation to safety discussions in other fields. The effects of national cultures notwithstanding, research of other aspects of safety culture in other forms of transportation, such as aviation and railway transport, has been more active than in shipping.

Recent research efforts on safety have been directed much by employees' attitudes and perceptions of safety [e.g. Hayes et al. (1998), Hurst et al. (1996), O'Toole (2002), Richter and Koch (2004), Rundmo 1996, Seo et al. (2004), Silva et al. 2004, Williamson et al. (1997)]. Safety can be analyzed from an organizational psychology point of view (Guldenmund 2000), but also as a control system (Rasmussen 2000). Further, the factors that affect the safety culture and its outcomes in an organization have been of interest in many fields, such as nuclear industry, chemical industry, hydrocarbon production, manufacturing, construction and transport as summarized in Räisänen (2009). One conclusion drawn from this literature is that the factors influencing safety culture seem to be rather independent of the field of application. The industries mentioned typically require hierarchical organizing and thus similarities may be expected between different industries. It is clear that there are generic types of human and organization-induced errors [e.g. Glendon and Stanton (2000), Petersen

(1996), Reason (1997)]. Consequently, findings from other fields that have been reviewed are expected to be applicable for shipping at least to some extent. Summaries of the most influential factors to safety in other industries can be made, and their validity in the shipping industry can be tested.

It has been found useful to discern factors that can reduce safety, and seek positive results by eliminating negative factors. Petersen (2005, p. 47) lists eleven common negative attributes that were associated with major incidents such as Chernobyl. They relate to organizational safety culture, and are listed below to provoke thought:

1. Diffused responsibilities, rigid communication, separation of decision-makers from the plant
2. Mindset that success is routine
3. Believing that rule compliance is sufficient for safety
4. Too strong team-player spirit with no room for risk reporting
5. Information from other facilities not processed
6. Disregard for lessons learned from past or from others
7. Safety performance less important than other performance indicators
8. Lacking emergency planning and training
9. Allowing unsafe design and operational features that are not used elsewhere
10. Project and risk management techniques available but not used
11. Undefined authorities and responsibilities in safety matters

Many of the above factors are related to the attitudes of employees, which have been identified as one of the most important factors that affect safety. In addition to causing risks, the employees are often the final link in the chain of prevention. Therefore, they have a crucial role in determining the safety performance of an organization, and thus the risk-taking skills and safety behavior of individuals is of interest. Especially the behavior of top managers and their relation to risk-taking is an interesting topic. Unfortunately, few studies have been carried out (Rundmo and Hale 2003, also Holmes et al. (1997), cited by the previous).

The actions of the top management affect the latent conditions for safety mentioned above. In addition to directly contributing to the motivation of the workforce, the top management has the budgetary power over safety expenditures, e.g. the implementation and development of safety management systems. The top management is also an important factor affecting the risk-taking of employees as it both creates and controls the environment in which accidents occur (Molenaar et al., 2002). It also influences employee safety attitudes, which correlate strongly with safety behavior (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. (Williams (2002, p.44) lists effective leadership behaviors, e.g. consideration, persuasiveness, tolerance of uncertainty and freedom, integration of organization and influence

with superiors. Blair (2003, p.18) emphasizes that leadership and safety culture are ”inextricably linked” and that leaders must focus on specific behaviors to bring forth change.

3 POSSIBILITIES FOR ASSESSING THE EFFECTS OF TOP MANAGEMENT TO SAFETY CULTURE

Assessment of safety culture is needed for establishing a benchmark for safety attitudes, for predicting the outcome of proposed safety interventions and for the follow-up of improvements. Typical methods that are used in safety culture assessment are attitude surveys and rating scales; in-depth formal or informal interviews with individuals; perception surveys and interviews; safety audits; measurements of the safety management system; behavioral sampling; focus group meetings; examination of written records and databases; and document analysis. Self-administered survey is undoubtedly the most common method. Information is also gained from practicing safety professionals, who typically use case reviews. Typical recurring factors in surveys are: positive attitudes towards safety, management commitment, supervisor competence, and prioritizing safety over production. Of these, management commitment has been studied more in detail, as the organization's perception of its safety culture is crucial, and management creates it through vision, values, measurement, rewarding and daily decisions (Petersen 2003b, p.28).

In contrast to information on safety culture, quantitative data for safety performance can be obtained from accidents and near misses, site observations, employee surveys, and safety management questionnaires [e.g. Reason (1997), van Steen (1997)].The number of accidents is often too low for statistical reliability, and information on smaller incidents and near misses is difficult to collect (Håvold 2000). Further, using statistics for measurement of performance, or as contributors to incentives (Fernández-Muñiz et al. 2007), may lead to non-reporting (Håvold 2000). Also, accident-free time may suppress the eagerness for reporting. Small incidents may remain unreported if the negative outcome may pose a threat to the reporter. Typically, when reporting systems has improved, accident rates increase, which may lead to false conclusions about worsening safety. Useful information for improvements can be obtained from accident reports: large catastrophes that lead to fatalities are typically disseminated closely. Much can be learned e.g. from publicly funded institutions whose failures in the field of safety are usually reported very thoroughly.

Benchmarking safety performance with other organizations and the forming of best practices is particularly important for practicing safety managers who may function alone without colleagues in their own organizations. The complexity

and efforts required for this assessment varies greatly depending on the level of perceived risks and available funds. For example, the potential catastrophes looming in generating nuclear power are less relevant for the shipping industry, for which easily applicable and robust methods are needed.

Based on literature surveys, Håvold (2005) found that safety attitudes have strong links with observed safety behavior in an organization also in the shipping industry. For measuring management attitudes he uses six questions, of which four relate directly to onboard management. Cooper (2002, p.31) argues that "observable degree of effort" in improving safety can be used as a measure in any organization, instead of accident and incident rates. He also argues that setting challenging goals for improvement helps the performance of the organization once the challenge has been accepted by its members. In aviation, it has been noted that regular access to safety information improves performance (Lee et al. 2005, p.3). On the other hand, Petersen (2003b, p. 32) refers to similarity of errors irrespective of the field of application, e.g. medical, aviation, or industrial.

The influential factors that concern top management, and could be used in assessments, are discussed in Räisänen (2009). A sample from Cox and Cheyne (2000), Fernández-Muñiz et al. (2007), Grote and Küntzler (2000), Health and Safety Executive (2008), Håvold (2005), Mearns et al. (2003), Lee and Harrison (2000), Rundmo and Hale (2003) is collected below. For assessment, the survey topics below can be expressed as statements and scaled e.g. by Likert scale, or as questions that require answering by numbers or narratives. The statement can be either positive or negative, and naturally this can be used for cross-examining the opinions.

Firstly, some positive statements:

- Senior management are genuinely concerned about the health and safety of their employees.
- Members of management are often in the plant and discuss safety with plant personnel.
- Safety proposals are welcomed during safety meetings, and are swiftly implemented.
- Safety is a work requirement and a condition for contracting.
- My company will stop work due to safety concerns, even if it means they are going to lose money.
- Management is aware of the safety problems in the organization.
- Management act decisively when a safety concern is raised.
- Managers consider that employees' participation, commitment and involvement is fundamental in reducing accident rate.
- Managers and supervisors express concern if safety procedures are not adhered to.
- There are sufficient written procedures, checklists etc., to ensure safety of plant operation.
- Employees are given enough training to do their work tasks safely.

Secondly, some questions that can be used to attain narratives or numerical values for comparisons:

- How frequently did senior managers conduct health and safety tours on the site?
- How frequently did senior managers attend health and safety meetings on the site?
- Are health and safety issues on the agenda at all routine meetings? Where are they in the agenda?
- How are managers held accountable for their health and safety performance?

Thirdly, some negative statements:

- Involvement in accident prevention is time-consuming.
- My company's procedures are only there to cover the management's backs.
- Management act only after accidents have occurred.
- Sometimes it is necessary to depart from safety requirements for production's sake.
- I am sometimes made to feel that I am not paid to think.
- The rules are too strict and I can work without them.
- Some health and safety rules and procedures are not really practical.
- If you say too much about safety, they might fire you.
- Minor accidents cause so much hassle they are quite often ignored.

It is noticeable from the lists above that some numerical metrics are possible, and that surveying the attitudes of managers and their subordinates can be carried out for comparisons and benchmarking.

4 OBSERVED KEY RISK CATEGORIES AND DEVELOPMENT AREAS

The management perception of key risks in some Finnish and Åland shipping companies was sought through interviews and interactions with a sample of top managers during 2009 and 2010 (Räisänen 2010). During the interactions to study the key risks, interviews were conducted, suggestions of improvement were made and possibilities for 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. Altogether 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.

The views of top managers of Finnish shipping companies on risks of their industry are important, as they help to focus research efforts and give a view on the managers' perception of risks. 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. The risk categories belong to generalized groups of technical risks, organization-related risks and risks due to individual employees, but many overlap. This is illustrated in Figure 1.

In the following, the main findings of key risk categories are discussed shortly. Further, it was found that each risk category offers interesting possibilities for further research, some of which are listed below.

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 towards safety, rendering it as an "operational issue" that is not relevant for investors. However, in cases where

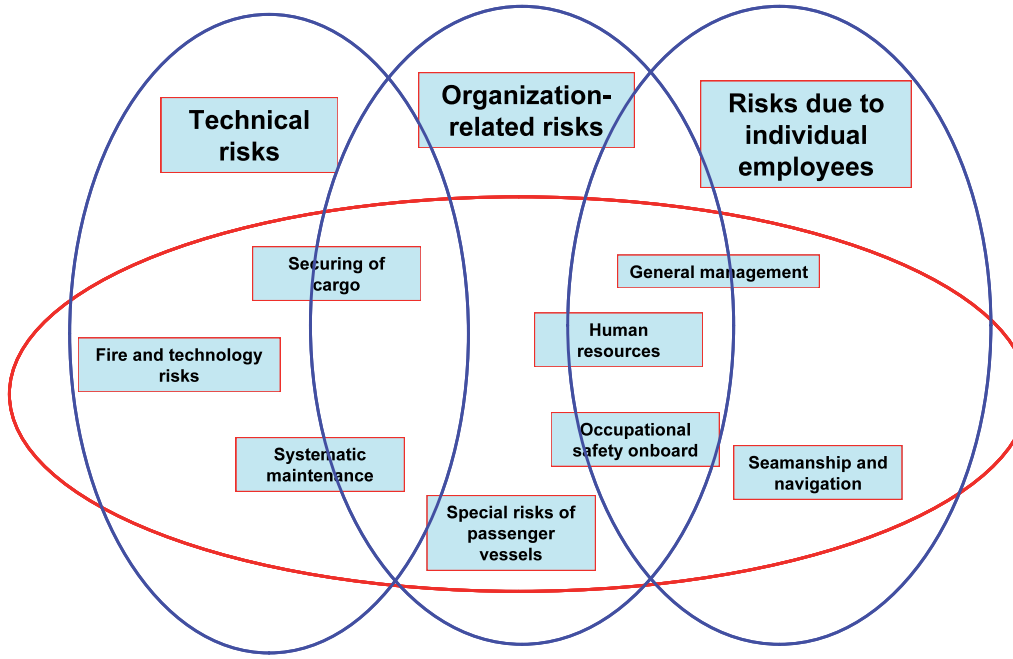

FIGURE 1. *Observed key risk categories related to three generalized risk groups.*

investors were reported to having affected the work of operational management, it was found that the owners can have a significant positive or negative effect on safety in a shipping company, e.g. in attitudes towards safety or in 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.

For future research, the safety behavior of top managers and their relation to risk-taking is an interesting topic. The personal qualities that are needed of a top executive running a dynamic business and managing safety may be conflicting. Running a business requires a risk-taking ability and a tolerance of uncertainty, which may compromise efficient safety management.

There are several parties outside the active management of shipping companies that are able to affect safety onboard. These effects, such as the influence of company owners, can form interesting research topics for the future. For example, it is known that safety budgets can vary greatly under different flags and between companies depending on ownership, which could be studied and for which useful minimum limits could be established. Also clients can be influential, as in oil transport, which provides opportunities for benchmarking carriers of other cargo types.

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 companies' operations.

The managers were acutely aware of the risks related to recruiting. In Finland, acquiring suitable deck and machinery personnel was recognized to be 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. Relating to this background, recruiting and workload-related research could prove beneficial.

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, the forms of collaboration between several companies 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) regarding safety issues. In general the comments were positive, but wishes for increased capacity in proactive and advisory services were recorded.

In the field of seamanship and navigation, technical development causes requirements for research. For example, increased usage of Automatic Identification System (AIS) on ships and increased traffic control requires new skills and adaptability of the crew, which could be studied closer.

FIRE AND TECHNOLOGY RISKS

Fire risk was also 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 they are dealt with a systematic approach in some companies.

For onboard fires, there exists an extensive body of knowledge and several fields of research are active. Also in this field, technical development opens new research chances. E.g. the costs of remote sensing and thermal imaging have decreased, providing opportunities for surveillance and the personal protective gear of firemen. However, research on avoidance of fires in general needs to focus on human and organizational factors as before.

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, e.g. 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, in other words choosing suitable methods that depend on the client and their actions.

As the world and traffic patterns are changing, also the security issues onboard change. Therefore, the work and procedures of security personnel would provide good opportunities for beneficial research.

SYSTEMATIC MAINTENANCE

According to the interviewees, systematic maintenance was one of the key development areas. Those with technical and navigational background had rather similar views on which systems are the most critical onboard. Particularly the main engine, auxiliary engines, bow thrusters, steam production equipment (with heavy fuel oil), searchlights, electronic charts, automation systems, navigational systems, the rudder, 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. Further research topics could be found is training procedures of new technical systems and the workload of maintenance systematization.

Preventive maintenance and intelligent diagnostics were considered by many of the interviewees to offer possibilities for future development and research. 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 of 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 on 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.

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 there are visible leaks. 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 worsen 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 also 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 the specified lashing loads. Further refinement with simple container loading manuals could be managed similarly in case of bulk cargoes, where a simple manual of the most common cargoes for the ship is used with further references in the Internet.

To promote further development in cargo safety, a working group on cargo safety (acronym LASTU) has been formed by transport stakeholders in Finland, promoting development and providing topics for further research.

OCCUPATIONAL SAFETY ONBOARD

Development of occupational safety onboard was seen as important by the interviewees, as injuries are not unknown in the industry. Typical causes for severe accidents 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 like lathe, ropes or jamming of body extremities are common. For passenger vessels, risks in galleys are also typical.

In addition to personnel injury and the associated grief, the companies suffer from 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, as 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 RESULTS OF THE BENCHMARKING STUDY REGARDING OCCUPATIONAL SAFETY

During the interactions with the shipowners, benchmarking and sharing of information were suggested for all key risks. Co-operation was found to be easiest in regard to occupational safety. An analysis was carried out to map out the safety levels of the participants. Some passenger and cargo ship owners were approached and asked to provide occupational and free time incident information as well as work hour data, which were all pooled to form a database, out of which certain statistics were calculated for benchmarking. The database comprised 1145 work accidents onboard during the years 2005–2009 totaling in 24 million work hours on 55 vessels. The number of work accidents was compared to the information from international shipping and oil business, as well as to some general data published by the Finnish Federation of Accident Insurance Institutions (FAII).

Significant development possibilities were discovered in the benchmarking study of the occupational safety statistics. Currently, the 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 their application practical, and budget limitations in mind. As a result, a confidential exchange and analysis of occupational safety incidents between shipowners has been 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, since 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 1).

TABLE 1. *Work categories of the occupational safety analysis.*

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

When the general results of the industry 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.

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 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 more prominent. It should be noted, however, that the number of accidents and the hours in some work categories were rather low notable for proper statistical significance. For practical development work, they can be deemed to be sufficient.

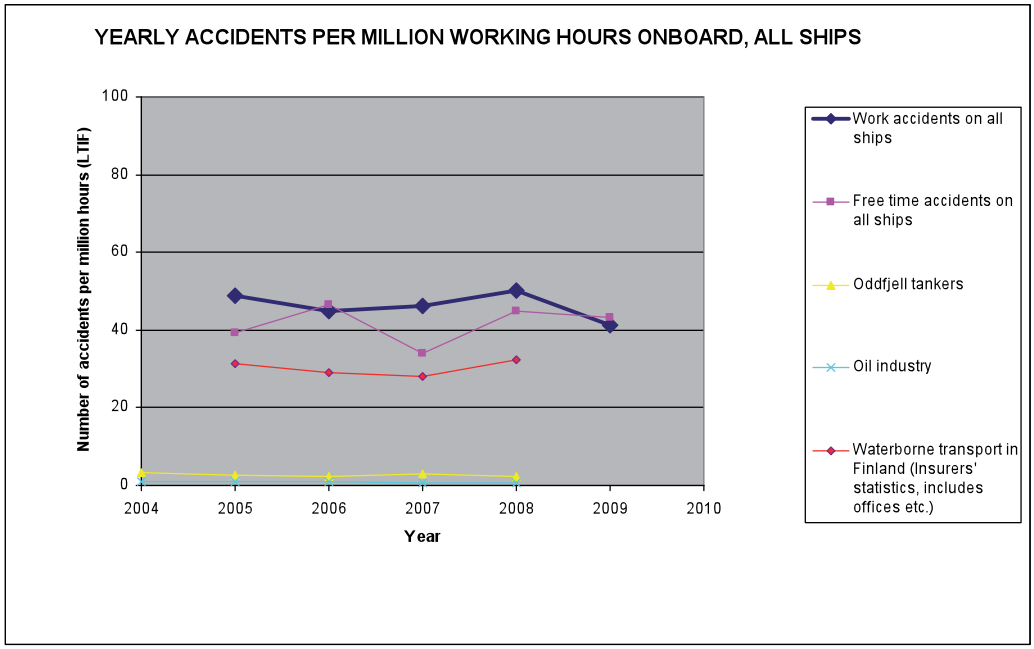

FIGURE 2. *Accidents per million working hours onboard for some Finnish shipping companies 2005–2009.*

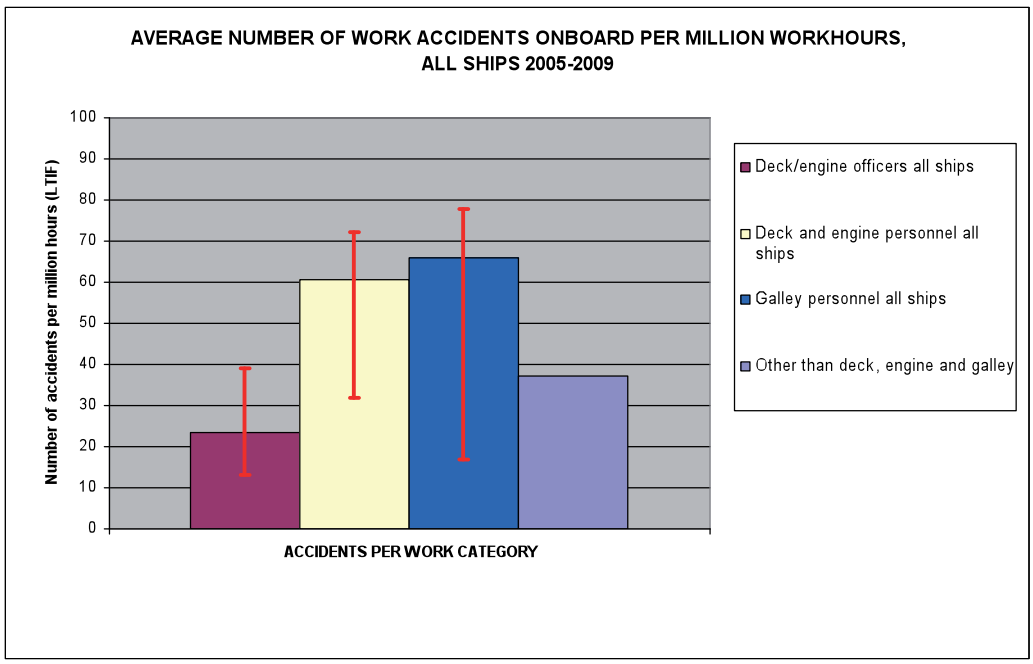

FIGURE 3. *Accidents per work category per million working hours, all vessels 2005–2009.*

6 CONCLUSION

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 influencing safety culture can be distilled from organizational 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 even more detail, as the organization's perception of its safety culture is crucial, and the management creates it through vision, 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.

Fruitful possibilities for improving safety were found among the Finnish and Åland 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. For all key risk categories, further development and research topics were identified. Of these, the occupational safety onboard was studied in further detail, and the work will be continued in a future project.

In particular, the accident rates of the participants from years 2005–2009 were analyzed. They were found to be larger than in the oil industry, which is not surprising, as it is known for its very low accident rates. However, this benchmarking provides a fruitful starting point for general safety development. Further, the differences between occupational groups of some companies were also noted as significant, which provides a good starting point for mutual development of safety details. Particularly, the work safety of deck/engine personnel and galley personnel for all ships, as well as security personnel for passenger vessels, will surely benefit from safety benchmarking and consequent development. The information relating to vessel types that was compiled for the companies during the analysis will also aid in further development.

The accident rates in shipping 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, I believe that particularly the work safety of deck/engine personnel and galley personnel for all ships as well as security personnel for passenger vessels will benefit from 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.

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