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SAFETY MANAGEMENT IN SHIPPING: MAKING SENSE OF LIMITED SUCCESS

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ABSTRACT

This article addresses the gaps between regulative safety ambitions and operational results and practice within the maritime sector. In particular, the article focuses on the gaps within safety ambitions in the form of, for example, rules and procedures and practise, exploring possible pitfalls when relying on safety from a system perspective without paying attention to its situational and human interrelationship. This examination applies the Practical Drift Model (PDM) conceptual framework developed by Scott A. Snook (2000). PDM explains why seemingly well-controlled and sophisticated organisational systems may in reality increase their risk potential. In fact, existing scientific safety literature has not offered much space in which to make sense of the gaps between theory and practice. Hence, we more closely examine certain examples of such gaps from our own data collected from the Norwegian controlled shipping industry. Applying a multi-method approach combining surveys and case studies, including field studies and interviews, we conclude that maritime accidents to a large degree derive from a mismatch between the local demands of the situation and global rules designed by planners. Finally, we conclude with some suggestions for what to do in order to improve safety in shipping.

1. INTRODUCTION

Shipping is a global industry as most vessels are affected by legislation in many countries and abide international rules; in addition, owners can choose flag states and labour markets in which to recruit crews. Such interdependencies also make shipping a highly complex business. In the safety area, many stakeholders (e.g., crew, shipping companies, unions, industrial bodies, national and international regulators) constantly act and react to internal and external changes. Although safety is to a large extent regulated and procedures and guidelines for best practices are in place, severe accidents and incidents still frequently happen.[1]

International safety regulations stem from the International Maritime Organization (IMO) in the form of conventions, protocols, and resolutions. At other levels, safety is addressed by regional, flag state, and port state regulations (Kuo, 2007), which are transformed into shipping companies' safety management systems in the form of procedures and standards. Companies' safety activities are regulated by the International Safety Management (ISM) Code, which was fully implemented on 1 July 2002 (International Maritime Organization, 2010). Although procedures and standards are in place to control risk and seafarers' behaviour, accidents involving human error

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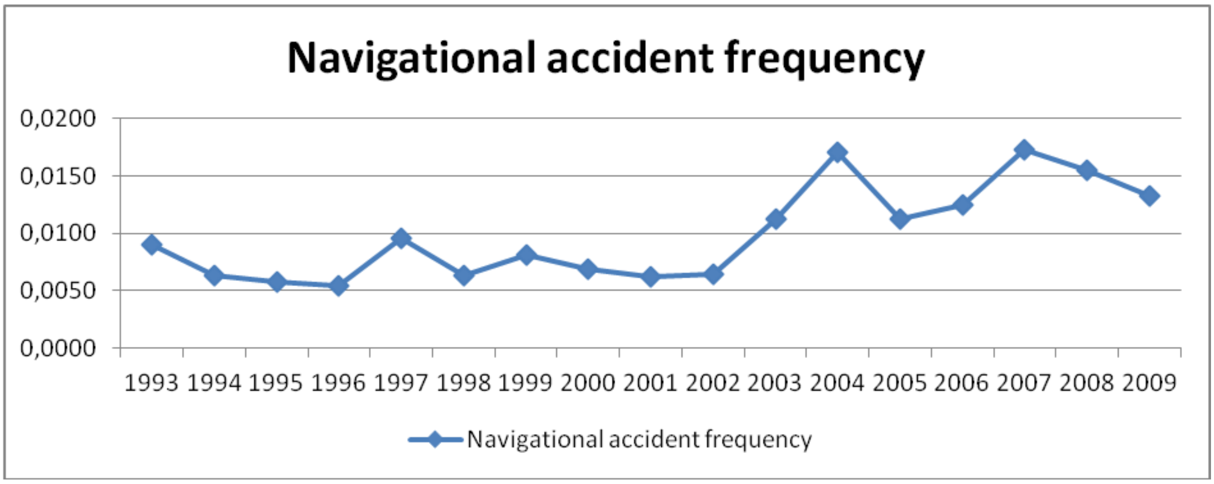
[1] Two of particular note are the Norwegian ship *Langeland*, which sank in a storm off the coast of Sweden (all six crewmen were presumed dead, and *Full City*, which went aground and polluted the southern Norwegian coastline. Both accidents happened during the same storm on the night of 31 July 2009.

also seem to be on the rise (Soma, 2008). Statistics from Lloyds' Fairplay (2010), shown in Figure 1, indicate the navigational accident frequency (collisions, contacts, and wrecked/stranded vessels) from 1993 to 2009 in relation to the world's fleet size.

Figure 1: Navigational accident frequency 1993-2009 (Source: Lloyds' Fairplay, 2010)
Fleet size in number of: Crude oil tankers over 100,000 dwt, Chemical tankers over 10,000 dwt, Containers over 20,000 dwt, RoRo cargo over 10,000 dwt, Bulk over 50,000 dwt.



As Figure 1 indicates, the frequency of serious accidents—especially navigational accidents—has been increasing since 2002, despite the introduction of the ISM Code, and this article intends to further explore why safety management and regulation through the ISM Code, procedures and standards seemingly have a limited effect.

1.1 Objective of the Article

This article addresses the gaps between safety ambitions in the form of establishing, for example, rules and procedures and practise, where we also explore possible pitfalls when relying on safety through a system perspective without paying attention to its human interrelationship, especially those in the sharp end—namely, the seafarers themselves.

In order to make sense of the gaps between safety ambitions and the practical outcome, we will examine quantitative and qualitative data collected from the Norwegian controlled shipping industry. By considering the Practical Drift Model (PDM), a conceptual framework developed by Scott A. Snook (2000) we aim to explain why seemingly well-regulated organisations develop traits that may evolve into significant accidents and disasters. As such, the PDM model enables us to look for possible new explanations of the success and failure of safety strategies.

The article is organised as follows. In the next section, we briefly present our theoretical framework by introducing PDM and argue for the relevance of the model. The following section presents relevant data from the survey of Norwegian-controlled shipping industry as well as the chosen methodological framework. The findings and discussion follow the logic of the PDM, which organises the presentation of the qualitative data. Finally, we summarise existing theoretical explanations and suggestions, supplementing them with some of our own new findings to formulate hypotheses for future theoretical research.

2. THEORETICAL APPROACH— THE PRACTICAL DRIFT MODEL

The Practical Drift Model (PDM) (Snook, 2000) emphasises how different degrees of mindfulness depend on different situations and contexts and how organisational systems during their lifetime develop both tight and loose couplings. The main objective of the model is to capture both contextual and temporal factors when explaining why incidents and accidents occur. More precisely, PDM consists of three dimensions: (1) situational couplings, (2) different logic of actions, and (3) time. The first dimension, situational coupling, refers to Karl Weick's statement that it is not the existence or non-existence of loose couplings that is of a crucial determinant of organisational functioning over time, but rather the patterning of loose and tight couplings (Weick, 1976). This statement underlines how organisations shift from tight to loose couplings and back again as the various sub-units within the taskforce alternate between low and high degrees of interdependence. The second dimension, logic of action, refers to what "new institutionalism" defines as contextually dependent mindsets or frames that influence peoples' behaviour (DiMaggio, 1994). Here, mindsets and frames refer to norms, scripts, routines, or habits possessed by the actors within an organisational setting. Snook's (2000) premise in PDM is that organisational members shift back and forth between rule- and task-based logics of action depending on shifting contextual factors. The third dimension, time, refers to the lifetime of an organisation, which is characterised by shifting periods of tight and loose couplings and different kinds of logic of actions. The dynamics of PDM are driven by the twin muscles of behaviourally anchored logic of action and stochastically determined situational coupling (Snook, 2000). This duality implies that periods of stabilisation with ruled-based logic of action will be replaced by periods of instability characterised by a more task-based logic of action. The latter invites higher risk potential and greater possibilities for accidents.

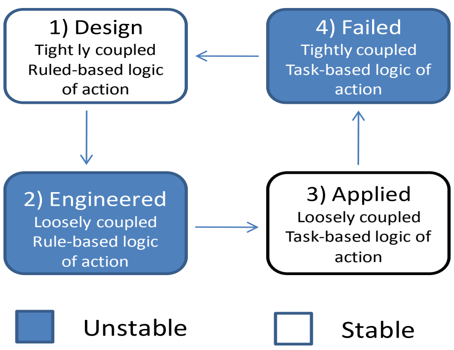


Figure 2: The Practical Drift Model (Based on Snook, 2000)

The different boxes in Figure 2 refer to various phases of the organisational development and different characteristics of situational couplings and actions of logic. Box 1 in the model is denoted as "design" and refers to the stage of an organisational lifecycle in which the governance structure is top-down oriented. The organisational managers or designers have put significant efforts into developing extensive routines and procedures in order to make the organisation robust and resilient against attacks and unforeseen events. This implies a technocratic character of the organisation, which also assumes tight couplings and a rule-based action of logic.

Box 2 is denoted as "engineered" and refers to an operational situation that is more loosely coupled. During operations, the rules of logic, which are designed for tight couplings, do not always match the situations. When organisations based on strict, high reliability principles experience that the unforeseen attacks and events do not occur as expected, the attention focused on the routines and procedures become part of everyday life and practice and, consequently, more relaxed. The logic of action based on the rules of "continuously red alert" tends to normalise, which results in a tendency for de-coupling organisational systems.

The real world does not act in accordance with organisational design; as actors become aware of this, they will be able to break the strict rules without any fear of sanctions or punishment. On a local basis, breaking the strict rules may actually get the job done more quickly and efficiently. The accumulated experiences from the real world of everyday practice will thus push the organisation away from the originally designed strict rules and create unstable situations. Such instability generates further pressure for change, as evident in the shift towards box 3 in the model, which is denoted as "applied".

The shift from "engineered" to "applied" involves a change of mentality among the actors and a transition from tight to loosely coupled organisational systems. This process is what Snook (2000) calls "practical drift".

During such a process of de-coupling, the organisation becomes increasingly free from the global rationality that characterises “design” and develops sub-units with their own defined rationality and internal governance structures. Such sub-units are autonomous entities whose logic of action is based on experiences and tacit knowledge. Accordingly, the actors drift further away from a rule-based to a more task-based system. The locally independent sub-units solve everyday problems in an applied task-based manner. The problem-solving processes become pragmatic responses to what the single units (e.g., work groups or vessels) justify as their own understanding of “the rules”.

Box 4 “fails” indicates a situation in which the system suddenly and stochastically becomes tightly coupled. The circumstances may include an incident in which single units confront one another (e.g., two ships on a collision course). In such situations, the actors in the individual units are forced to act on the assumption that all others act in accordance with the original rules and initially designed procedures. This may create extreme instability and, in the worst case, a catastrophe. The actors are actually trapped in a game where trusting their own logic of actions is the only solution, yet they must simultaneously base their decisions on the assumption that others are following the general rules. From “failed”, the organisation once again enters the phase of “design”. In “redesign”, the organisation tries to control for the experienced unwanted outcome, often in the form of even tighter designed control criteria.

Thus, the model indicates a recovery phase in which actors learn from mistakes and re-introduce a top-down-based governance structure with tight couplings and logic of action based on generally accepted rules. Real-life accidents often induce such processes. Therefore, the model indicates certain determinism—namely, “peaceful” organisations without repeated redesign processes inevitably drift towards ruin. On the one hand, this is the old story of “the unrocked boat” (Reason, 2001). On the other hand, the model indicates how structural constraints or enforcements also become influenced by external contexts and either fortify the lack of mindfulness or increase mindfulness based on locally based logic of actions. Both ways of practical drift may be equally dangerous.

PDM thus emphasises the organisational contradiction between decentralisation and control, where decentralised decision making is needed to permit flexible responses to surprises while increasing the degree of complexity requires centralisation and discipline. Bridging the gap between safety goals and actual performance aims to reduce this kind of contradiction and create organisational designs that may simultaneously inhibit the logic of hierarchical control and decentralised decision making.

3. METHODOLOGICAL CONSIDERATIONS

This article adopts a multi-method approach combining surveys and case studies, including field studies and interviews. Safety management and its interrelationship with human behaviour are, in accordance with current accident and safety management theories (e.g., Cooper, 2000; Reason, 2001; Turner and Pidgeon, 1997; Weick and Sutcliffe, 2007), understood as a multi-layer construction comprising organisational members’ fundamental safety-related assumptions and values (what is important), beliefs (how things work), and patterns of behavioural norms (how things are done). The fundamental assumptions that individual group members have towards safety management and the explanation of actual behaviours at operational level are difficult to understand and explain without interactive probing and qualitative methods. Fundamental assumptions are assumed to be reflected in behavioural norms and perceptions, which are far more accessible through quantitative methods. Once integrated, these factors are commonly referred to as safety culture (Reason, 2001; Reichers and Schneider, 1990)

The current study was carried out in two phases. The first phase was a self-completion questionnaire survey of crewmen working on Norwegian controlled liquid tankers and dry cargo vessels. A random sample was drawn from the Norwegian Shipowners’ Association’s list of membership. The second phase involved a sub-sample and case studies selected from the survey sample group. This second phase employed semi-structured interviews with crewmen and shore personnel along with participatory observations. Thus, the quantitative results are representative of the selected population and are applicable for generalisation. Although the narratives presented in the articles are not applicable for generalisation, they provide examples and understanding of how the gap between safety goals and actual performance is created through social processes. In addition, some characteristics of the interaction between the various organisational members and the existing safety control systems are brought forward with the qualitative results.

Furthermore, a multi-method approach is applied so that the interrelationships between the elements may be examined in order to establish antecedents, performance, and outcomes (Bergman, 2008; Brannen, 2005;

Cooper, 2000). More precisely, the survey aims to indicate seafarers' perceptions of and attitudes towards safety management and risk. The qualitative results aim to provide a more thorough understanding of the overall situation, underlying processes, and seafarers' own situational experiences.

3.1 Questionnaire Development

The survey instrument was developed and validated by Studio Apertura in collaboration with the Norwegian DNV and the SINTEF research institution (Studio Apertura, 2004). The main part of the questionnaire comprises 10 sections representing specific safety-related dimensions: (1) top management's safety priorities, (2) local management, (3) procedures and guidelines, (4) interaction, (5) work situation, (6) competence, (7) responsibility and sanctions, (8) working environment, (9) learning from incidents, and (10) description of the organisation. This article analyses the results from the third section on procedures and guidelines. All items were measured on five-point Likert scales ranging from "strongly disagree" to "strongly agree". The respondents were also given the possibility to comment each dimension.

3.2 Survey Samples and Administration

In total, 1,574 questionnaires were distributed to 83 tankers and bulk carriers. Each vessel received a package with individual questionnaires and a sealable return envelope. On each vessel, the safety delegate received instructions related to administration, purpose, and anonymity. Vessels not returning any questionnaires were reminded up to four times. The survey was administrated during the spring/summer of 2006.

A total of 76 vessels from 29 companies returned 1,262 forms, providing an individual response rate of 80.2%, a vessel response rate of 91.5%, and a company response rate of 93.5%. In addition, 297 respondents provided written comments. For further information regarding survey sample and administration, see Oltedal and Wadsworth (2010) and Oltedal and McArthur (2011).

3.3 Survey Demographics

Questionnaires were returned from 40 liquid bulk carriers (liquid tanker) and 36 dry bulk carriers (dry cargo); 63% of the respondents were employed on a liquid tanker and 37% on a dry cargo vessel. The sample was male dominated (92.5% of the respondents), and 22 nationalities were represented. The majority of respondents were from the Philippines (65.5%), followed by Norway (9.2%), Poland (8.1%), and Russia (5.5%). Just over 56% of the respondents were under the age of 40. Only a few (11.5%) of the respondents (mostly Norwegian nationals) had fixed employment within the shipping company. The remaining 88,5% were contract employees—43.6% with 9-month contracts, 21,5% with 6-month contracts, and 4,5% with 3-month contracts. The remaining 18.9% had a different length of contract, none of which was more than 1 year. Finally, when signing on a new vessel, 15.2% of the respondents stated seldom or never signing on to the same vessel, 39.9% stated staying on the same vessel sometimes, and the remaining 44.8% often or always stay on the same vessel. On seven of the vessels, all respondents who returned the questionnaire stated that they often or always sailed on the same vessel.

3.4 Case Studies

Four shipping companies—two tankers and two dry cargo companies—were approached about conducting case studies from 2007 to 2009. In order to ensure the companies' anonymity, company-specific information was retained. In all four companies, the HSQ manager and Crewing Manager were interviewed. In one company, the safety management system (SMS) data system was examined. In the other companies, all available statistics, experience feedback from reported cases, and safety bulletins were examined. Information was also retrieved through participatory observations at sea from two field studies, participation in captains' conferences where safety was an issue, and both formal and informal interviews with seafaring captains and shore-based personnel involved in safety-related matters.

The qualitative information aims to give a more thorough understanding of the processes underlying the presented statistics. The narratives serve two important complementary purposes. First, they contextualise the data in a broader and deeper sense than the quantitative studies are able to offer. Second, they personalise the relationships between regulatory regimes and their subordinates, illustrating what kind of meaning the agents put into their action when deciding to follow or not to follow the prevailing regulatory rules. This article emphasises seafarers' view.

3.5 Statistical Analysis and Presentation of Results

All statistical analyses were performed using PASW (by SPSS) statistics version 18.0. Descriptive statistics for each item, including the percentage of frequency distribution, mean, and standard deviation, are presented.

Principal Component Analysis (PCA) with Varimax rotation and Pairwise deletion was carried out in order to examine survey items' interrelationships and their common underlying dimensions. The extracted rotated component matrix and loadings were presented. The loading represents the correlation between the variable and the extracted factor(s), with estimates ranging from 0 to 1,00. Items that load strongest on a given component are considered the most like the underlying latent dimension (Hair, 1998; Pett, Lackey and Sullivan, 2003).

4. RATIONALE OF PROCEDURES IN MARITIME SAFETY MANAGEMENT AND RESEARCH FINDINGS

This section presents data related to operational procedures. The use of procedures in error management involves two components: error reduction and error containment (Reason, 2001). According to Reason (2001), some problems are associated with the existing form of error management, including the fact that error management is generally not informed by current knowledge related to error and accident causation. Moreover, error management tends to focus on personal and active failures rather than latent conditions and the situational contributions to making errors. With reference to this article, latent organisational and situational conditions are defined as (1) incompatible goals that include (a) group goal conflicts when the informal norms of a work group are incompatible with the safety goals of the organisation and (b) conflicts at the organisational level in which there is incompatibility between safety and productivity goals; (2) procedures in relation to their quality, accuracy, relevance, availability, and workability; and (3) training and problems that include the failure to understand training requirements, the downgrading of training relative to operations, poor task analysis, and the inadequate definition of competence requirements (Reason. 2001). In the following discussion, our results related to these areas—namely, incompatible goals, procedures, and training—will be further addressed in relation to the industries' approach to safety management.

Survey questions related to the perception of procedures are presented in Table 1, with descriptive statistics included in percentages, together with mean and standard deviation. Scale information and coding are 1=strongly disagree, 2=disagree, 3=not sure, 4= agree, and 5=strongly agree.

Table 1.
Descriptive Statistics, Procedures, and Checklists

Survey item description	1	2	3	4	5	Mean	Std
Due to the company's demand for efficiency, we sometimes have to violate procedures	14.9	41.4	12.8	26.6	4.4	2.64	1.151
Due to the captain's demand for efficiency, we sometimes have to violate procedures	18.4	42.1	14.3	21.9	3.2	2.49	1.117
I have received good training in the company's procedures	0.9	2.6	6.1	58.9	31.5	4.18	0.728
I feel that it is difficult to know which procedures are applicable	14.4	47.0	17.3	19.0	2.3	2.48	1.028
The procedures are helpful in my work	0.6	1.4	4.8	55.6	37.6	4.28	0.678
The procedures are difficult to understand or are poorly written	15.3	57.3	12.6	12.8	2.0	2.29	0.941
We have the opportunity to influence and form the procedures	3.4	13.1	15.5	55.3	12.8	3.61	0.978

The descriptive statistics summarised in Table 1 show that 31% of the respondents violate procedures due to the company's demand for efficiency while approximately 26% do so due to the captain's demand for efficiency. In addition, about 90% of the respondents are satisfied with the training received in their company's procedures. Moreover, approximately 93% perceive procedures as helpful in their work, indicating that the respondent's attitudes towards procedures per se are good. Thus, when procedures are breached, it is more likely due to reasons other than poor attitude. About 21% feel that it is difficult to know which procedures are applicable, which indicates a procedural system not adequate for the situation and, as a result, weaknesses throughout the overall safety management system. In addition, approximately 15% find the procedures difficult to understand and poorly written. Finally, about 68% stated that they have the opportunity to influence and form the procedures.

The interrelationship among the items is presented in Table 2, along with items' component loadings. Based on the analysis, two components (i.e., factors) are extracted. The matrix contains factor loadings for each variable (i.e., item) at each factor. Factor loading is the means of interpreting the role each variable plays in defining each factor and represents the correlation of each variable and factor. Higher loadings (e.g., > 0.3 or higher) indicate the variable representative of the factor and underlying dimensions. Within each factor, interrelated variables are clustered at the same component and are the key to understanding the nature of each particular factor (Hair, 1998). The interrelationships are subject to the following theoretical discussion in order to address their meaningfulness.

Table 2
Items' Interrelationships

		Loadings	
		Comp. 1	Comp. 2
I1	Due to the captain's demand for efficiency, we sometimes have to violate procedures	**0.845**	-0.027
I2	Due to the company's demand for efficiency, we sometimes have to violate procedures	**0.815**	-0.077
I3	I feel that it is difficult to know which procedures are applicable	**0.697**	-0.093
I4	The procedures are difficult to understand or are poorly written	**0.639**	-0.212
I5	The procedures are helpful in my work	-0.158	**0.793**
I6	I have received good training in the company's procedures	-0.186	**0.760**
I7	We have the opportunity to influence and form the procedures	0.014	**0.686**

*Comp. = component

The extracted rotated component matrix presented in Table 2 indicates two underlying dimensions: component 1 and component 2. Component 1 reflects an inadequate procedural system and approach (I1 through I4). Component 2 indicates an adequate procedural system and approach (I5 through I7).

The items interrelated in component 1 indicate that shipping companies that exert commercial pressure (I1 and I2) are also recognised by an overly complex procedural system (I3) along with procedures that are poorly formulated (I4). High factor loadings on all items included in component 1 denote that these features are likely to be present simultaneously in these organisations. In addition, features denoted in items belonging to component 2 (I5 through I7) are likely to be absent as they have low and negative loadings at component 1.

The items interrelated in component 2, indicating companies where the procedural system is perceived to be useful in daily operations (I5), also relate to good training in these procedures (I6) and allow the crew to influence and form the procedures (I7). Companies with these features are also less likely to serve as pressure to ensure efficiency as these items (I1 and I2) have low and negative loadings at component 2. For the same reason, these companies are denoted by a procedural system perceived to be easier to relate to in daily operations.

Overall, 297 respondents provided written comments on the questionnaire; 62 made written comments related to procedures and checklists. The comments were categorised into the following three sub–groupings: (1) procedure quality and usability (n=33), (2) violation of procedures due to commercial pressure (n=11), and (3) others (n=18). Comments were provided on a volunteer basis and, thus, not representative of the population. However, they provide valuable insights into characteristics perceived to be problematic. The results are summarised in Table 3.

Table 3
Survey Comments Related to Procedures and Checklist

33 respondents	Procedures and checklists are not applicable and do not reflect the situation on board: too detailed, too many, and look like they have been developed by people with no sea-going experience.
11 respondents	Procedures are being breached due to commercial pressure.
18 respondents	Other, such as the relevance of training and work-specific situations.

Respondents were also asked to list their reasons for not following procedures. Each respondent could mark up to three of seven pre-specified options or write any other reason, if not listed. The results are listed in Table 4, with the number of respondents ticking each reason (N), percentage (N%) and valid percentage (N Valid %). When calculating valid percentages, missing cases are omitted.

Table 4
Reasons for Violating Procedures Listed by Frequency

Reason for not following procedures	N	N%	N Valid %
1 The work will be done faster	538	42.6	47.2
2 The procedures do not work as intended	488	38.7	42.8
3 There are too many procedures	394	31.2	34.6
4 I feel pressured because I am overloaded with work	365	28.9	32.0
5 It improved the quality of my work	312	24.7	27.4
6 I am not familiar with the applicable procedures	227	18.0	19.9
7 The rest of the crew does it	203	16.1	17.8
8 Others	35	2.8	3.1

Both Table 3 and Table 4 indicate that procedures are violated and checklists are not followed due to high workloads and commercial pressures. This is supported by the other survey comments, which are presented in Table 5.

Of the 297 respondents who provided written comments, 108 comments were related to workload and commercial pressure. The comments were categorised into the following four sub–groupings: (1) high demand for efficiency and time pressure (n=35), (2) low crewing level related to work (n=33), (3) violation of rest hours due to high workload (n=30), and (4) others (n=10). Survey comments related to workload and commercial pressure are presented in Table 5.

Table 5
Survey Comments Related to Workload and Commercial Pressure

35 respondents	High demand for efficiency and time pressure, especially when arriving in and leaving port.
33 respondents	The number of crewmembers is too low compared to work tasks, which are constantly increasing in quantity—especially administrative
30 respondents	Rest hours are not followed, mostly due to low crewing level and high workload.
10 respondents	Not possible to categorise, comments as "*sorry, I am tired*" and "*I fell asleep at watch*".

The qualitative results from case studies and interviews indicate that the extensive use of procedures and checklists, including those provided by the shipping company itself as well as by third parties as charterers and customers. Other shipping-related research also identifies an increasing volume of regulations, controls, and administrative work as the main factor negatively affecting on-board safety (Knudsen, 2009). Based on Dreyfus and Dreyfus' expert model, Knudsen (2009) also pointed out that rules and procedures are justified for inexperienced people. However, research also indicates that use of such standardised measures is more widespread within the tanker sector (Oltedal, 2010) than within bulk and dry cargo (Oltedal and Engen, 2010). These differences are assumed to originate partly from each sector's relationship with their respective customers. Customers of dry cargo shipping demand fewer requirements with regard to safety management while liquid tankers are to a larger degree embedded in the oil industry, with a more mature safety management system. However, it is suggested that this relationship between the liquid tanker industry and their customers will bring about changes based on external demands in contrast to internal needs for safety reasons. Although some sector differences are evident, the crew customarily deals with procedures and checklists from own their company, charterer, customers, and oil installation—of which all are different but at the same time standardised to fit all.

Case studies also indicate that bridge officers regard procedures and checklists as valuable for safety reasons, but within certain limits. Procedures and checklists are also seen as problematic as there are too many of them and they are too detailed and too standardised. The crew experienced less standardisation and determined that the possibility to accommodate procedures and checklists in accordance with the ship-specific situation would improve safety more. Problems with completing checklists and following procedures mostly occur during hectic operations, such as visiting and leaving ports.

5. DISCUSSION AND NARRATIVES

The discussion and narratives are presented as they relate to Snook's (2000) four phases of (1) design, (2) engineered, (3) applied, and (4) failed, which includes moving from the first phase (design) through engineered, applied, and into redesign. This section's discussion supports the statistical results with interview narratives, illustrating the situation in depth. Although the statistical data reveal discrepancies between formal procedures and actual performance, the narratives illuminate why such discrepancies come into existence and how they are characterised. From the methodological point of view, they complement the survey and give us a better supplementary understanding of what is actually taking place in the sharp end of the maritime industry.

5.1 Design

Although progress has been made on international cooperation, the late 1980s and early 1990s experienced a series of maritime disasters (Anderson, 2003; International Maritime Organization, 2010), such as the *Herald of Free Enterprise* in 1987 (Department of Transport, 1987), the *Exxon Valdez* in 1989 (National Transportation Safety Board, 1990), and the *Scandinavian Star* in 1990 (Justis-og politidepartementet 1991). International conventions alone did not seem to produce the intended levels of safety. Thus, international regulatory bodies began looking for ways to revise and improve safety regimes. Within the industry, SMS came to play an important role in achieving and maintaining high levels of safety and reducing losses resulting from accidents and incidents. Faith in the value of such systems became widespread, and they were made mandatory through the International Safety Management (ISM) Code (International Maritime Organization, 2005). The ISM code requires all companies to develop, implement, and maintain an SMS, which includes the functional requirements of a safety policy as well as instructions and procedures to ensure the safe operation of ships in compliance with relevant international conventions and flag state legislation. Within these requirements, each shipping company is free to find a functional solution best fitted to its own organisation and operations. However, previous research has shown that actual work and practice often do not reflect what is stated in the shipping companies' overall safety management policy and functional requirements (Oltedal, 2010; Oltedal and Engen, 2010).

Statistical results related to the design phase (presented in Table 1 and Table 2) indicate that the procedural system is perceived to be more helpful in daily operations when the crew has the opportunity to influence the procedures during the design phase. The following narrative (Narrative 1), given by a Norwegian captain, illustrated a (common) impression of a safety management system designed in such a way that it is detached from daily operations and does not pay attention to its human interrelationship.

Narrative 1: Norwegian captain about safety management system and procedures.

"(...) my impression is that the aim is to belch forth as much paperwork as possible. And some of the things, procedures and checklists are not possible to relate to. They are useless crap developed by someone who has never set foot on a vessel. Just look at this (referring to pre-port arrival checklist) 'Electronic positioning instruments checked–positions verified'. Of course we verify our position. We do that all the time when manoeuvring. We do not need a checklist to remind us to check where we are. And this 'Pilot and Port Control have been given proper ETA (Estimated Time of Arrival) notice'—and what do they mean by proper ETA. You can be sure that the agent has been at the phone for the last days asking for ETA, and you can never be 100% sure of your arrival. Things happen, and we are not the only vessel entering the port. And all the other points are

more or less the same (researcher's comment: more than 20 items to be checked). But what these checklists really do is draw our attention away from what we are supposed to do: manoeuvre the vessel. We feel like we are being treated like children; don't they think that we know how to do our job? We even have checklists for the checklists. We spend our days more or less filling in checklists, and for what purpose? To have someone to blame if anything goes wrong?"

This story was shared with several other informants, who concurred that it depicted reality on board their vessels. Narrative 1, supported by survey comments presented in Table 3, also illustrates two points brought forward by Snook (2000). First, planners—not operators—must design a system in which they would never have to work. Second, planners are writing for future work situations and, as such, have limited information to draw upon. In this, it is important to keep in mind how procedures are (normally) dealt with within the framework of a traditional SMS as well as its relationship to risk assessment. An SMS consists of several sub-systems. First, a system of reporting and collecting experience data from the vessel itself is required. This is followed by a system of data processing—namely, the summarisation and analysis in order to reveal causal factors and perform trend analysis, which forms the basis for the development of safety measures. One critical system requirement is the reliability and accuracy of input data (i.e., near miss and accidents reports). As long as the input is reliable, the overall system presupposes the possibility of developing efficient measures in order to control operational safety (Kjellén, 2000).

Given the arguments related to human rationality, Perrow (1999) has been reluctant to support the usability of risk analysis. In the absence of absolute rationality, during the SMS processes, some risks are minimised and other maximised while information is categorised and simplified in order to facilitate processing. Perrow (1999) suggested that availability heuristics are used when examining all existing cases of a phenomenon, then basing their judgment on all this experience as people tend to judge a situation in terms of the most readily available case—namely, the one most easily remembered.

Other issues hampering the applicability of an SMS include planners' lack of knowledge of the operating system, planners taking risk but not facing the consequences of their own decisions in running operational risk, a lack of education, and a lack of training in probabilities and statistics (Perrow, 1999). Thus, in these processes, crucial information may be lost. According to Perrow (1999), heuristics appear to work because in reality our world is loosely coupled and, thus, has a lot of slack and buffers in it that allow for approximations rather than complete accuracy. Another drawback in the applied SMS, further contributing to uncertainty, is the underreporting of experience data. Other research results indicate that approximately 35% of seafarers working on Norwegian controlled tanker vessels state that they never or only sometimes report minor incidents. About 36% state that they sometimes or always alter the reports submitted in order to cover up mistakes (Oltedal, 2010). Within the dry cargo sector, approximately 40% of the respondents state that they never or only sometimes report minor incidents while about 36% indicate that they sometimes or always alter the reports submitted (Oltedal and Engen, 2010).

Under such circumstances, where experience data are missing or incorrect, it is even more challenging to reveal underlying causes and influencing factors. Moreover, when developing measures for a future situation, there is uncertainty with regard to what that situation will display. The complexity of influencing factors and patterns of actions makes it difficult to categorise events into pre-fixed schemes, such as tools for root cause analysis and safe job analysis. In addition, new measures themselves may have unintended consequences. Moreover, the analysis of real and potential accidents often takes place within a blame-oriented environment, with a tendency to point to causes of human error; this may hinder revealing other underlying causes (Oltedal, 2010). Such a situation is illustrated in Narrative 2.

Narrative 2: Norwegian mate concerning a not-applicable procedure.

"*(…) in one situation, one of the able bodies cut himself with a knife. It was a small finger cut, and nothing serious. The incident was reported, as we are required to, whereupon we were instructed that it was no longer permitted to carry knives. In situations where knives were required, a safe job analysis and risk assessment were to be performed first. However, what they [people ashore working with SMS] do not understand is that not wearing a knife may involve greater risk. What if someone gets entangled in a hawser, with a risk of being dragged overboard, a situation where a knife would be quickly required to cut loose, what shall we do? Run to the bridge and carry out a risk assessment first? However, we bypassed this new regulation and did a general 'safe job analysis', which concluded that all able bodies could wear knives on a general basis*."

When it comes to near misses and experience data, theory on high reliability organizations (HRO) argues that mindfulness and preoccupations with small failures may improve the reliability of the operational system. An HRO approach implies, inter alia, that the organisation is sensitive to operations and first-line experiences, encourages alternative frames of reference, and creates an error-friendly learning culture in which people seek feedback, share information, ask for help, and talk about error and experiment (Weick and Sutcliffe, 2007). However, if mindfulness is to be possible, it requires support from the top management and throughout the entire organisation. Mindfulness, as a proactive activity, is resource demanding. Mindfulness implies that every operator thinks differently about success and the possibility for failure along with the use of creativity in order to imagine what can go wrong and how. Mindfulness implies that every operator—if in any doubt at all—may stop operations and, if so, with support from the organisation and co-workers, even if the situation ultimately turned out to be safe every time. We do question if any organisations exposed to competition and constantly facing decisions of safety versus efficiency are capable of having all organisational members in a mindful mind mode for a longer period of time before efficiency comes to dominate safety. After all, no organisation exposed to competition exists with the primary goal of being safe; they need to become competitive in order to avoid bankruptcy.

Both Narratives 1 and 2 depict situations in which measures have been developed detached from the operational system, with the consequence that the measures are experienced as difficult to relate to in operations. Narrative 2 also effectively depicts where first-line operators (seafarers) bypass the shore sides' efforts in the design phase in adjusting to an applied mode. Planning has a symbolic as well as functional aspect (Clarke, 1999). According to Clarke (1999), organisations and experts use plans as a form of rhetoric—tools designed to convince audiences that they ought to believe what the organisation says.

In particular, some plans have so little instrumental utility in them that they warrant the label "fantasy document". The usual presumption in social science is that the first step in an adequate planning process is to assess fairly completely what the problem is; the second step is to write a plan that addresses the problem, and the final step is to implement the plan. However, just like Perrow (1999), both Snook (2000) and Clarke (1999) are sceptical towards the utility of planning, especially in relation to future complex situations with a high degree of uncertainty. The uncertainty among the planners when working with safety management may very well result in the development of overly burdensome rules or rules that are too detailed in their efforts to reduce uncertainty by controlling (most) human actions. Such a reality exists within shipping, as supported by the majority of survey comments presented in Table 3. Moreover, the results in Table 4 indicate that about 43% of the survey respondents breach procedures because they do not work as intended, about 35% because there are too many procedures, and about 27% because deviation from procedures will improve the quality of their work.

Similar to Perrow (1999), Snook (2000) identified part of the problem as inherent in the rationale of the design phase in a SMS. More precisely, the assumption is that the operational system is tightly coupled, yet most of the time the organisational sub-units are a loosely coupled system. When a global rule is violated, operations usually go on as normal. On the contrary, breaking global rules may be perceived as being more efficient and even rewarded by the organisational management. Thus, a mismatch exists between the rule-based logic of action and the presumed tight situational coupling, which brings us into the next phase: "engineered".

5.2 Engineered

"Engineered" is defined by the interaction of the rule-based logic of actions and loose couplings. Although measures are originally designed for a tightly coupled reality, crews do experience a loosely coupled reality as nothing happens when the rules are broken. When such behaviours are not followed by some kind of reprimand, punishment, or any dangerous situation, their substantive risk-reducing reason may be questioned by operators (Snook 2000). Moreover, the presence of real-world constraints of actions may be overlooked by planners, including commercial pressures from the shore. The results in Table 4 show that the top reason for violating procedures is the need to work faster, which was ticked by about 47% of the respondents. Perceived pressure due to the overload of work is among the top four reasons for violating procedures, with approximately 32% of survey respondents concurring. Commercial pressure is also perceived to be present on board, as supported by survey comments in Table 5, case studies, and previous research carried out within both the liquid tanker sector (Oltedal, 2010) and the dry cargo sector (Oltedal and Engen, 2010). For example, it is well known among seafarers that hours of work are regulated primarily in theory only. Comments in Table 5 substantiate that rest hours are not followed due to high workloads, among other issues. Numerous anecdotal accounts were presented of not only some seafarers' excessive hours, but also the manipulation of the hours for work/rest records in an attempt to conceal the truth and suggest compliance. One narrative depicting such a situation follows (Narrative 3).

Narrative 3: Norwegian captain about rest-hour regulations

"Rest-hour regulations? There is no such thing as rest-hour regulations! The regulations say that we are supposed to have 8 hours of rest during the day, but when calling in port after passing through the English Channel, it is not unusual to be at the bridge for up to 18 to 20 hours. When you sail from Ushant to Rotterdam in

about 40 hours! Nowadays with crew shortages, the bridge officers are getting promoted faster and are more inexperienced, and it may be difficult to leave them alone on the bridge with all the responsibility. As the master, I am in command of the vessel and responsible for safe navigation. Even though it is not explicitly stated in IMO regulations that I should be at the bridge at all times when passing through the channel, most companies have a standing order that the captain has to be on the bridge in congested waters, such as the Malacca Strait, Singapore Strait, and the English Channel. I know who they would blame if something happened—if the vessel grounded or something—and I was not present. In addition, I am expected to send reports to the company and charterers and so on and thereby have to leave the wheelhouse, contrary to standing orders. If it is for the immediate safety of the vessel, it is okay to depart from the regulations. And that is what we do. When we are short of manpower to do anything like maintenance, painting, or anything, I make the remark that it is for safety reasons, even if it is not, and then it is sometimes okay. Anyway, after passing through the channel, preparations for port arrival have to be done. When the pilot is boarding, I have to be present at all times. When calling in to the port, I may not have slept at all for 30 hours! The first people to meet me upon arrival is the port state control, flag state control, classification, QA control, and vetting inspectors from customers, charterers, or our own company. Sometimes they queue up and everyone expects to be first in line. Each vetting lasts for about 6-8 hours and requires a lot of the crew to be available—mostly officers; the most important people are kept awake for the longest periods. The first thing I am asked is if I have had 8 hours of rest. I have to say 'yes'; if not, I am in trouble. The inspector knows that I am lying, and I know that the inspector knows that I am lying, but they do not care as long as they can tick of the right box as okay. Apart from this, I have to handle provisions, crew changes, ballasting, loading, and discharging in the shortest time possible. And the return keeps you awake for another few hours. The situation is impossible, and everybody knows that the regulations and 'safety first' slogans are all a charade, but nobody cares as long as the paperwork is okay and they have someone to blame if something should happen".

The demand to maximise profit may induce management to promote efficient and unsafe behaviour, which may result in a reduced error margin or the overstepping of the boundary for functionally acceptable performance. Management pressure for efficiency may also result in reduced crew level. The majority of the total operation expenses may be broken down into crewing, insurance, repairs and maintenance, stores and lubrications, and management and operations. Crewing costs typically amount to 30 to 65% of the total, depending on crew nationality, and are the easiest-to-reduce expenses in order to avoid failure or increase profit. Especially in light of the current economic recession, with the accompanying decline in the freight rates, the search for cost-cutting initiatives is a motivator that ensures profits and continued operations. Crew reductions have historically been the main instrument for cutting costs (e.g., the shipping crisis in the late 1970s and early 1980s) and still are a likely area for cost reductions (MacDonald, 2006).

The appropriate crew level also depends upon other areas, such as operations, trading areas, and frequency of calling in ports. Too few crew members are more notable when calling in and leaving port—operations that have a higher demand for efficiency (Oltedal, 2010; Oltedal and Engen, 2009). When arriving, staying in, or leaving port, many things happen in a short period of time that are not specified in the principles for safe manning (International Maritime Organization [IMO], 1999), but affect the workload. This could be the need for piloting, discharging, loading, crew change, provisioning, bunkering, inspections, and the like. Fatigue is also considered to be influenced by the demand for efficiency and fast turnover rate (Smith, 2007). Under such fluctuating work pressure, it is even less likely that a standardised global measure is appropriate for the actual situation. Our data also suggest that the industry is well aware of the situation. The following comments on rest-hour regulations were made at a conference for operators, ship management, charterers, and inspectors.

"*(…) I uphold that everybody is well aware that rest-hour regulations are not complied with. Even when doing the planning, we know it is impossible to comply with the regulations. But there is not that much we can do. If we plan for regulation compliance, we might lose contracts".*

This comment was followed by a question:

"*But if we agree that the violation of rest-hour regulations is a near miss (researcher's comment: everyone agreed). Should not such violations be reported as near misses? And if you did, what would happen?"*

The following answer was provided:

"*If we openly admit that the rest-hour regulations are violated frequently, we will not get the next contract".*

Undoubtedly, these IMO conventions (e.g., rest-hour regulations) have improved safety in many areas. Nevertheless, companies and crew find ways to bypass the regulations if needed, and the control systems intercept only some of the concerning actors. However, what is striking in this situation is organisations' awareness of the problem and that they—with full awareness—design plans that are not in accordance with reality. This disconnection between the real world of everyday practice and design is the driving force of the "practical drift" (Snook, 2000). Snook (2000) defines "practical drift" as a phenomenon resulting from the mismatch between the local demands of the situation and those of global design rules. As such, the pervasive demands of day-to-day practice inevitably shift the logic of action from one based primarily on formal rules to one driven more tightly by the task, loading schedules, port arrivals, and efficiency. Subsequently, over time, pragmatic practice loosens the grip of even the most rational and well-designed formal procedure, which brings us to the next phase: "applied".

5.3 Applied

When moving into the "applied" quadrant, rule-based logic of action yields to task-based logic. The net effect of this practical drift is a general loosening of globally defined rationality, in which task-based logic of action now matches the loosely coupled situation. In this phase, the crew is no longer operating according to globally designed rationality. Rather, it is replaced with the rationality of each local unit (e.g., a vessel, department, or team). However, although the workforce now operates according to multiple, incrementally emergent sets of procedures, each borne out of unique sub-unit logics grounded in the day-to-day pragmatics or loosely coupled words, the operational system still remains resilient as long as *the system remains loosely coupled.* As a result, the working environment may be very different within each local unit (e.g., a vessel, department, or team). Crew and team instability constitute additional challenges in this setting. As presented in section 3.3, survey demographics, most non-Norwegian crew members are contract employees hired through crewing agencies and do not work within a stable team. The demographics further show that 44.8% often or always sign in the same vessel each sailing period. However, about 45% of these are spread out over various vessels, and most vessels experience various degrees of instability within teams. Previous research also suggests that working within a well-established team does have a positive effect upon safety culture in general as well as interpersonal relationships (Snook, 2000; Oltedal and Wadsworth, 2010). Interpersonal relationships relate to, inter alia, the degree of trust and open communication amongst crewmembers. Reason (2001) regards a trusting relationship as a cornerstone for getting individuals to report their own mistakes and experiences, which is fundamental for the basic rationality of an SMS. For both subordinate and superior/managerial positions, additional challenges may arise in relation to the multinational crew and unstable crewing with low stability within teams.

When signing on a new ship, new crew is unfamiliar with the ship's on-board management style as well as fellow crewmembers and the on-board working climate. The seafarers do need some time to familiarise themselves with and adjust to the new situation. For instance, if the ship management at the seafarers' previous vessel was blame oriented, the seafarer will most likely sign on the new vessel with the latest experience in mind, thereby being cautious about reporting his own mistakes for fear of being blamed or sanctioned. Over time, each seafarer learns how management is oriented at the particular vessel. In other words, seafarers become assimilated into the applied logic of their current unit. The problem is even more pronounced when the seafarer is constantly changing vessels, working with new management during each sailing period and experiencing this familiarisation process each time. The management style is known to vary within the sector. Poor shipboard management and leadership have also been identified in previous research (Oltedal and Engen, 2009; Knudsen, 2004). Narrative 4, from the comments on a survey question, illustrates one example of what happens when moving into the "applied" quadrant.

Narrative 4: Filipino mate concerning rest-hour registration

"(…) I once experienced being ordered to adjust my work and rest-period registration in a way so as to comply with the regulations. To be open with this or to react in disagreement may somehow jeopardise your next employment".

Interpersonal relationships amongst crew, in practice, also reflect the degree to which the crew shares safety-related information when changing shifts as well as more informal processes of sharing safety-related information during operations; as such, these relationships serve as a premise for the HRO principle of mindfulness. However, another issue not taken into consideration by HRO is relations of power. When entering a relationship with others, we constrain and are constrained by others as well as enabling and being enabled by others (Stacey, 2007).

As Narrative 4 indicates, the power balance favours the individual giving the order. However, such power balances are also constantly changing, shifting in favour of some while going against others depending on the relative need they have for each other (Stacey, 2005). The Filipino mate who shared the narrative is in need of employment; as a contract worker, the power balance is against him. In this particular situation, regulations, restrictions, and control systems are of little use. The HRO principles of mindfulness are also of little use as the premises for mindfulness are not present. In other words, no premises exist for a trusting and open relationship. However, by changing the employment terms, the power balance could change, and the situation could become more favourable for compliance with external and internal requirements.

Both Perrow (1999, 2004) and HRO consider interaction to be a prime mover constituting networks or systems at different levels that further interact with each other as the system influences the individual's behaviour within the organisation and in safety-related issues. Where Perrow (1999, 2004) emphasises system characteristics and power constellations as the main factors, HRO is preoccupied with the internal structure, coordination, and goal specification. However, according to Stacey (2005), these so-called forces (established premises) are taken as powerful and stable conditions, arising outside of those who relate to them in daily operations, in their own direct experience and influence. The individuals are supposed to comply with global rules; however, they may feel alienated when relating with them and thus make a local interpretation and adjustments of the standardised rules.

Making a departure from Stacey's (2005) theories, international and national conventions and legislations, such as work-hour regulations, should not be regarded as forces to which all must comply, but rather a result of complex responsive processes of interaction. The point of departure is how the various groupings of local interaction respond to the work-hour regulation and how the regulation is expressed differently in many local situations. From our own research, we find that the responses are expressed in numerous ways. Some have already been mentioned as false registrations of work hours (see Table 5), erroneous justification of a situation by an invented safety reason, ignorance, and so on. From the system perspective, deviations in actual behaviour are controlled by feedback through control systems, such as SMS. However, these are also responses that are adopted differently in each local interaction (i.e., a practical drift in various directions).

Developing new conventions for vetting is the way IMO normally responds to risk. Each of these changes is happening in small groups of local interactions among (small) groups of individuals. Each group incorporates different responses, logic, interpretations, and situational sense-making. Hence, we cannot talk about different systems, entities, or levels that are detached from one another; rather, we should focus on changes that occur through continually responsive processes of interaction. The result is that each operational unit over time drifts further away from the globally established standards, and local responsive processes result in the development of new local rationality and rules of engagement. However, although the workforce operates in conflict with global rules, it is still assumed that people in other units behave in accordance with the original set of established rules. Problems then occur when either party miscodes the situation or fails to act according to the shared global rules or when the situation again becomes tightly coupled.

5.4 Practical Drift from Applied to Failed

When operating in applied mode, each subgroup follows its own unique path of practical drift. Each uneventful day that passes reinforces a steadily growing false sense of confidence that everything is all right. However, in one rare stochastic fit, the system then becomes tightly coupled, and applied, as the "normal" praxis becomes the cause of the accident (Snook, 2000), as illustrated in the follows example. In December 2008, the *Mirabelle*, a Maltese flag Norwegian operated general cargo ship, grounded shortly after departure from port. The captain was alone at the bridge when grounding, which was identified as the main cause of grounding. As he was alone, he handled the manoeuvring, the navigation, the look-out, and the handling of the searchlight, thereby trying to do four jobs at once (Danish Maritime Authority, 2009). One month later, on January 16, the *Mirabelle* grounded once again, this time along the coast of Norway in the early morning. The navigator was alone at the bridge and had fallen asleep on watch (O'Cinneide, 2009).

In this case, both accidents were in some way related to crewing level, resulting in the first situation in work stress and in the second situation in fatigue. With reference to the *Mirabelle*, an important factor is time. These factors with low crewing level had been present for some time, although not intercepted in the ISM/SMS system for remedies. The longer the passage of time between design and failure, the less the possibility of detecting the "real" underlying causes, as crew may be undermanned and fatigued for a long time without any mishaps. Groundings, along with ship collisions, are known to be the most typical type of accidents at sea. Between 1996 and 2003, 652 groundings and collisions involving vessels over 500 gross tonnes were reported to the Marine Accident Investigation Branch (MAIB) under the United Kingdom's Merchant Shipping Regulations alone (Marine Accident Investigation Branch, 2004). The MAIB investigations showed that a small number of causal factors are common to nearly all bridge watch-keeping accidents and highlighted the following three principal areas of concern: (1) fatigue and groundings: a third of all groundings involved a fatigued officer alone on the bridge at night; (2) lookout and collision: two thirds of all vessels involved in collisions were not keeping proper lookout; and (3) safe manning and role of the master: a third of all the accidents that occurred at night involved a sole watch keeper on the bridge. Similarly, another study undertaken by the Swedish Maritime

Administration (SMA) found that, in 84% of 32 reported collisions and groundings occurring between 1997 and 2002, the accident occurred between 2300 and 0800 hours. The study concluded that fatigue-related problems affecting bridge watch keepers are, with very great probability, occurring more frequently than initially believed (International Maritime Organization, 2006).

Although fatigue, rest-hour regulation, and safe manning are recognised as causal factors, accidents still happen due to these factors. An important mechanism to ensure compliance with IMO requirements is ship inspections. However, the flag states are not alone in conducting such inspections. Port states, classification societies, customers, charterers, cargo owners, operators, and others also conduct inspections. Each year, flag states are evaluated and ranked based on their effective enforcement of international rules, whereupon they are placed on a "black list", "grey list", or "white list" (Maritime International Secretariat Services Ltd, 2008). Some flags do not manage or intend to uphold their responsibilities. The drawbacks with flag state control can in theory be balanced by port state control (PSC). However, the PSC also faces problems. In 2007, the European PSC, Paris Memorandum of Understanding (ParisMOU), performed 22,877 inspections on 14,182 individual ships registered with 113 flags, which resulted in 1,250 detentions (ParisMOU, 2010).

The ParisMOU is an open register, and results from inspections, target areas and so on are public information as well as important parameters towards customers. The ParisMOU strategy is blaming and shaming. However, the latest review from Paris-based Equasis, which provides PSC data to the shipping industry, reveals that in the same period (2007) no record of inspection existed for some 17,910 ships. These ships avoid inspections and slip through the PSC net. The most common types of vessels slipping through are old general cargo ships, many of which have no classification record and are registered with flag states with a poor safety record (Corbett, 2009). These ships may very well be the ones most in need of an inspection.

We also suspect that vessels that are inspected and found to be operating according to regulations are not necessarily doing this. Data from our own research indicate that some companies or vessels deliberately try to avoid the regulations (e.g., comments in Table 5). Vessels have work, overtime, and rest-hour registrations that do not reflect reality. Inspectors may on some occasions reveal the problem by comparing different registrations (i.e., if the registration indicates that the vessels are both bunkering and simultaneously have an engine crew that is off duty). However, we assume that the inspectors, for various reasons, do not manage to reveal all cases that are not in accordance with the regulations.

Fatigue, lookout, and safe manning are highly interrelated with one another as well as with safety in general. IMO, in addition to the industry in general, is familiar with this problem. In 1993, a joint ILO/IMO group of experts on fatigue drafted a report on fatigue and its contribution to maritime casualty and accidents (International Maritime Organization). In order to improve overall safety, such experience data are fed back into the original quadrant of "design", resulting in the "redesign" phase. Based on our data, two different approaches towards redesign were identified: (1) organisations where global rules are redesigned detached from operational systems and (2) organisations where global rules are redesigned by frontline personnel. Research identifies shipping as an industry with an extensive use of procedures and checklists; when redesigning the SMS system, new procedures or checklists are likely to be added (Oltedal, 2010). However, data suggest that crews are more satisfied with operational SMS, procedures, and checklists when given the opportunity to influence them and when sharp end experiences are taken seriously. Snook (2000) also pointed out that, for organisational leaders, it is easy to get carried away on control trips with the misuse of procedures and checklists. When real situations reflect the fact that control is not efficient, one solution might be to control even more. Sometimes such well-intentioned efforts to prevent failure through tight control often produce just the opposite effect. The original problem of practical drift became a mismatch between situational couplings and rationale of logic, with rules being designed for a tightly coupled situation. As a result of this mismatch, we argue that a better solution is to acknowledge the world as loosely coupled, thereby minimising the use of global rules and being open for local adaption.

6. CONCLUSION

A paradox is inherent in safety management by local control strategies. New safety measurements are often a result of deviations (errors, incidents, or accidents) resulting in some disturbance of the production process—namely, material damage or injury (Oltedal and Engen, 2009; Rasmussen, 1997). This implies that, in order to enhance safety, an unsafe deviation has to happen first. Thus, to be safe, you need to be unsafe. Moreover, resulting safety measures are then used as a standard for finding explanatory cause(s) towards future similar deviations. Reality is compared with the organisational safety standards and deviations attributed to human error. This is analogous to having a nautical chart that does not show the sandbank the ship has just grounded on and then blaming the seabed for not corresponding to the nautical chart.

As previously mentioned, the shipping industry's approach is often person orientated. Safety measures tend to aim at controlling human actions, often in the form of excess use of procedures and checklists. These measures are standardised to fit all; it could be a fleet of 5 vessels or 100 vessels. However, in actual work, no operation is ever the same. The vessels are different as well as the people, constellations of people, power figurations, weather, and so on. A standardised measurement will therefore never align with reality. Despite this, human actions and deviations are compared to the standard and found to be erroneous. In the search for control, new and even more detailed measurements may be developed. This is a vicious cycle created by the anxiety of not being in control. Snook (2000), Reason (2001), Hollnagel (2009), and others have all suggested that organisations should leave such person-oriented approach in their search for causal and influencing factors.

Reason (2001) also warned about what he calls "anxiety-avoidance", which fits the previous narrative. Anxiety-avoidance describes an organisation that has discovered a technique to reduce risk and repeats it over and over again regardless of its effectiveness, like constantly adding yet another procedure in response to unwanted incidents. Thus, the organisations working towards safety in this manner do not use the safety system theory as suggested, but abuse it due to the anxiety of not being in control or for other reasons. Reason (2001) and Stacey (2007) further mentioned anxiety related to not being in control as an important reason for overreliance on structure and systems. Moreover, Reason (2001) emphasised taking local experience into account through a safety information system and reporting. During the research, we also encountered companies that let the crew have a major control over the development of the safety system, with the shore management's views being overridden by the sailors. In these situations, the sailors demonstrated a more positive attitude towards, and experience with, the procedural system. Thus, when the SMS is perceived as relevant, when applied to the premises for practical drift, it is attenuated.

However, when it comes to actual behaviour, Reason (2001) recognised that both human attitude and behaviour are extremely difficult to change. This shifts the focus towards organisational structures and practices, is supposed to be more controllable, and should guide and arrange for a certain kind of behaviour through conditions at the local workplace. Furthermore, human error can never be eliminated, and the future is unpredictable. It might be provoking for some, but we suggest that organisations, managers, and planners accept that work and life imply risks and uncertainties; no matter how much we try, unwanted events of some kind will always happen. The real difference in safety management is how we *approach* such events. Staying with human error as the main explanatory factor may result in greater efforts in order to control all human actions. Alternatively, it is important to understand the underlying processes of practical drift and its interrelationship with mechanisms of control, situation, and human rationality. Yet however much we try, accidents like the *Herald of Free Enterprise* in 1987, the *Exxon Valdez* in 1989, the *Scandinavian Star* in 1990, and the *Estonia* in 1999—and more—will always happen.

Snook (2000) suggested that any organisation, when working with safety management, should pay attention to three areas: (1) looking beyond individual error by framing puzzling behaviour in complex organisations as individuals struggling to make sense; (2) following the basic design principles of high performance teams and thinking twice about chasing the advantages of social redundancy; and (3) treating organisational states of integration and reliability with chronic suspicion. The important thing is to recognise them for what they are: constant outcomes of dynamic systems and ongoing accomplishments that require active preventive maintenance. This article has also underlined how the individual character of single units must keep a certain degree of flexibility while simultaneously being guided by superior regulations. If a complex and heterogeneous sector such as international shipping is overloaded with standardised regulations, local actions will be hampered in solving everyday incidents. The consequence will be a lid on local flexibility, which may increase risk rather than reduce it. The challenge is to strike a balance between a centrally developed design that is accepted and followed by the local actors and an environment in which these regulations can open up for pragmatic solutions, when required. Such a regulatory framework requires intelligent designers and continuous revision when confronted with an endless stream of real incidents. An effective feedback loop of information between the local actors and the central designers may thus create a pathway between central design and local pragmatism that can prevent the system from moving from practical drift into failure and catastrophe.

In order to improve safety management in shipping, it is suggested that shipping companies should rely less on standardized measures as a general strategy towards safety management. While standardized measures are considered more applicable in stable and predictable situations, situations characterized by instabilities and uncertainties should be approached differently, e.g. allowing for decisions to be taken by frontline personnel, the crew, in accordance to the theories of mindfulness and high reliability organizations. This includes the support of competence-promoting activities so that the crew have the ability to adapt their behaviour to new situations. It should also be opened up for adaptability of standardized measures when the operations or vessel itself should require it. Furthermore, in situations where standardized measures are considered applicable, the crew should be allowed to participate in the process of developing the safety measures. This to ensure that the measures are adequate for real operations.

All in all, the shipping companies should strive to include all levels and departments in the organization when working with safety management in order to ensure that safety decisions is made in balance with all the other organizational goals and decisions, such as demand for efficiency.

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