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UTILIZATION OF INCIDENT REPORTING IN THE FINNISH MARITIME INDUSTRY

Anne Vepsäläinen

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Käyntiosoite / Visiting address:
ICT-talo, Joukahaisenkatu 3-5 B, 4.krs, Turku

Postiosoite / Postal address:
FI-20014 TURUN YLIOPISTO

Puh. / Tel. +358 (0)2 333 51
Fax +358 (0)2 281 3311
http://mkk.utu.fi

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FOREWORD

Marine traffic is expected to increase rapidly in the future, both in the Baltic Sea and in the Gulf of Finland. As the number of vessels in the area increases, so does the risk of serious marine accidents. To help prevent such accidents in the future, the International Maritime Organization (IMO) has put forth the International Safety Management Code (the ISM Code), which aims to improve the safety of the vessels by requiring proactive attitude and involvement both from top management and operational workers in the shipping companies.

This report has been prepared as part of the METKU project Developing maritime safety culture that was carried out in the Kotka Maritime Research Centre in 2008–2010. The research partners were Aalto University, University of Turku, 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, City of Kotka and private companies. The report was written by B. Sc. Anne Vepsäläinen and M. Sc. Jouni Lappalainen.

In the METKU project, a cross-sectional approach was adopted to analyze whether the ISM Code has actively enhanced maritime safety in the Gulf of Finland. Moreover, the objective of this particular project report was to find out the IMO's attitude towards incident reporting, to establish a theoretical framework of reference in incident reporting, and to observe how reporting is actually being employed on the seas. Existing incident reporting systems were also researched.

A central finding in the present report is that existing incident reporting focuses mostly on information flow away from the ship, whereas the backward information flow is much less planned and monitored. Furthermore, there is a technical approach and a social approach to 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 incident reporting, these two approaches should be bridged.

The Centre for Maritime Studies of the University of Turku expresses its gratitude to all parties who have contributed to the making of this report.

Kotka 12th August, 2010

Ulla Tapaninen
Professor
Centre for Maritime Studies

ABSTRACT

Marine traffic is expected to increase rapidly in the future, both in the Baltic Sea and in the Gulf of Finland. As the number of vessels in the area increases, so does the risk of serious marine accidents. To help prevent such accidents in the future, the International Maritime Organization (IMO) has put forth the International Safety Management Code (the ISM Code), which aims to improve the safety of the vessels. The second work package of the Development of maritime safety culture (METKU) project investigates the effects of the ISM Code and potential areas of improvement in maritime safety.

The first phase in the work package used a literature review to determine how maritime safety culture could be improved. Continuous improvement, management commitment and personnel empowerment and motivation were found to be essential. In the second phase, shipping companies and administrators were interviewed. It was discovered that especially incident reporting based on continuous improvement was felt to be lacking. This third phase aims to take a closer look at incident reporting and suggest improvements based on the findings.

Both the IMO and national legislation encourage shipping companies in incident reporting, and on the national level a shared incident reporting system (ForeSea) is being pushed forward. The objective of this research project was to find out the IMO's attitude towards incident reporting, to establish a theoretical framework of reference in incident reporting, and to observe how reporting is actually being employed on the seas. Existing incident reporting systems were also researched. The study was carried out using a literature review and the results previously gathered in interviews. The results of phase two were elaborated further for themes relating to incident reporting.

According to the findings of this research, the theoretical background of incident reporting dates back to the early 20th century. Although some theories are widely accepted, some have also received criticism. The lack of a concise, shared terminology poses major difficulties in maritime incident reporting and in determining its efficiency. A central finding is the fact that existing incident reporting focuses mostly on information flow away from the ship, whereas the backward information flow is much less planned and monitored.

In incident reporting, both nationally and internationally, stakeholders are plenty. The information produced by these parties is scattered, however, and thus not very usable. Based on this research, the centralizing of this information should be made a priority. Traditionally, the success of incident reporting has been determined statistically, from the number of reported incidents. Yet existing reporting systems have not been designed with such statistical analysis in mind, so different methodologies might yield a more comprehensive view. The previous findings of seafarers and management (including shipping companies and administration) having differing views on safety work and

safety management were backed up by the results of this study. Seafarers find seamanship and storytelling important, while management wants a more systematic and broad approach on safety matters.

The research project was carried out by the Centre for Maritime Studies of the University of Turku, in the Kotka unit (Maritime Logistics Research), with coordination by the Kotka Maritime Research Centre. The major financiers of the project were the European Union and the city of Kotka. The financing authority was the Regional Council of Päijät-Häme. Partners in the project were the shipping companies Finnlines Oyj, Kristina Cruises Oy, Meriaura Oy and VG-Shipping Oy, and the ports of Helsinki, Kotka and Hamina. The partners provided both funding for the project and information for the research.

TIIVISTELMÄ

Meriliikenteen on ennustettu kasvavan voimakkaasti tulevaisuudessa koko Itämeren alueella, myös Suomenlahdella. Liikennöivien alusten määrän kasvaessa, myös vakavien merionnettomuuksien riski kasvaa. Ennaltaehkäistäkseen tulevaisuuden vakavia merionnettomuuksia Kansainvälinen merenkulkujärjestö IMO on asettanut kansainvälisen turvallisuusjohtamissäännöstön (ISM-säännöstö). ISM-säännöstön tavoitteena on kehittää alusten turvallista toimintaa. Merenkulkualan turvallisuuden parantaminen (METKU) –projektin työpaketissa kaksi tutkitaan tämän säännöstön vaikutusta sekä etsitään kehittämiskohteita merenkulun turvallisuuden parantamiseksi.

Ensimmäinen vaihe työpaketissa kartoitti kirjallisuuden perusteella kuinka turvallisuuskulttuuria voidaan kehittää merenkulussa. Keskeisimmiksi tavoiksi nimettiin jatkuva parantaminen, johdon sitoutuminen sekä miehistön aktivoiminen ja motivointi. Toisessa vaiheessa haastateltiin varustamoita ja viranomaisia, jolloin saatiin selville, että erityisesti jatkuvaan parantamiseen perustuvassa poikkeamaraportoinnissa koetaan olevan puutteita. Tämän, kolmannen vaiheen tarkoituksena on tarkastella lähemmin poikkeamaraportointia ja antaa suosituksia löydösten perusteella.

Niin IMO kuin kansallinen lainsäädäntökin kannustavat varustamoita poikkeamaraportointiin ja kansallisella tasolla on panostettu yhteisen poikkeamaraportointijärjestelmän (ForeSea) käyttöönottoon. Tämän tutkimuksen tavoite on selvittää IMO:n näkökanta poikkeamaraportointiin, mikä poikkeamaraportoinnin teoreettinen viitekehys on sekä selvittää miten merenkulku on ottanut raportoinnin käyttöön. Lisäksi selvitettiin minkälaisia poikkeamaraportointijärjestelmiä on jo olemassa. Tutkimus suoritettiin kirjallisuustutkimuksella sekä käyttämällä edellisessä vaiheessa kerättyä haastatteluaineistoa. Haastattelututkimuksen poikkeamaraportointiin liittyviä teemoja syvennettiin.

Tutkimuksen tulosten perusteella poikkeamaraportoinnin teoreettinen tausta on edellisen vuosisadan alkupuolelta. Vaikka taustalla vaikuttavat teoriat ovatkin joiltain osin yleisesti hyväksytty, osa on saanut myös kriittistä arvostelua. Merenkulussa poikkeamaraportointia ja sen vaikuttavuuden mittaamista vaikeuttaa liian laaja, yhtenäistämätön termistö. Tutkimuksen keskeinen löytö olemassa olevista poikkeamaraportoinneista on, että niissä tiedon kulussa on panostettu erityisesti laivalta poispäin tapahtuvaan tiedonsiirtoon. Palaavan tiedon kulku on taas vähemmän suunniteltua ja seurattua.

Poikkeamaraportoinnissa, niin kansainvälisesti kuin kansallisestikin, eri toimijoita on runsaasti. Eri toimijoiden tuottama tieto poikkeamista on kuitenkin hajallaan, jolloin sen hyödynnettävyys ei ole parhaimmillaan. Tutkimuksen perusteella ehdotetaankin, että näiden tietojen yhteen saattaminen pitäisi ottaa tavoitteeksi. Poikkeamaraportoinnin onnistumista on tutkittu perinteisesti tilastollisesti selvittämällä raportoitujen

poikkeamien määrää. Olemassa olevia raportointijärjestelmiä ei ole kuitenkaan suunniteltu tällaisten tutkimusten tekoon, joten erilaisilla arviointimenetelmillä voitaisiin saada kokonaisvaltaisampi kuva. Tutkimuksen tulokset tukivat aikaisempia havaintoja siitä, että merenkulkijoilla ja hallinnolla (sekä varustamot että viranomaiset) on erilaiset käsitykset turvallisuusjohtamisesta ja -työstä. Merenkulkijat kokevat merimiestaidon ja keskusteluun pohjautuvan turvallisuustyön tärkeäksi kun taas hallinto haluaa tehdä turvallisuustyöstä systemaattisempaa ja varustamon sisäisen toiminnan ylittävää.

Tutkimus tehtiin Turun yliopiston Merenkulkualan koulutus- ja tutkimuskeskuksen Kotkan yksikössä (Merenkulun logistiikan tutkimus) ja projektia koordinoi Meriturvallisuuden- ja liikenteen tutkimuskeskus. Projektin tärkeimpiä rahoittajia olivat Euroopan Unioni sekä Kotkan kaupunki. Taloushallinnosta vastasi Päijät-Hämeen liitto. Projektin muina yhteistyökumppaneita toimivat varustamoista Finnlines Oyj, Kristina Cruises Oy, Meriaura Oy ja VG-Shipping Oy sekä satamista Helsingin satama, Kotkan satama ja Haminan satama. Yhteistyökumppanit tukivat projektia sekä rahallisesti että antamalla tutkimustietoa.

TABLE OF CONTENTS

ABBREVIATIONS AND DEFINITIONS

AIBF	Accident Investigation Board of Finland
CHIRP	Confidential Hazardous Incident Reporting Programme
DP	Designated Person i.e. the ISM responsible officer of the shipping company
EMCIP	European Marine Casualty Information Platform
EMSA	European Maritime Safety Agency
EU	European Union
ESAW	European Statistics on Accidents at Work
FAII	Federation of Accident Insurance Institutions
ForeSea	(The Finnish) Information system of maritime accidents, near-misses and incidents
GISIS	Global Integrated Shipping Information System
IFWA	Investigation and reporting of fatal workplace accidents
ICC	IPSO Classification & Control Ab
IMO	International Maritime Organization
Insjö	Informationssystemet om incider i sjöfarten [(The Swedish) Information system of maritime incidents]
ISM Code	International Safety Management Code
MARS	Mariners' Alerting and Reporting Scheme
METKU	Research project Merenkulun turvallisuuskulttuurin kehittäminen [Development of maritime safety culture] during the years 2008–2010
Nearmiss.dk	(The Danish) Knowledge base of near-misses and unintended events at sea
Trafi	The Finnish Transport Safety Agency

1 INTRODUCTION

1.1 Background of the study

Among the major accidents that occurred in the late 1980s, the accident of the Herald of Free Enterprise triggered concern about maritime safety culture among international maritime authorities. This concern led the International Maritime Organization IMO to start to develop common shipping management guidelines for the maritime industry. As a result, the IMO provided an international safety management (ISM) code.

The purpose of the Development of maritime safety culture (METKU) project is to study how the ISM Code has influenced the safety culture in the maritime industry. The project aims to find the best practices for the shipping companies while improving their operations by implementing and developing their safety management systems. The project consists of five different work packages and each of them is conducted by a responsible research unit.

The METKU work packages:

- WP1: Statistical measurements of maritime safety. Aalto University School of Science and Technology, Ship Laboratory.
- WP2: Evaluation of the performance of safety management systems in Finnish shipping companies. University of Turku, Centre for Maritime Studies.
- WP3: Comparing ISM – OSHAS practices in shipping companies and port operation. Kymenlaakso University of Applied Sciences, Maritime Studies.
- WP4: Exploring the best practices in shipping companies. Turku University of Applied Sciences, Ship Laboratory.
- WP5: Safety management practices in Finnish maritime and port authorities. Kymenlaakso University of Applied Sciences.
- WP0: Project management and communications. Kotka Maritime Research Centre.

This report is part of the work package two. The research was carried out by the Centre for Maritime Studies of the University of Turku, in the Kotka unit (Maritime Logistics Research) in and with coordination by the Kotka Maritime Centre. Partners in the project were a group of shipping companies and three major ports. The partners provided both funding for the project and information for the research. The major financiers of the project were the European Union and City of Kotka. The financing authority was the Regional Council of Päijät-Häme. The partners are listed below:

- VG-Shipping Oyj
- Meriaura Oy
- Kristina Cruises Oy

- Finnlines Oyj
- Port of Hamina
- Port of Helsinki
- Port of Kotka
- European Union's Regional Development Fund
- Regional Council of Päijät-Häme
- City of Kotka

1.2 Aims, methods and structure of the report

This report is the third intermediate report in the Development of maritime safety culture project. The aim of the study is to take a closer look at incident reporting and suggest improvements based on the findings. Because the earlier interview study made in the METKU research project revealed that the Finnish shipping companies have not been able to fully implement incident reporting and analyzing as a way to continuous improvement, which is one of the core targets of the ISM Code (Lappalainen & Salmi 2009), it was considered important to closely examine the premises of incident reporting.

In this report, the following research questions are examined:

- What is IMO's point of view on incident reporting?
- How is incident reporting regulated on a national and on an international level?
- What is the theoretical framework behind incident reporting, in other words, on which premises does the motivation for reporting arise?
- How is the reporting actually being employed on the seas according to literature and interviews?
- What kind of incident reporting systems are there already in use?

The study is carried out using a literature review and the results previously gathered in the interview study. Particularly the previous reports prepared as part of the same work package of this project are used (Lappalainen 2008; Lappalainen & Salmi 2009) In addition, relevant research literature, stakeholders' internet pages, and seminar and conference publications are used.

The report is structured in a customary manner. Foreword, abstract in English, abstract in Finnish, table of contents, and abbreviations and definitions can be found in the beginning before the actual research content. In **chapter 2,** basic definitions, incident reporting regulations, incident reporting systems and underlying theories of incident reporting are examined. In **chapter 3,** one type of external incident reporting – accident investigation – is studied more closely. In **chapter 4,** the means of measuring the impact of incident reporting are researched, and then the utilization of the systems is described,

first based on research literature and then according to interviews made in the project. **Chapter 5** is the final chapter, in which the main findings of the research are summarized in the conclusions and discussion. In this chapter, some proposals are also suggested.

2 INCIDENT REPORTING

In this report, the word "incident", if not mentioned otherwise, is used as an umbrella term to refer to any deviation in normal procedures, ranging from, for example, unsafe practices to near-misses or from injuries to accidents. Incident reporting, then, is reporting such a case. In some research articles, the word incident is used as a synonym for the word near-miss. In most cases, the distinction can be made according to the context.

Incident reporting, then, means reporting – either written or oral – of any such event that is considered an accident or a near-accident. Incident reporting can be either internal or external. Internal reporting means that the reports are made inside the company and also used only inside, whereas external reporting means that the reports are distributed also outside the company or that the reports are completely made by an outsider. Incident reporting systems are computerized, often web-based, software for reporting.

In this chapter, first the basic definitions are explained, then regulations, both the Finnish legislation and IMO's resolution, are briefly examined. After that, existing incident reporting systems, internal systems, national reporting systems, and international reporting systems of maritime industry, are presented.

2.1 Basic definitions

The terminology concerning incidents is broad. This subchapter explores some of the essential terms of incident reporting, as defined by IMO. The end of the chapter provides a summary of the effects that the definitions have and answers the question why it is important to recognize them.

IMO defines a **near-miss** case as a chain of events, which could have led to a loss. An actual loss is prevented only by a fortunate break in the chain of events. The unrealized loss might be, for example, an injury, environmental harm or a negative impact to business. (IMO 2008a)

According to IMO, a **marine casualty** means an event that has resulted in any of the following:

1. Death of, or serious injury to, a person.
2. Loss of a person from a ship.
3. Loss, presumed loss or abandonment of a ship.
4. Material damage to a ship.
5. Stranding or disabling of a ship, or the involvement of a ship in a collision.
6. Material damage to marine infrastructure external to a ship, which could seriously endanger the safety of the ship, another ship or an individual.

7. Severe damage to the environment, or the potential for severe damage to the environment, brought about by the damage of a ship or ships. (IMO 2008b)

Very serious casualty is, according to IMO, an accident faced by a vessel, which leads to loss of the vessel, to fatality or to serious pollution (IMO 2008c).

According to IMO, **serious casualty** means a casualty, which does not fall into category of very serious casualty. In serious casualties there might be, for example, a fire, explosion, collision, grounding or an accident caused by ice. In order to fulfill the characteristics of serious casualty, there has to be serious injury to the vessel or contamination of the environment and/or need for towing or other help from land. (IMO 2008c)

Less serious casualties are, according to IMO, casualties that do not fall into categories of very serious or serious casualty. Less serious casualties also include, for the purpose of recording useful information, marine accidents, which include hazardous incidents and near-miss cases. (IMO 2008c)

Non-conformity means a detected situation, where the objective evidence shows that specified requirements have not been fulfilled (IMO 2002).

Major non-conformity means a deviation, which is a threat to the safety of the employees or the vessel, or a severe risk to the environment, and it requires immediate remedial action. Major non-conformity also includes the lack of systematic and effective enforcement of the ISM Code. (IMO 2002)

The ISM Code urges to report and analyze non-conformities, accidents and **hazardous occurrences** (IMO 2002). Later, in the circular Guidance on near-miss reporting IMO specifies that hazardous occurrence is the same as a near-miss (IMO 2008a).

According to IMO a **marine incident** means an event, other than a marine casualty, which has occurred directly in connection with the operations of a ship that endangered the safety of the ship, its users or the environment (IMO 2008b).

In incident reporting investigations and in literature, the most essential terms are **accident** and incident. According to the research undertaken for this report, it does not seem that IMO, in its guidelines or codes, defines the term accident. Despite the lack of defining this term, it can be found in IMO's own texts (for example in the ISM Code).

An **injury** means accident suffered by a person. A serious injury is, according to IMO, an injury resulting in inability to function normally for more than three days (IMO 2008b).

The above is a brief summary of how IMO defines different terms which are related to incident investigation and reporting and found in guidelines, circulars and resolutions

that IMO has issued. There is altogether approximately ten different terms that IMO uses in its precepts and of those terms many overlap. Maritime safety has obviously the essential problem of broad terminology, which has not yet been standardized. This inconsistency can have a negative impact on reporting, because if one does not know, for example, what is meant by a near-miss, it is hard to report such an occasion.

It can be assumed that IMO has noted this problem, because for example in its circular letter Guidance on near-miss reporting IMO states that the best benefit for reporting of near-miss cases cannot be achieved until everyone understands the definition of the term (IMO 2008a). Intelligible to non-experts and a practical way of explaining what is meant by a certain term is to give a few examples of such a case. This is done in the Guidance, and hopefully the same approach is in the future applied to other terms as well.

Furthermore, the inconsistent and situation-specific usage of terms causes a fundamental problem when trying to compare different researches and statistics made on safety management. Hubbard & Neil (1986) and Jones et al. (1999) have also drawn this same conclusion.

2.2 Incident reporting regulations

Maritime incident reporting is decreed in the Finnish law and IMO's regulations. In this chapter these writs are examined briefly.

2.2.1 Occupational Safety and Health Act

Occupational Safety and Health Act is one of the basic laws of Finnish working life. The act was revised in the beginning of the year 2003, and it replaced the old act from 1958, which had been amended many times (Salminen et al. 2007). The new act states that the employers should systematically and adequately analyze and identify the hazards and risks caused by work. Also, the employer should keep these analyses in possession and revise them, if the conditions change essentially. (Occupational Safety and Health Act)

According to Suomaa (2003), this introduction of the safety management model into the everyday activities of a workplace is the biggest reform brought on by this new act. The base of this idea is that safety management should be spontaneous, systematic and persistent. Hence, the Occupational Safety and Health Act demands that all Finnish companies have some kind of a reporting scheme – otherwise identifying emerging risks is impossible.

2.2.2 ISM Code

For the safe operation of vessels and pollution prevention, the International Maritime Organization (IMO) issued an International Safety Management Code (the ISM Code). The ISM Code came into being in November 1987 from resolution A.596(15) by which IMO's Assembly requested that Maritime Safety Committee urgently develop recommendations for management of ro-ro passenger vessels to guarantee their safe operation. In October 1989, resolution A.647(16), IMO Guidelines on Management for the Safe Operation of Ships and for Pollution Prevention, was developed. This resolution created the basis for the present ISM Code. At this stage, the resolution was still only a guideline, but its contents were much the same as the present ISM Code's. In November 1991, IMO gave its new resolution, A.680(17), which was an updated version of the previous resolution. In November 1993, Guidelines was replaced by resolution A.741(18), which is the same as the current ISM Code. The code was reinforced in December 2000 by resolution MSC.140(73), Adaptation of Amendments to the International Safety Management (ISM) Code. As a summary of these two codes, IMO published the ISM Code in 2002, which is the latest publication at the time this report is being written. The ISM Code came into effect worldwide in several phases in 1998–2002. (IMO 2005)

The aim of the ISM Code is to ensure safety at sea, to prevent injuries and loss of human lives, and to avoid damages to environment, especially the marine environment, and property (IMO 2002). In practice, the ISM Code obligates shipping companies to create their own safety management system to enhance maritime safety culture (Lappalainen 2008). According to IMO, one of the most important ways to do so is to continuously improve the safety management system. IMO also states that the ISM Code is based on general principles and objectives, because two similar shipping companies or congruent sailing conditions do not exist (IMO 2002). IMO also recommends that administrations do not develop their own criteria for the safety management system, so that the shipping companies will not start to order systems from outside but will instead develop the system to suit their own needs (IMO 1995).

The ISM Code briefly states the cases in which the incidents are supposed to be reported to the shipping company and analyzed:

- "The safety management system should include procedures ensuring that non-conformities, accidents and hazardous situations are reported to the Company, investigated and analysed with the objective of improving safety and pollution prevention.
- The Company should establish procedures for the implementation of corrective action." (IMO 2002)

IMO also gives further guidance on ISM-based reporting in the circulars Reporting near misses (IMO 2001) and Guidance on near-miss reporting (IMO 2008a). The ISM Code itself only requires companies to have internal reporting practices. On the other hand, in the other circular (IMO 2008a) it is advised that companies consider whether reports should be disseminated to a wider audience.

In addition, the ISM Code itself does not specify how the incident analysis should be done. In the Guidance on near-miss reporting (IMO 2008a), IMO mentions four main steps as to how near-misses should be investigated. These are:

1. Gathering near-miss information
2. Analyzing information
3. Identifying causal factors
4. Developing and implementing recommendations

In all likelihood, these same steps –at the very least– are regarded to be the substratum of any incident analysis conducted by a shipping company. The IMO hopes that the process of internal near-miss reporting will involve the personnel of the ship reporting near-misses to the designated person and the designated person only passing on such reports in anonymous form. (IMO 2001)

2.3 Incident reporting systems

This chapter will explore the existing reporting systems; first the internal reporting systems, then the national reporting systems, and after that the international reporting systems will be examined. The final subchapter will provide a short summary of the systems.

2.3.1 Internal reporting systems

As noted previously, the ISM Code requires that a company's safety management system include procedures for reporting accidents, non-conformities and hazardous situations. In its guidelines to administrations on implementation of the ISM Code, IMO recommends administrations to limit the criteria in the form of prescriptive management system solutions, because this might lead companies to implement solutions prepared by others (meaning presumably ready-to-use commercial products). This would make it difficult to develop the solutions to suit that particular shipping company (IMO 1995). From this it can be deduced that IMO has a reserved opinion on turnkey safety management products sold to companies.

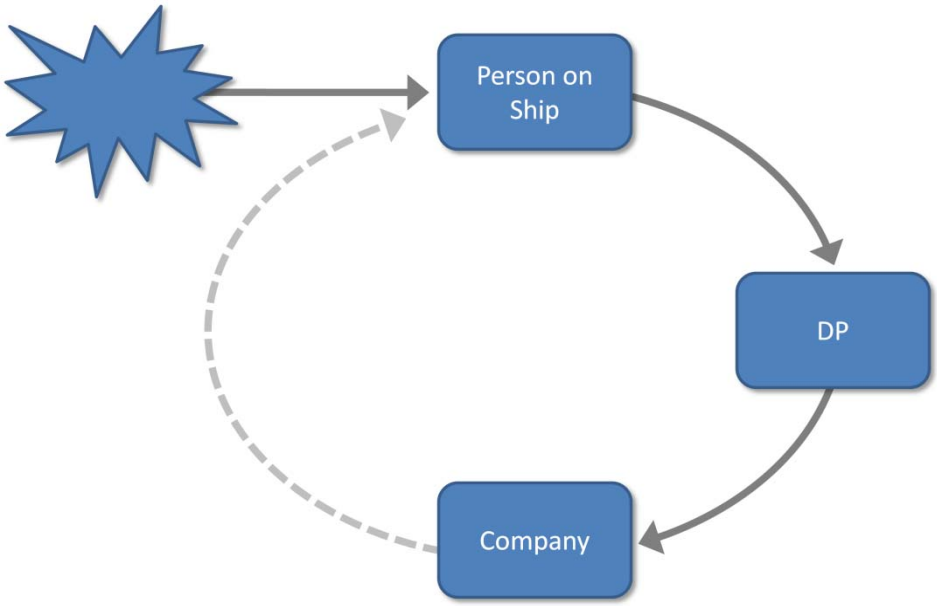

Figure 2.1 Information flow of internal reporting systems

There is hardly any public information available on internal reporting systems. If these reporting systems work according to IMO's plan, the information flow should be similar to the one shown in Figure 2.1 (IMO 2001). Based on the findings of the interview study by Lappalainen and Salmi (2009), the companies are following IMO's guidance in this. In chapter 4.3 of this report, where results of the METKU research project interviews concerning incident reporting are presented, some further findings are mentioned. It should be underlined that the ISM Code does not require the incident reporting to be electronic.

2.3.2 National reporting systems

Finland - ForeSea

The Finnish Transport Safety Agency (Trafi) and ship owners have introduced a Finnish incident reporting system for maritime personnel. The reporting system, ForeSea, was launched in operation in the summer of 2010 using the knowledge gleaned from Insjö (see next subchapter). The system is established and administrated by the same company as Insjö, i.e. ICC (IPSO Classification & Control Ab). (Bråfelt 2010) The database also includes all reports from the Insjö system that have been written in English. In the future, the reports in Swedish will be translated into Finnish and added to the system (Finnish National Reference Group 2010).

The internet form for the incident reporting consists of contact information, type of ship, type of event and event description (ForeSea 2010). Contact information is only used for feedback, and after all of the information is registered the link to the reporter is

deleted. As in the Insjö system, only designated persons of the shipping companies can send a report. Before sending any report, the designated persons need to register as users in the system.

Sweden – Insjö

In Sweden, the Swedish Shipowners' Association together with the Swedish Transport Agency (previously the Swedish Maritime Safety Inspectorate) has developed an incident reporting system, Insjö, to collect information about accidents and near-misses (Insjö 2010). The project started in 1997, and after development and a testing period it was launched for use in 2002 (Bråfelt 2010). Insjö is a web-based application, the use of which is voluntary. All input to the system goes through the ISM responsible officer from each of the shipping companies. After receiving the report, administrator of the system, ICC, erases any information that could make it identifiable.

In the end of May 2010, there were about 2,500 reports in Insjö, of which approximately half were accident reports and the rest near-misses and non-conformities (Insjö 2010). If divided per year, annual reporting pace is a little less than 300. Altogether approximately 80 companies are registered users of the system, which includes, for example, ship owners, catering companies, rescue operators, and maritime schools. (Insjö 2010)

The internet form, which is used to report the incidents, consists only of four open questions (Insjö 2010). Altogether, with contact information, and information on the type of ship and type of event, the report form is no more than one page long.

The data bank consisting of the reports can be used on the same web site where reporting is done. Database is open for anyone who has access to the web. Reports are either in Swedish or in English, depending on the language in which they are reported.

Denmark - Nearmiss.dk

After the Swedish Insjö reporting system was introduced, the same kind of incident reporting system was launched in Denmark in 2007 (Bråfelt 2010). The Danish system, Nearmiss.dk, is funded by Danish Shipowners' Association and administrated by a private consulting company (Nearmiss.dk 2010). At the moment, 19 Danish shipping companies are using the reporting system, and so far the number of reported cases is approximately 1,000. The companies using the system are published on the web site.

Just as Insjö, Nearmiss.dk is also an anonymous reporting system and the reporting always goes through the shipping company's designated person. Maybe the biggest contrast to Insjö, and to many other incident reporting systems as well, is that near-misses and non-conformities are the only collected event types. In addition, to be able to view the reports, one needs to log in to the system. The reason for this limitation is the

need to avoid data being used in inappropriate studies or comparisons. This underlines the fact that the reporting system is only an experience database, and therefore it cannot be used as a source for statistical study. (Nearmiss.dk 2010)

2.3.3 International reporting systems

CHIRP

In the UK, there is an incident reporting system for global maritime and aviation industry called CHRIP. For the maritime industry, the acronym stands for Confidential Hazardous Incident Reporting Programme. The reporting systems are operated by a charitable company and funded by the UK Department of Transport and the Civil Aviation Authority. For the aviation industry, the reporting system was launched in the year 1982, and in 2003 it diversified into the maritime sector at the invitation of the UK Department for the Environment, Transport and the Regions. (CHIRP 2010a)

The reports to the CHIRP are sent by anyone from the maritime industry sector, including the shipping industry, fishing industry and also leisure users (CHIRP 2010b). Reporting is not anonymous, because the authors of the system confirm every report, but full confidentiality is guaranteed throughout the process. The information gained through the reports is disseminated through the quarterly newsletter Maritime Feedback. The publication is free of charge and can be downloaded from the web site www.chirp.co.uk. The newsletter is also distributed as a printed version, roughly 120,000 copies per issue (CHIRP 2010c).

According to Review of the CHIRP Maritime Programme (CHIRP 2010c), conducted by an independent review board, the system receives about 100 reports annually. During the period of July 2008 to June 2009, the sources of reports were as follows: leisure 44%, commercial transport 40%, offshore 5%, fishing 4% and others 7%. In contrast to many other reporting systems, CHIRP does not only distribute the incident data but also follows up individual reports and takes interest in them by giving recommendations. The review board, including representatives, for instance, from Marine Accident Investigation Branch, Maritime & Coastguard Agency and National Federation of Fishermen's Organisations, concluded that there is a continuing need for CHIRP and that measures should be taken to improve it.

MARS

Besides the CHIRP system, there is also another international incident reporting system, provided by the Nautical Institute (MARS 2010). The Nautical Institute is an international nonprofit organization registered in the UK. The Institute is open for all qualified seafarers and others interested in shipping. Some 20 private maritime-related

companies fund the reporting system, MARS, an acronym for Mariners' Alerting and Reporting Scheme.

Reporting to the system can be done both by using an online form on the internet site, or by printing out the form and then sending it to the Institute by mail. The person who reports the incident can be anyone involved in the maritime industry, including commercial, naval and fishing industry and pleasure users (MARS 2010). The form is quite detailed including, for instance, questions on reporter's contact information, ship type, number of officers and crew members, flag state, information about the voyage. In addition, the reported is asked to provide information on time, location and weather conditions of the incident. The description of the accident or near-miss is to be filled out on an open question field. Although personal information is asked for, strict confidentiality is guaranteed. Those reported incidents which can be considered useful knowledge, are published in the Institution's monthly journal Seaways. Seaways is free of charge for those who are members of the Institution, for others it is chargeable.

2.3.4 Summary

If brought together, the different incident reporting systems form an information flow, which starts from the person on ship to designated person, then flows into the internal system and from there either to a national or an international reporting system. And of course there can even be cases where the report is sent to both a national and an international system (see Figure 2.2). This process is well described in the system descriptions. By contrast, the description of the information flow from the systems back to the person reporting the incident is, if not lacking, at least weak in many cases.

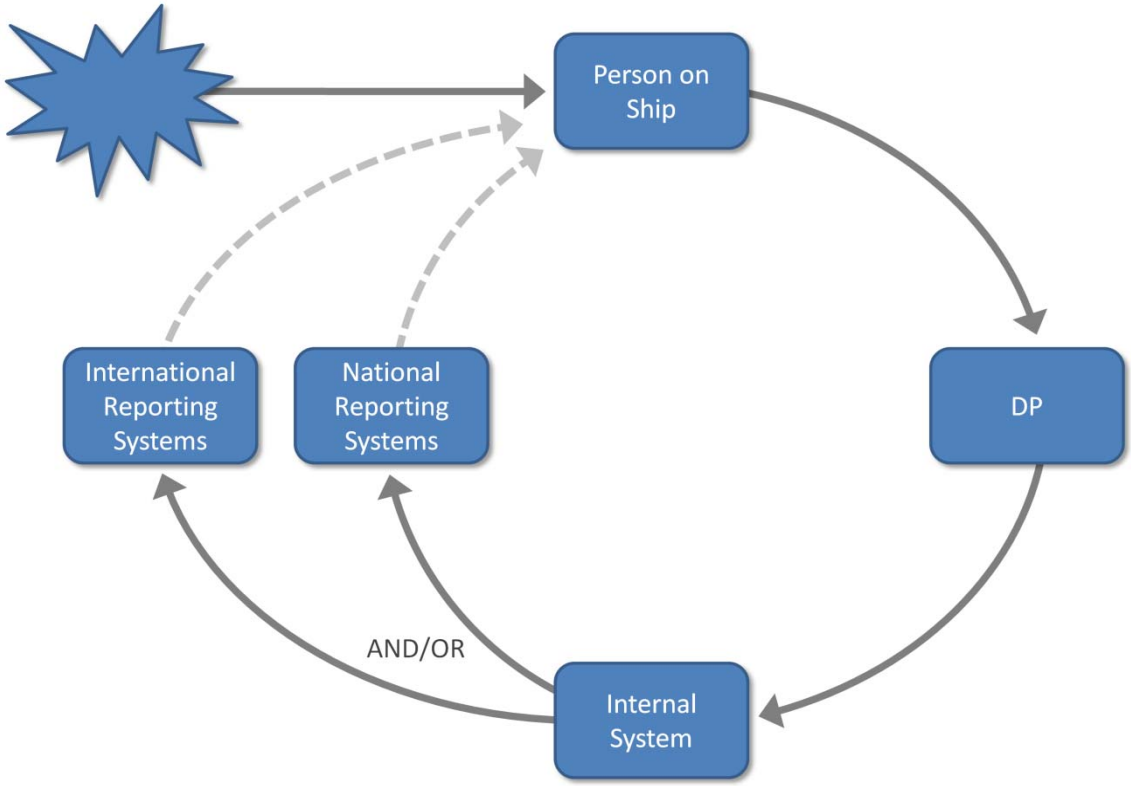

Figure 2.2 Information flow of incident reporting systems

2.4 Underlying theories of incident reporting

When measuring the state of safety and also when improving it, H.W. Heinrich's accident pyramid is often mentioned. In this chapter, this pyramid model will be examined more closely, and its significance will be illustrated by exploring how it has been used to measure and improve safety. The theories presented on the basis of accident pyramid are:

1. Amount of accidents increases from fatal to serious casualties, less serious casualties and to near-miss cases; this is the so-called iceberg model.
2. The situation which leads to an accident is caused by a chain of events, where different reasons inevitably follow each other. This is called the domino theory.
3. Serious and less serious casualties are caused by the same reasons, also known as the identical causation hypothesis. (Heinrich 1959)

2.4.1 Iceberg model

In 1931 Herbert William Heinrich presented a model for accident rations in his book Industrial Accident Prevention. After studying a wide range of accident reports of different American companies, he concluded that for every serious accident there are 29 less serious accidents and 300 near-miss cases. Serious accident, in Heinrich's study,

means an incident, where an insurance company or a federal bureau was informed. Less serious accident means a case, where first aid was needed, and near-miss cases mean that injuries were avoided, but the probability for an injury or property damage was high. (Heinrich 1959)

Heinrich's accident ratio model is often referred to as Heinrich's iceberg model (for example, Saloniemi & Oksanen 1998; Salminen et al. 1992; Sanne 2008). It is also referred to as the safety iceberg (Nielsen et al. 2006) and the accident pyramid.

Many have tested the iceberg model, for example Kines (2002) and Salminen et al. (1992), and it is widely accepted. The only thing that creates dispute is the relation of different accident types to each other (Nielsen et al. 2006). Iceberg model seems to hold true also when looking at Finnish employees' accident and occupational diseases statistics from the years 1996 to 2006 by duration of disability, using the Federation of Accident Insurance Institutions (FAII) definitions (Figure 2.3) (FAII 2008).

Figure 2.3 The iceberg model of occupational accidents in Finland

It should be added that statistically gathered ratio is always dependent on how one defines a serious, less serious or near-miss accident. In addition, the ratio varies between different lines of work because of their different accident risks (Hubbard & Neil 1986).

2.4.2 Domino theory

Out of the accident causation models, perhaps the one most commonly referred to is Heinrich's domino theory, which he proposed on the grounds of the accident pyramid. The domino theory states that for every injury occurrence, four different accident chain parts can be found, which all need to take place, "to fall", for the injury to occur. Occurred injury is the fifth fallen piece of the domino, which precedes wrong guidance from social environment, then fault of a person and unsafe act and/or mechanical or physical hazard, and finally accident and injury (Figure 2.4) (Heinrich 1959). The idea

is much the same as in Reason's "Swiss-cheese" accident model (see, for example, Jalonen & Salmi 2009).

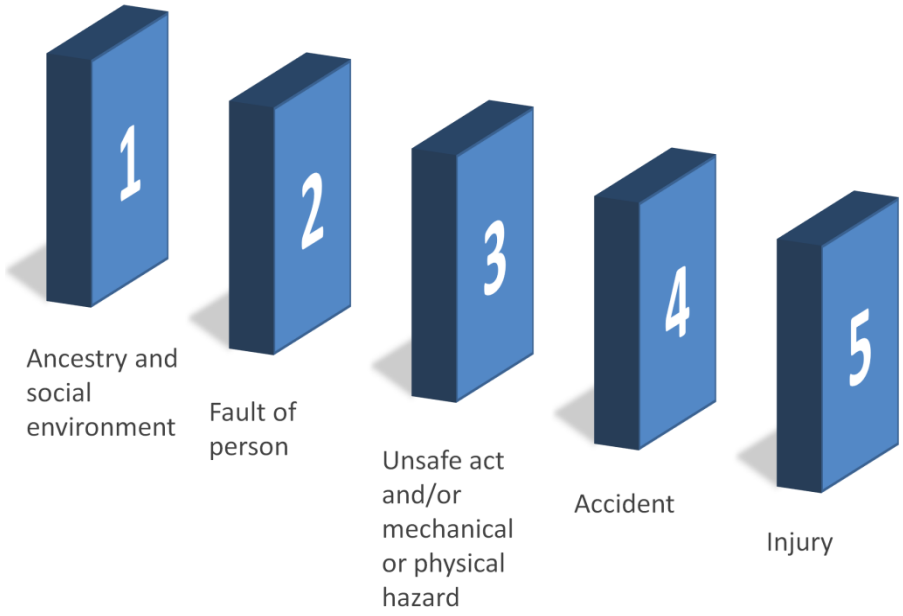

Figure 2.4 Heinrich's domino theory

Salminen (2010) separates from the accident theories represented so far 11 different accident models. Therefore, the domino theory is just one of many represented accident theories. Although the theory was presented almost one hundred years ago, it is still currently in use, for example by Rajala and Väyrynen (2010).

2.4.3 Identical causation hypothesis

Heinrich's third hypothesis on the accident pyramid was that serious and less serious accidents are caused by the same underlying reasons (Heinrich 1959). That is, identical causation hypothesis says that serious and less serious accidents have an identical chain of causes, the fall of dominos, in the background. From this idea a conclusion has been drawn that by studying less serious accident and near-miss cases, useful knowledge can be acquired for the prevention of serious accidents (Jones et al. 1999).

IMO also supports the identical reasons theory on near-miss cases and accidents that have already occurred. IMO's opinion is mentioned in its reporting guideline (IMO 2008a), which states:

> "Learning the lessons from near-misses should help to improve safety performance since near-misses can **share the same underlying causes** as losses." (emphasis added)

By the presumption of similarity between different accident types (serious casualties, less serious casualties and near-miss cases), improvement of safety culture in different industries has begun to focus on near-misses, because their number is relatively higher than that of actual casualties and therefore the data is broader (Zachau 2008).

Despite its broad usage, the identical causation theory has also been criticized. According to Salminen (2010), the identical causation theory has been criticized by Petersen (1971), who states that different reasons are in effect in the origin of serious and less serious casualties. This point of view is called the different accident causation hypothesis. In addition, Carter & Mencel (1985), for example, state that the empirical evidence of the ratio between near-miss cases and actual casualties is weak, and Salminen et al. (1992) have come to the conclusion that the identical causation theory should be replaced by the different accident causation hypothesis. In addition, Kines' (2002) research on men's work-related accidents by falling lends support to the different accident causation hypothesis.

2.4.4 Summary

In maritime safety work, a clear switch can be seen from accident investigation to near-miss reporting. But when the theoretical basis of this change is examined, it is obvious that there are dissenting opinions. In this light, it should be considered how much it is wise to invest on incident reporting as a tool for safety management. Because there are no exact scientifically proved numbers on the relationship between different accident and near-miss types, quantitative studies based on comparison of these relationships should be avoided. The most significant finding about the theories presented is the critique leveled against the identical causation hypothesis. If the different accident causation hypothesis is true de facto, the basis of near-miss reporting becomes questionable.

3 ACCIDENT INVESTIGATION

Accident investigation is closely linked with incident reporting. In point of fact, accident investigation is a type of external incident reporting. In this report, it has been given its own chapter in order to give the reader a more comprehensible view on the subject. First, the accident investigation regulations are examined briefly, then two institutions executing accident investigations are presented, and in the last subchapter investigation report databases are reviewed.

3.1 Accident investigation regulations

Maritime accident investigation is decreed in the Finnish law and IMO's regulations. In this chapter these writs are examined briefly.

3.1.1 Accident Investigation Act and Decree

Investigation of all major accidents, dangerous situations and accidents in maritime, aviation and rail industries is enacted in the Accident Investigation Act and Decree. The purpose of the laws is to improve general safety and prevent accidents. The investigation is commissioned from the Accident Investigation Board of Finland, AIBF, which operates under the Ministry of Justice. The tasks given by the laws to the AIBF, besides the actual investigations, are to keep up the preparedness to start investigations quickly, to keep register on pending and finished accident investigations, to train personnel for commission of inquiries, to give common guidelines on how to investigate accidents and how to make investigation reports, to supervise the financial management of the investigations, to press and distribute reports of investigations and to participate in international cooperation. (Accident Investigation Decree)

Waterborne traffic accidents are investigated by the AIBF when they have occurred in Finland's territorial waters or if a Finnish vessel has been involved in the accident. Also, waterborne traffic incident can be investigated, if it is believed to improve general safety or to prevent future accidents. (AIBF 2010)

3.1.2 Casualty Investigation Code

IMO adopted a mandatory Casualty Investigation Code in 2008 through resolution MSC.255(84) Adoption of the code of the international standards and recommended practices for a safety investigation into a marine casualty or marine incident (Casualty Investigation Code). The new regulation entered into force on 1st January 2010. The Casualty Investigation Code is part of the SOLAS Convention. (IMO 2008d)

The Casualty Investigation Code requires a marine safety investigation to be conducted into every very serious marine casualty, defined as a marine casualty involving the total

loss of the ship or a death or severe damage to the environment. The Code also recommends an investigation into other marine casualties and incidents, by the flag State of a ship involved, if it is considered likely that it would provide information that could be used to prevent future accidents. The Code requires state administrations to conduct these investigations. (IMO 2008d)

3.2 Accident Investigation Board

In Finland, the Accident Investigation Board (AIBF) investigates all major accidents, dangerous situations, and accidents in maritime, aviation and rail industries. Investigation of the accidents and other tasks of the AIBF are imposed in Accident Investigation Act and Decree. These laws also include overall directions on how the categories of the accidents should be investigated and how the methods of investigation should be implemented. The investigation of maritime accidents complies with International Maritime Organization's Casualty Investigation Code (MSC255(84)). (AIBF 2010)

Through its investigation activities, the Accident Investigation Board aims to enhance overall safety and prevent accidents. As a result of an accident investigation, an investigation report is produced that contains safety recommendations for the competent authorities and other parties concerned. In fact, the safety recommendations translate the investigators' views on the means of prevention of similar or corresponding accidents in the future. Moreover, the Accident Investigation Board follows up on the implementation of the recommendations issued. The investigation work conducted by the Board exclusively focuses on the improvement of safety, not with the questions of culpability, responsibility or liability for damages. (Lappalainen & Salmi 2009)

In accident investigations, special attention is paid to the safety management systems of the companies of accident vessels. The purpose of investigating the safety management system is to find out whether the companies have complied with its procedures and whether the safety management systems conform to the requirements of the ISM Code. The safety management system documentation is investigated thoroughly, similarly to the safety records of the accident vessel. The safety records include, for example, previous accident and non-conformity reports, master's review reports and reports of corrective actions. (Lappalainen & Salmi 2009)

Annually, the number of investigated maritime accidents is approximately ten, on top of which there are about ten near-misses (so called other incidents). The investigation reports are distributed to instances involved, and they are also published on the Board's web pages. AIBF is also required to provide the reports to GISIS and in the future also to EMCIP (Figure 3.1).

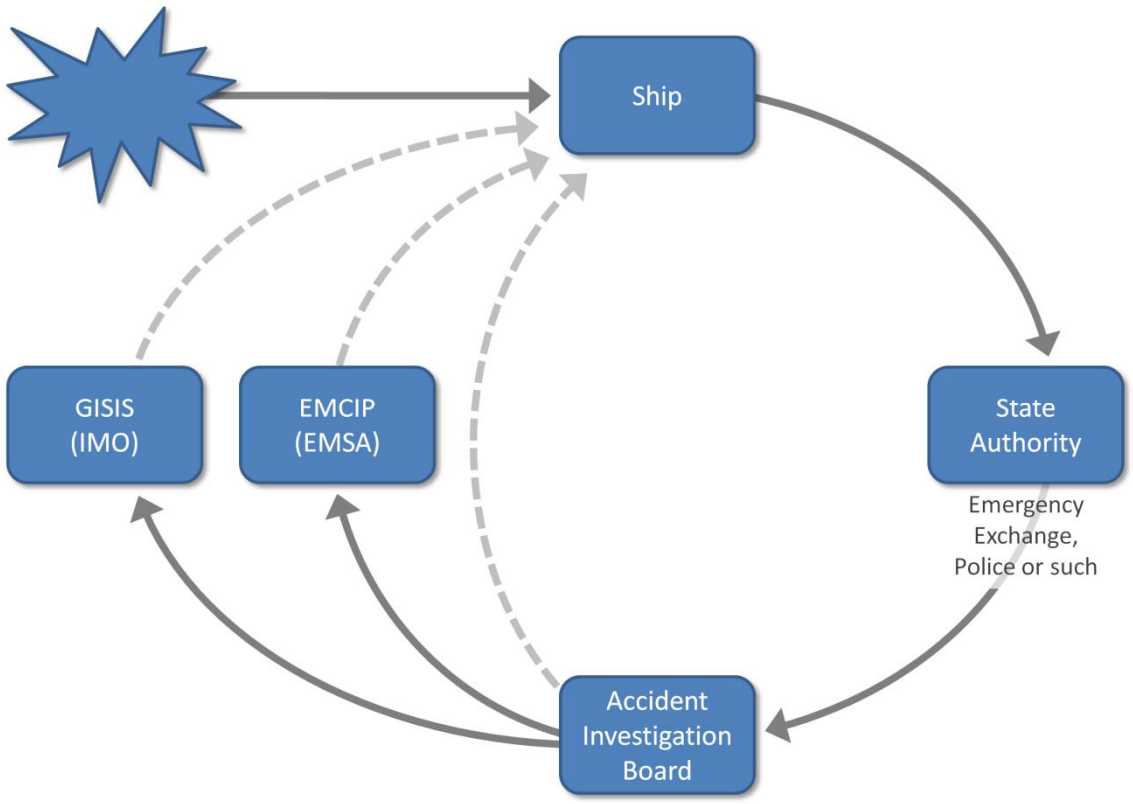

Figure 3.1 Information flow of accident investigations

3.3 Investigation and reporting of fatal workplace accidents

Federation of Accident Insurance Institution (FAII) maintains the official record for work-related accidents in Finland. The Institution gets its information from member companies. Member companies include every insurance company operating in Finland, which handles work-related accidents (FAII 2010). FAII also investigates all occupational accidents which lead to fatality (Figure 3.2). The Investigation and Reporting of Fatal Workplace Accidents, IFWA, was founded in 1985 as a joint agreement between the key labor market organizations and the FAII. Between the years 1985 and 2008, more than 800 fatal occupational accidents have been investigated. (FAII 2010)

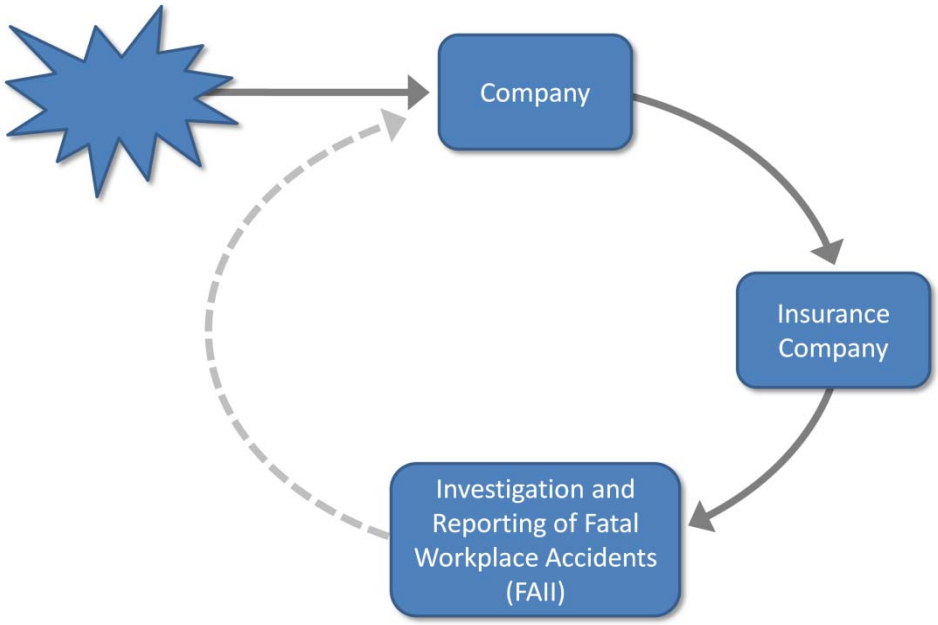

Figure 3.2 Information flow of fatal workplace accidents

As a result of an investigation, an investigation report is created and put in collective database, which is public for all those who are interested in it. The database can be found on FAII's internet site www.tvl.fi. It is possible to do basic searches from the database, such as line of business, occupation, ESAW taxonomy and date of the accident. Most of the database cases have accident investigation report attached. The reports are also distributed annually to companies' safety departments according to industry, so that companies in the same industry as the company with a recorded fatal accident get the report. The number of distributed reports is between 50,000 and 60,000 annually. (FAII 2010)

Search conducted on the database in July 2010 gives the total of 11 maritime fatal accidents, of which the earliest is from 1986 and the most recent from 2010. All of these investigations have accident investigation report attached.

3.4 Investigation report databases

EMCIP

European Marine Casualty Information Platform, EMCIP, is the database of the EU that will collect marine casualty information from EU Member States. EMCIP is developed by the European Maritime Safety Agency, EMSA, and it will be launched in 2011. The purpose of EMCIP is to provide objective, reliable and comparable information about maritime accidents for the Member States and the European Commission. (EMSA 2010a)

The database will store information on casualties involving ships, including merchant ships (cargo, passenger, fishing and service), recreational craft and inland waterway vessels. The database will also have information about occupational accidents related to shipping. In addition, the data can be used to create annual reports, statistics and research studies, and the information can also be delivered to other databases. (EMSA 2010b)

The Member States' public investigation authorities distribute the incident reports to the database; in Finland's case it is the Accident Investigation Board of Finland. Because the investigation of maritime incidents is organized according to each Member State's own laws and regulations, the national authority distributing the data varies. For example, in Finland the author is, as stated above, the Accident Investigation Board of Finland, which operates under the Ministry of Justice. In Estonia it is the maritime administration's department for marine casualty investigation and maritime safety development; in Denmark, the investigation authority is the maritime administration's casualty investigation division; in Sweden, the investigation is conducted by two authorities: the investigation division of maritime administration investigates casualties, and in case of very serious casualties investigation is carried out by a separate board. In Norway, the maritime casualties are investigated by criminal prosecution -related maritime investigators or civil courts. (EMSA 2010c) From this small set of examples from the Member States and Norway, it can be seen that casualty investigations are managed in very different ways in different States. The essential challenge with a common database will therefore be the question of a shared taxonomy.

According to Correia (2010), the taxonomy of the database has been devised by EMSA in cooperation with the Member States, and it follows the recommendations made in Casualty Analysis Methodology for Maritime Operations project from the year 1999 and IMO's circular Casualty-related matters – reports on marine casualties and incidents (MSC-MEPC.3/Circ.3). At the moment, only casualty event taxonomy is available on EMSA's internet pages, and it consists of the following parts: capsizing/listing, collision, contact, damage to ship or equipment, grounding/stranding, fire/explosion, flooding/foundering, hull failure, loss of control, missing, and non-accidental event (EMSA 2010a). These are to some extent concordant with the circular but much more general.

When it comes to occupational accidents, EU-centered data collection is already in operation. Data from Member States is gathered by using European Statistics on Accidents at Work (ESAW) classification standards. In Finland, occupational statistics are gathered in insurance companies, then sent to the Federation of Accident Insurance Institutions (FAII), where they are put together and sent to Statistics Finland and also to European Union's statistical office, Eurostat (FAII 2010). See Figure 3.3 below. There

is no information available on how the occupational data in EMCIP will be received, but it can be presumed that ESAW-based statistics will be used.

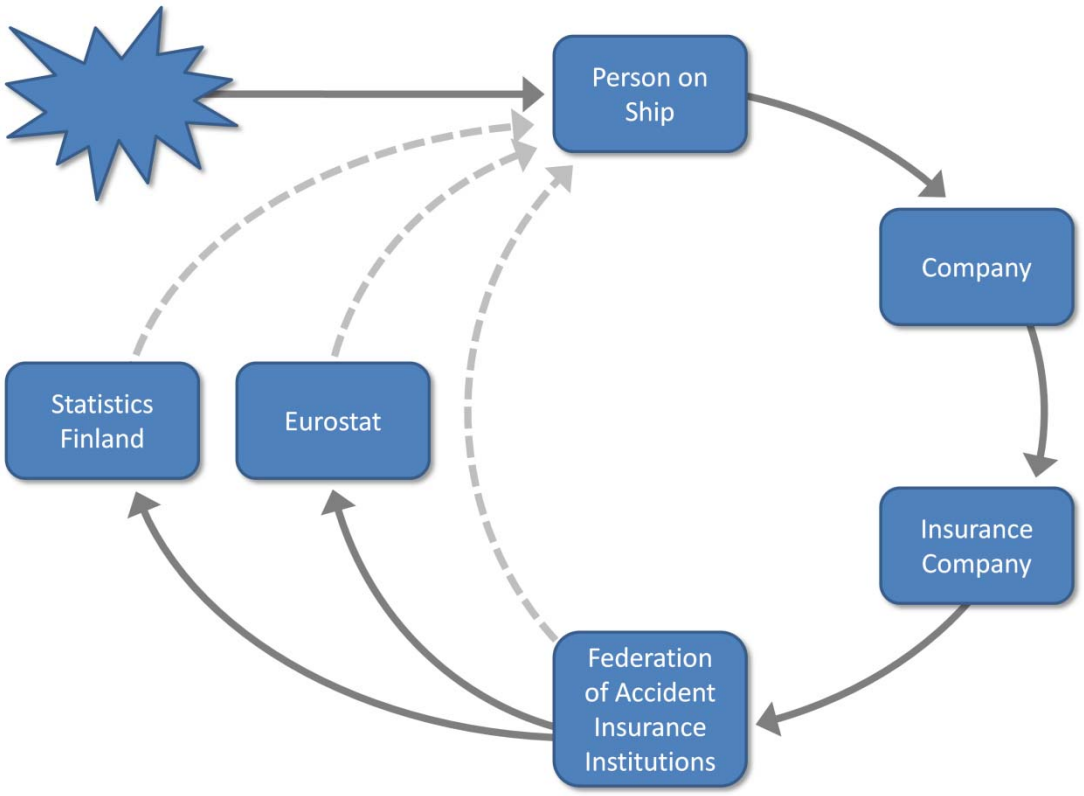

Figure 3.3 Information flow of occupational accident statistics

GISIS

Marine Casualties and Incidents module is a casualty database maintained by IMO's Secretariat and part of Global Integrated Shipping Information System, GISIS. The database contains information on both factual data collected from various sources and of more detailed information based on investigation reports received by IMO or on reporting forms annexed to MSC-MEPC.3/Circ.3 and sent to IMO. (GISIS 2010)

The database includes approximately 20 incidents that occurred to ships flying under the Finnish flag, but of those only one has an investigation report attached and even that has been received by the Secretariat in a hard copy form, so it is not available on the internet. These incidents are from the time period of 1985 to 2009. Only four incidents have taken place on the Finnish coast, and they are all also included under the category of Finnish flag state accidents.

4 MEASURING THE IMPACT AND UTILIZATION OF INCIDENT REPORTING AND INVESTIGATION

4.1 How to measure the impact of incident reporting

As already stated in the phase 2 report Transforming maritime safety culture (Lappalainen 2008), it is difficult to measure the impact of the ISM Code on the maritime industry for two reasons: first, because there is no accurate data to use, and second, it is not possible to know if the impact measured is solely due to the Code. Similarly, it is difficult to measure the impacts of an incident reporting system. There are no adequate statistics to conduct a reliable study, and even if there were, it is not possible to differentiate the impact from other safety-related factors. This was also the conclusion when the impact of the Finnish accident investigation was studied (Valonen 2010).

Furthermore, according to Bråfelt (2010b), it is evident by looking at the reports in Insjö that those reporting to incident reporting systems do not make or understand the difference between an accident and a near-miss. This means that, in the reporting systems, under the term accident there can be near-misses, and under near-misses there can be accidents. Therefore, incident reporting systems can not be used for statistical purposes.

Valonen (2010) makes three proposals for how to measure the impact of accident investigation. The same proposals are equally usable for measuring incident reporting. The proposals are:

1. The purpose of actions should be divided in smaller aims that direct the carried out actions and are measurable.
2. After defining the aims, the means to get to those aims are specified.
3. By measuring those aims, it is possible to get a general idea about the impact.

Valonen also writes that quantifiable results are not likely to be found, so the best result can be gathered via qualitative research (Valonen 2010). The smaller aims should be measured by practices best suitable for that certain aim. These can be, for example, interview studies, questionnaires, reader surveys, and self-evaluations.

Taking previous remarks into account, it seems that the present way of promoting and measuring safety improvements by the number of reports is skewed. In a previous study on the utilization of IFWA accident information in Finnish safety promotion, carried out by Lind and Kivistö-Rahnasto (2008), three essential findings were made:

1. Not all companies receive the relevant reports; the main reason being that companies were not members of a particular employer association.
2. Companies receiving reports applied accident information in various ways.

3. The reports were seldom utilized in the companies.

4.2 Maritime industry: a literature review

The referred studies show that one of the most serious shortcomings of implementation of the ISM Code concerns the process of continuous improvement and incident reporting (Lappalainen 2008). Several studies have concluded that incidents are not reported perfectly.

In literature, reporting of non-compliance and deficiencies by the ships' personnel has been seen as a significant indicator of a properly functioning safety culture (Mejia 2001). According to Anderson (2003), a properly working reporting process indicates the cycle of continuous improvement in a valid manner. Unfortunately, the procedures for incident reporting do not work properly. The Paris MoU (2008a) reported that one of the most common ISM-related deficiencies was the lack of reporting non-conformities, accidents, and hazardous occurrences.

The main focus of the study by Anderson (2003) was to investigate how the incidents, near-misses, and other hazardous occurrences were reported. Anderson discovered that the reporting of incidents was quite insufficient among the seafarers. Especially the minor incidents were not regularly reported. Anderson was particularly surprised that most of the seafarers were more or less reluctant to report the incidents. Furthermore, Anderson discovered that in certain cases, further analysis of and corrective actions on the reported incidents were not properly carried out.

Withington (2006) considered the means for measuring the progress of improvements in the safety management system. According to Withington, accurate reporting of incidents could provide the fundamental basis for evaluating the effectiveness of the ISM Code. He recognized that in practice severe insufficiencies can unfortunately be found in the reporting of the shipping companies, regardless of the requirements of the ISM Code that necessitate establishing a proper reporting system for incidents. The level of the reporting varies significantly between companies, flag States and port States.

4.3 Finnish maritime industry: an interview study

In this chapter, the results of the METKU research project interviews concerning incident reporting are summarized. The interviews were conducted in seven different Finnish shipping companies. Altogether 76 persons from the companies participated, of which 62 were active seafarers. In addition, 18 officials from other interest groups were interviewed. The interest groups consisted of the Finnish Maritime Administration (from 1.1.2010 divided into TraFi and Finnish Transport Agency), Finnpilot and the Accident Investigation Board.

In order to evaluate the implementation of the required reporting practices, the interviewees were asked how incidents and near-miss situations are reported and analyzed, and how corrective actions are performed. In addition, the designated persons were asked about the quantities of reported incidents per year and per vessel. The designated persons were also asked about the existence of quantitative targets, indicators or usage of statistical methods for evaluating the safety performance of the company.

The designated persons and the masters of the vessels were asked about the number of reported incidents and near-misses per year. The average number of reported incidents and near-misses varied greatly depending on the vessel. Typically, the number of written reports was low, just a few reports per year and per vessel. On some vessels, only one to three cases were reported per vessel per year. In some vessels, the reported number was as much as twenty to thirty incidents per year per vessel.

The interviewees shared a common opinion that incidents are reported defectively. Regardless of how many incidents were reported per year, the majority of the interviewees held the view that compliance should be improved in reporting incidents. Surprisingly, some interviewees also considered that over-reporting occurs. According to the interviewees, the reason for over-reporting was a system that rewarded active reporting.

The public administration also considered incident reporting problematic. The inspectors thought that the maritime personnel's adoption of incident reporting has been poor. According to one maritime inspector, the ISM Code has not been successful in introducing incident reporting to the maritime personnel. Another maritime inspector added that the older seafarers have often neglected to report incidents. According to the inspectors, the attitude of crew members toward incident reporting is unsatisfactory, and the ratings and hotel and catering staff do not report incidents at all.

When executing an ISM audit in a shipping company, the maritime inspector goes through the internal reports of non-conformities, accidents and hazardous situations. They considered that very few incidents were reported per vessel and per year. One inspector added that it was hard to believe that more situations which should have been reported have not occurred. According to one maritime inspector, there should be cause for alarm if no reports on incidents or non-conformities can be found onboard.

The inspectors that were interviewed thought that poor reporting practices were also a problem at the international level. The interviewees said that reporting practices do not depend on the nationality of the ship. Their shared opinion of foreign ships was no better than of ships under the Finnish flag when the state of the incident reporting was asked.

Some reasons for this unwillingness to report were mentioned. Some interviewees thought that people are ashamed if something goes wrong. One interviewee told the researchers that some masters discourage reporting, because they think that nothing should happen on their ship. Especially older seafarers thought that minor incidents should not be reported, as they felt this was bureaucratic.

According to some interviewees, minor mistakes and all technical problems are reported (due to the fact that these problems are wanted to get noticed by the management), but mistakes that cause near-miss situations are not reported unless forced by circumstances.

Nevertheless, some interviewees told that unreported incidents and near-miss situations are discussed onboard. Improvements are made, although written reports do not exist. One maritime inspector also believed that corrective actions have been executed onboard without official reporting. One interviewee added that when a close shipmate makes a mistake, the witness usually fails to report it. People are reluctant to put blame on their shipmates. However, when a foreign ship has caused a near-miss situation, it is much easier to make a report of the incident.

According to some seafarers, cases where bonus salaries were based on a safety target (for example, target zero defects of occupational casualties) could be an obstacle to drawing up an incident report. If the casualty has been minor, the report has often been neglected.

Some mariners felt that the concept of incident was not specific. They suggested that the descriptions of non-conformities, accidents and hazardous situations be clarified and standardized in the maritime industry.

4.4 Suggested theories explaining poor reporting practices

Although some premises of incident reporting have been criticized (see chapter 2.4), the majority of the literature emphasizes the importance of incident reporting. Incident reporting schemes have been considered essential tools for continuous improvement. In addition, IMO promotes incident reporting (IMO 2008a). Because the METKU interview study (Lappalainen & Salmi 2009) revealed shortcomings in incident reporting in the Finnish shipping industry, it is important to understand why these schemes often fail. In this chapter, the suggested theories for this are examined.

Sanne (2008), Knudsen (2009) and Antonsen (2009) have described the obstacles causing poor reporting practices. According to Sanne (2008), incident reporting schemes laid by the management are not integrated into personnel’s practices and cultural frame. He sees that this could be explained by the personnel and the management sharing different accident etiologies. The management has acquired a

system etiology, which relies on written incident reports, data collection, and a systemic analysis of root-causes, whereas the employees believe in an occupational etiology as a model of accident causality. The occupational etiology is based on rules of thumb, tacit knowledge, apprenticeship, habitual organizational routines, and storytelling.

In his research, Sanne (2008) found many reasons for employees' non-reporting practices. The main reasons for non-reporting originate from the following:

1. Employees share an etiology whereby reporting is not a solution to learn from incidents.
2. Discouraging feedback from already made reports.
3. The incident has been embarrassing for the involved.
4. Work culture where incidents are corrected by employees' themselves.

Knudsen (2009) studied the maritime personnel's attitudes towards continuously increasing safety regulation and towards administrative workload of maritime personnel. Knudsen used a concept of seamanship in the sense of maritime personnel's professionalism, professional pride and comprehensive practical experience. According to Knudsen the maritime personnel's reluctant attitude towards literal guidance, manuals, checklists, and reporting practices could be explained by this.

According to Knudsen (2009), many seafarers think that the safety instructions and requirements are prepared by people who have no connection to the reality of operation onboard. Maritime personnel see that the experience and competence of the active seafarers have been ignored during the preparation of the safety instructions and requirements. Seafarers feel that this belittles their professionalism. Knudsen (2009) also found that maritime personnel are overloaded by paperwork without additional resources.

Antonsen (2009) also found similar attitudes as Knudsen in a study concerning the safety culture of Norwegian offshore supply vessels. According to Antonsen, the seamen have reluctant attitudes towards working by formal and written rules. Antonsen found contradictions between the occupational culture of the seamen and the rule-based safety management approaches.

In conclusion, there seems to be a cultural gap between the personnel onboard and the management and administration ashore. The referred studies can be brought together by an assumption of two different approaches to safety work. These are the technical approach and the social approach. The first is adopted by the management and the administration, and the latter by the seafarers. The technical approach on safety management relies on technical systems, computerization, and standardization, whereas social approach relies on rules of thumb, storytelling, and seamanship.

In their study on the revised act on the occupational safety and health actions of workplace, Salminen et al. (2007) found out that companies have polarized into small and large ones according to how they manage their safety operations. The large ones have dedicated industrial safety organizations, which are skilful and able to do systematically proactive and target-oriented safety work. By contrast, the small ones have only little knowledge of safety management and its implementation.

Similarly, the interview study conducted in the METKU research project showed that in the studied small companies (with less than ten ships) there were no electronic incident reporting systems in use, whereas more than half of the large companies (with at least twenty ships) were using electronic systems. On the other hand, one must keep in mind that differentiating between paper and electronic reporting does not measure the quality of safety management. In addition, in the interviewed companies there was no significant correlation between the way of reporting and the content of the safety system.

What is more, in those shipping companies where an electronic incident reporting system was in use, it was often used only by part of the fleet due to the age of some of the vessels in use. In the older vessels, lack of electronic systems, such as satellite internet access, make it more difficult to use electronic safety management systems. Therefore, paper folders are still an everyday practice in many vessels.

5 CONCLUSIONS AND DISCUSSION

Because the interview study made in the METKU research project revealed that the Finnish shipping companies have not been able to fully implement incident reporting and analyzing as a way to continuous improvement, which is one of the core targets of the ISM Code (Lappalainen & Salmi 2009), 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 the 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. In this chapter, the main findings of the study are presented and some proposals are also given.

IMO encourages shipping companies to have procedures for reporting and analyzing non-conformities, accidents and hazardous situations (IMO 2002). In its Guidance on near-miss reporting, IMO emphasizes 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" (IMO 2008a). Although IMO describes the required reporting practices well, maritime safety still has the essential problem of broad terminology: there is altogether approximately ten different accident terms that IMO uses in its precepts, and of those many are overlapping. The lack of a concise, shared terminology poses major difficulties in maritime incident reporting and in determining its efficiency.

In the 1930s, H.W. Heinrich introduced a theory of different incidents relations (Heinrich 1959). Best known of the hypotheses based on this theory is the iceberg model, which states that 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 the identical causation hypothesis. The domino theory is an accident model, explaining how accidents originate. The identical causation hypothesis states that different incidents have same kind of underlying reasons. These two theories are widely contested. Therefore, they should be taken into consideration if IMO's guidance on incident reporting is expected to have the desired effects.

The main finding concerning existing incident reporting systems is that the flow of information seems now to be more from the ships to systems and external institutions when it should be the other way around. From this basis it is highly recommended that actions to reverse the flow of the information be taken. See Figure 5.1. This incoming information (bold arrows in the figure) is also worth a closer study.

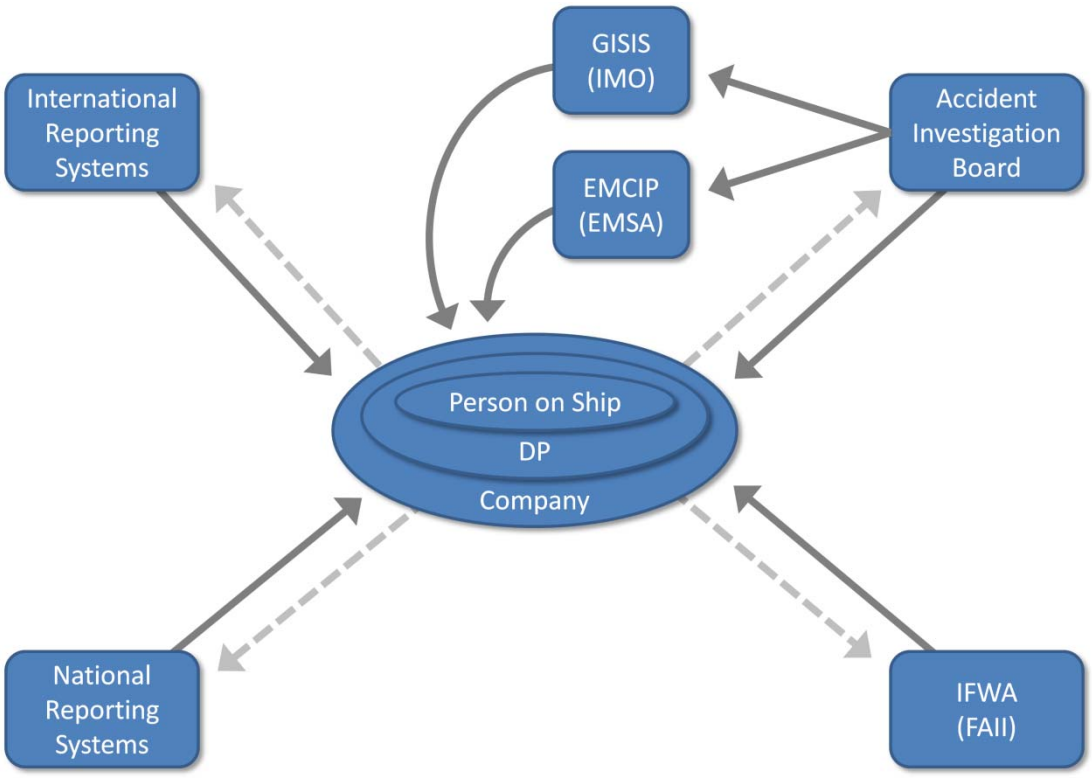

Figure 5.1 Suggested information flow between actors in maritime incident reporting

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 the already existing knowledge in safety work, it is crucial that the databases are united in one shared database. In the best scenario, this collective database could include all essential information on maritime related incidents: statistics, IWFA reports, AIBF reports, internal incident reports, and so on. This way, all the information would be easily available to those for whom it is produced – the seafarers. Furthermore, the seafarers should be encouraged to read the incident reports and go through them with their fellow workers. The mere existence of the data does not ensure that it is used in 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 notion that there seems to be a cultural gap between the personnel onboard and the management and administration ashore. The referred studies on poor reporting practices (Sanne 2008; Knudsen 2009; Antonsen 2009) can be brought together by an assumption of two different approaches to safety work. These are the technical approach and the 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 relies on technical systems, computerization, and

standardization whereas the social approach relies on rules of thumb, storytelling, and seamanship.

The technical and the social approach to safety management are both important when improving maritime safety. They do not exclude one another – on the contrary. The technical approach gives objective figures about the state of safety, and some models (see, for example, Salmi 2010) are even suitable for proactive safety management. However, the deficiencies of the technical approach include staying on a descriptive level, being mainly in academic usage and the lack of practical guidelines and models of operations.

The social approach on safety management is based on personnel's experience, and it takes into account everyday working habits. Seafarers also feel that methods such as storytelling and standard practices are useful safety management tools. On the other hand, these practices can not be used in organizational learning or by the whole industry.

To get the best possible outcome of incident reporting, these two approaches should be bridged. For example, Rajala and Väyrynen (2010) propose a combination of storytelling and ESAW-based chain analysis, a multi-method approach which they consider "a pragmatic concrete approach to boost safety management". They state that this approach could easily be applied to enhancing safety communication and could, thus, enhance the awareness of the personnel.

Based on this study, it is proposed that in the future the utilization rate of incident reporting systems is examined internationally. The research should not be made only on the grounds of the number of reports, but especially the feedback from the already made reports should be examined. Furthermore, national and international co-operation between organizations which are eager to develop maritime safety should be established.

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University of Turku
CENTRE FOR MARITIME STUDIES

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University of Turku