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The Maritime Safety Management System (MSMS): A survey of the international shipping community

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Abstract

This paper presents the findings of a research project on the Maritime Safety Management System (MSMS) conducted at the Australian Maritime College (AMC) in 2004. The main objectives of this study are to identify key shore-based and near shore activities associated with maritime operations that are currently not covered by the ISM Code and players involved in these activities; to explore and analyse important relationships among them which can affect the management of safety; and to investigate the key safety issues within these relationships and the risks related to these safety issues. Based on this identification and analysis, the basic elements of a good maritime safety plan are identified. This study applies a two-stage methodological approach, in which a focus group discussion is utilised first to explore the initial ideas from maritime experts, followed by a mail survey to reflect the perceptions of the international shipping community. The findings of this study provide essential insights to the formulation of such a global Maritime Safety Management System for the sake of 'safer ships and cleaner oceans'.

Key words: ***Maritime Safety Management System, safety culture, shore-based activities, safety relationships, safety issues, safety risks***

Introduction

The International Safety Management (ISM) Code aims at providing an international standard for the safe management and operation of ships and for pollution prevention, ensuring safety at sea, prevention of loss of life, and avoiding damage to the environment as well as property. Its primary coverage is the sea transportation leg where the ships sail from one point to another, and

other operations at sea such as mobile drilling units. However, maritime safety also involves other shore-based activities which can provoke the critical issue of safety management connected to maritime transport and operations. In this respect, the International Harbour Masters' Association (2002) argued that a ship is statistically more likely to suffer a navigational incident in confined and busy waters close to a port than in the open sea, and the risk of serious and long-lasting damage to the environment is invariably greatest closer to land. The interface between ships and ports, the operations within ports and terminals, the communication between ship and other shore-based agencies such as pilot, port authority, VTS authority while ships are on the channel or fairway, etc., are some typical examples of shore-based activities which are associated with maritime transport and are of importance in the implementation of a safety management system. A lack of safety management policy and, on top of it, a 'safety culture', of such shore-based activities will necessarily have an impact on the activities which are currently covered by the ISM Code.

Generally, there have been gaps in the safety management network between sea-based and shore-based activities. Such gaps can be addressed in different ways such as the unification of common standards of safety regulations, certification and verification, as well as human resource issues, i.e. coordination among people on board ships, in ports/terminals and in ship operating/management companies. In order to achieve a complete net of safety management aiming at preserving maritime safety and protecting the environment, it is essential that shore-based activities should also be covered by a new code or an extended International Safety Management Code. The following sections describe a research project, which aimed to identify all shore-based and near shore activities associated with maritime operations that are currently not covered by the ISM Code and include them in a global Maritime Safety Management System (MSMS), conducted at the Australian Maritime College in 2004.

Research design and methodology

There are two main research methods applied in this study. First of all, a focus group discussion through e-mail was utilised to explore ideas and obtain perceptions of experts and operators in the field. Based on this, a postal survey was conducted by sending a questionnaire to the international maritime community. Prospective participants in the focus group were selected from the contact database of the Australian Maritime College. Maritime experts in Australia and New Zealand, with their background and expertise being port authorities; harbour masters; marine pilots; port operators; maritime consultants; VTS managers; and maritime administrators, were contacted. An e-mail containing the project's background, objectives and methodology was then sent to all participants. Upon confirmation of acceptance, an eight-question questionnaire was sent to all participants. The open-ended questions included in the questionnaire aimed at exploring participants' perceptions on issues such as the need to extend the ISM Code to cover shore-based activities; key activities that should become part of the MSMS; main players involved; safety-related relationships among them; key safety issues and risks associated to them; and basic criteria for a good maritime safety plan. Other inputs which they felt were necessary for the MSMS were also invited.

The responses of the participants were subsequently collated with author-related links removed, then synthesised and analysed into a single document. This was then sent around to all participants for their comments and additional inputs before being finalised. Upon completion of this process, the final version of the discussion analysis was devised. Based on this analysis, a detailed postal questionnaire (Appendix) was developed and sent around to participants again as a pilot study for their comments. It was then verified and finalised for being sent out to the international shipping community, together with a cover letter explaining the background and objectives of the study. The questionnaire contained seven main sections with ten questions addressing issues identified through the analysis of the discussion, and one general section inquiring on the demographic information of the respondents. Since the topic of this study was

exploratory in nature, the questions were both close and open-ended to provide respondents an opportunity to expand upon or explain their answers. The measurement scales applied were both nominal and ordinal, since the main purpose of the questionnaire was to explore the attitude of respondents towards the related issues being surveyed. Measurement was constructed on five-point scale, ranging from 1 (not at all important, strongly disagree, very irrelevant) to 5 (very important, strongly agree, very relevant).

The design for the postal survey was decided through the analysis of the focus group discussion. The potential respondents targeted by the survey included port authorities/harbour masters; port operators/stevedoring companies; and key actors in the aids-to-navigation activities such as VTS authorities; lighthouse authorities; etc. The sampling frame for this survey was chosen from the list of members of the International Association of Ports and Harbours (2004), list of members of the International Association of Marine Aids to Navigation and Lighthouse Authorities (2004) and the latest ranking of global port operators by Drewry Shipping Consultants. In an effort to increase the response rate for this postal survey, the questionnaire was also posted on the website of the AMC. By the cut-off date, there were 53 returned answers to the questionnaire received via both mail and electronic means (on-line questionnaire). This represented a 34% response rate.

Perception of MSMS

The main findings in this research are provided below. They include the key safety issues, identification of shore-based and near shore activities, main players, safety-related relationships, risks related to key safety issues, contents of a good maritime safety plan, and requirements for success of a good maritime safety plan.

Key safety issues in the MSMS

Paradigm shift and the inclusion of the 'safety culture'

Safety culture can be considered as the root of other factors which affect the management of safety. Safety culture has been defined as ‘a series of beliefs, norms, attitudes, roles and social and technical practices which are established to minimise the exposure of employees, managers, customers and third parties to hazard’ Dyrhaug and Holden (1996). Weick (1987) also describes safety culture as ‘a clear understanding of the system and its safety features, positive attitudes towards safety measures, and an incentive system that encourages safety in operations’. It is argued that management in every organisation that has a safety culture encourages a questioning attitude among workers and encourages, rather than punishes. Deming (1986) conceptualised this philosophy in his point number eight, ‘drive out fear’, as one of the important fourteen points to guide an organisation’s transformation to total quality, affirming that the success of an organisation depends on every employee’s participation and input. Several sources, e.g. Barker (2003); Verton (2003); Woods (2004), have cited the August 2003 report of the space shuttle Columbia Accident Investigation Board indicating that NASA created an environment in which engineers were afraid to speak up about potential dangers, and that NASA’s overconfident and inflexible culture, as well as management failures, ‘had as much to do with this accident as the foam’. In this respect, the report pointed that the space agency’s mindset created an environment in which a piece of foam could destroy the mission and seven lives.

All respondents in this study also agreed that the key issue is paradigm shift to align culture to include safety as a way of life, rather than to factor out safety parameters of operational and management activities. It was indicated that a large proportion of causes of maritime accidents have their roots in human factors. If there is a paradigm shift to include safety in the organisational culture, the management of safety would be greatly improved, since a culture of safety in an organisation plays a critical role in shaping the operations and management practices involving the safety issue. There is a high level of consensus (mean response = 4.66) among respondents to the statement that a positive safety culture is a key determinant of a successful MSMS.

Safety culture involves two main elements, namely ‘management commitment’ and ‘employee involvement’. This is supported by all respondents. These appear to be the two most important dimensions of the safety culture construct. Good safety performance involves much more than simply the preparation of well structured company safety procedures and standards, since many safety problems have their roots in poor management attitude towards safety. Safety culture is, therefore, very much an ‘attitude of mind’. From the organisation’s point of view, the inspiration of a safety culture should begin at the top and be communicated down to the bottom of any organisation. It is thus critical that there should be a high level of commitment from senior management and involvement of all staff in order to inspire the safety culture throughout the organisation. This is, again, also supported by the international shipping community (mean response = 4.66). It is also necessary that a safety culture is inspired among all sectors of the maritime transport chain, since one sector can let the others down. Respondents of the survey strongly supported this and, in fact, this is the issue with which they most agreed (mean response = 4.68). It is thus critical that education of safety awareness in maritime operations, as part of organisational culture, be incorporated into the curriculum of maritime universities and training institutions.

The role and commitment of senior management

Senior management plays a vital role in the establishment of a safety system and in the recognition and implementation of some important issues. First, it is essential to recognise that the major risk involving safety lies in the management of human factors. These include attitude, personality differences, cultural differences, aptitude differences and standards of training. Secondly, it is necessary to recognise that operational errors are inevitable and the management’s proper role is to establish responses and defences within the system to avert disastrous consequences of operational errors. Thirdly, it is also essential to develop, maintain and audit a safety system to ensure compliance and to detect and mitigate system deficiencies

and failures. The role and commitment of senior management in the above issues is essential, especially the pro-active monitoring and education of staff and the instilling of a 'safety culture' into the system. This view was supported by both the focus group members and the survey respondents (mean = 4.64).

Commerciality versus safety

While it is necessary to promote safety in maritime operations, the question is how to remain focussed on safety whilst operating in a commercially responsible manner. Members of the focus group indicated that all the players in the safety system experience more or less the same level of commercial pressure to push the boundaries imposed by risk management and control measures. The safety provisions are usually considered to be a cost burden dictated by law, and thus a necessary evil. There has always been a conflict between commercial efficiency and safety, indicating the fact that the resources, which are available for safety, should be spent in the most cost-effective way. This can be done using preventative measures, through the Formal Safety Assessment (FSA) with the application of risk management and cost-benefit assessment (CBA) techniques, using process which involves hazard identification, risk assessment, studying alternative ways of managing those risks, carrying out cost-benefit assessment of alternative management options, and finally, making decisions on which option to select (IMO, 2004).

Grote and Kunzler (1996) found that conflict between safety and commerciality can more likely be solved in favour of safety in organisations where safety is understood as an integral part of the primary task of the work system ('positive safety culture'). However, this by no means indicates that the commercial issue is downgraded in such organisations. The main question is to incorporate safety as an indispensable part of the operation systems whereas commerciality and safety are treated on equal footing, especially in the maritime industry where the profit margins can be slim and safety plays a vital role. In addition, the relationship between commerciality and safety is only balanced as every employee in the company thoroughly understands the co-

existent status of the two issues, and that improved safety will prevent productivity loss and cut costs in the long run. In this respect, it is important that safety should be built into organisational management, and managers should clearly understand the hidden costs of accidents and realise that 'good management is good safety' Pater (1990). It is necessary that safety is included in the work practices of every operation of the organisation and becomes an indispensable part of the planning, operation and management. The relationship between safety and commerciality, implied in the statement that safety and commerciality issues should be treated equally because safety is an indispensable part of all operation systems, is strongly supported by the respondents with the mean response of 4.49. There is also a high level of consensus among respondents that safety should be a part of the work practice in every operation of the organisation (mean = 4.6).

Consistency of regulations and requirements

There is a high level of consensus in the international shipping community with the view that consistency of safety regulations and requirements in all sectors of maritime transport is essential to achieve an effective MSMS (mean response = 4.38). It is evident from this survey that the inharmoniousness of regulations and requirements involving safety among various sectors of the maritime transport chain may jeopardise the effectiveness of a safety management system. Take the ship/port interface as example, if safety requirements from the ship are not appropriately corresponded by the shore side, safety of not only the ship but also the port would be put at risk. Consistency of regulations and requirements, aided by coordination and cooperation among sectors of the maritime transport chain, would therefore essential for the effectiveness of the maritime safety management system.

Appropriate and workable legislation and working procedures involving safety

The focus group indicated that appropriate and workable legislation, as well as working procedures involving safety, are key for the successful implementation of any safety management plan. This is because if legislation or working procedures are too onerous,

employees may only pay lip service to them. It is revealed by the survey that there is also a high level of consensus on this issue, with the mean response of 4.49. This finding indicates that respondents again were fairly in agreement with members of the focus group regarding key safety issues of the MSMS.

Table 1 summarises the consensus on key safety issues in the survey.

Insert table 1 about here

Shore-based and near shore activities in the MSMS

It was agreed by focus group members that the ISM Code should be extended to cover broader activities relating to maritime safety in order to establish a global Maritime Safety Management System. These activities are broad ranging from administration to operation and management of safety. Furthermore, the magnitude of activities is substantial since they are not only land-based within the port and terminal area but also extend to the point when the ship enters the pilotage area. The analysis of the survey shows that the respondents identified VTS/AIS and general waterway management as the most important activity in a global MSMS (mean = 4.7). Aids-to-navigation was identified as the second most important activity with the mean response of 4.66. The ranking of activities in a global MSMS based on their perceived importance is shown in table 2.

Insert table 2 about here

Stevedoring, safety surveying and consultancy, and ballast water exchange were identified as the least important activities in a global MSMS. Nevertheless, these activities have the mean score of response greater than three (‘neutral’), meaning they should still be kept in the list of activities in the MSMS. In general, all activities to be included in a global MSMS identified from the focus group discussion are supported by the respondents to the survey. The identification of the main players involved in these activities is essential as the next step for setting up the maritime safety system. This is provided in the following section.

Main players involved in the MSMS

It was emphasised by the focus group that the players involved in developing such a global system should be both from operational and management levels especially the regulators and peak bodies of these players. Moreover, there should be participation of related international organisations governing these main players, i.e. International Harbour Masters Association (IHMA), International Marine Pilots Association (IMPA), International Association of Ports and Harbours (IAPH), International Association of Lighthouse Authorities (IALA) etc. In addition, there was an interesting suggestion to include the ship and cargo agencies in the safety system since they are at the moment not only immune to any code, being a 'law unto themselves', but also 'create the greatest pressure on ship's crew once in port and have no regard for the ISM Code' (quotes from respondents). What is even worse is that at least some of them do not know the existence of this Code. Those who perceived by focus group members as key players in the MSMS include port authorities/habour masters, port and terminal operators/stevedoring companies, pilots, tug and towage providers, VTS managers, marine surveyors and consultants, marine environmental managers, port worker unions, independent contractors (mooring, security, etc.), regional council (for instance, council of the city where the port is located who also have interests in the port's business for safety and environmental protection reasons), fishing industry, and ship and cargo agencies.

VTS managers were the most important players in the global MSMS (mean response = 4.83). Pilots were also perceived as the second most important players in the MSMS with the mean response of 4.81. Table 3 indicates the importance of key players in the global MSMS.

Insert table 3 about here

There are also some other considerations with regard to the respondents' perception on the key players in the global MSMS. First of all, as expected, the ship and cargo agencies were viewed as some of the important players in such a safety system with a mean score of response of 3.57, confirming the finding from the focus group discussion. Secondly, regional councils and fishing

industry received as mean score of response lower than three ('neutral'), thus their role in a global safety system like MSMS is questionable. It is therefore reasonable to conclude that, with the exception of the regional councils and fishing industry, all other key players identified in the focus group discussion are supported by the survey of international shipping community and perceived as important to be included in the global MSMS.

Safety-related relationships in the MSMS

From the standpoint that maritime safety should be viewed from a total system perspective, relationships exist and are represented in both horizontal and vertical dimensions, at both operational and management levels. Relationships in the vertical dimension and at operational level include those among players on board the ship such as between the ship master/watch-keeping officers and the pilot, or between the ship master/watch-keeping officers and the ship crew. At the management level, relationships exist between the players on board the ship and its operating/management company ashore. Relationships in the horizontal dimension are those between the ship and its operating/management company and other players in the maritime transport system. At the operational level, there is the relationship between players on board the ship and the maritime safety related agencies ashore, such as the VTS (Vessel Traffic Service) and ATN (Aids-to-navigation) authorities or the Harbour Master, and between the ship and other players beyond the ship such as the tug operator. At the management level, a communication relationship can be represented between the ship operating/management company itself and the flag states and port states, as well as at the higher level between the flag state where the ship is registered and the international organisations which have interests on maritime safety, such as the IMO. These maritime safety related communication relationships are illustrated in table 4.

Insert table 4 about here

Effective communication, in both dimensions and at both levels, has been proved as a critically important factor contributing the improved maritime safety. The communication between the pilot and the ship's master/watch-keeping officers, for instance, is the most important of this

type at the operational level. This communication is vital to the safe operations of the ship and to better understanding each player's duties and responsibilities. In fact, some differences may result from the fact that the pilots and masters/ship officers do not share common ideas of what is required. On the other hand, these groups sometimes do not even exchange the necessary information for the management of the ship's safety. For example, in the investigation of a maritime accident, the Transport Safety Board of Canada (2004) found that both the pilot and the second mate did their own calculations of the vessel's position, but they did not exchange and crosscheck the information.

An analysis of responses to the question about the importance of these relationships revealed that the relationship between pilot and master/ship officers is the most important one in a MSMS with the mean response of 4.87, followed by the relationship between ship staff and VTS manager (mean response = 4.75). The importance of the relationship between master and ship officers was also confirmed as it was ranked the third most important (mean response = 4.62). Meanwhile, the relationship between ship staff and harbour master was also supported as the fourth most important one with the mean response of 4.53. The perceived importance of internal and external relationships in a global MSMS is illustrated in table 5.

Insert table 5 about here

In order to be effective, it is also essential that there should be a well-established and active relationship between players at the operational level and the ones at the management level. It is desirable that this relationship is a key one affecting the management of maritime safety. When asked about their perception towards the relationship between players at the operational level and their regulators/peak bodies at the management level, 86.8% of respondents viewed it 'as the key safety relationship affecting the safety environment', and only 13.2% of respondents perceived it 'as normal as other relationships'.

The identification of key safety relationships as revealed from the focus group discussion was confirmed and their magnitude of importance was also supported by the international shipping community. In this respect, the relationship between Pilot and Ship Master/Ship officers plays the critical role to the management of maritime safety as the most important communication relationship, affirming the results found in various other studies regarding communication in maritime transport. In establishing a shore-based maritime safety system, it is also proved that the relationship between players on board the ship and safety-related agencies ashore such as VTS manager and Harbour Master contributes greatly to the safety management. Furthermore, it is noted that the communication relationship between players at the operational and management levels is critically important to the establishment, implementation and maintenance of any maritime safety management system.

Risks related to key safety issues in the MSMS

The following safety risks were identified by the focus group:

- Over abundance of safety planning but ineffective implementation or monitoring;
- Over reliance on paperwork to solve safety problems or adjusting the procedures to fit the existing culture and believing that it is satisfactory. Employees over burdened with paperwork may turn themselves off and take shortcuts;
- Safety system being onerous to the extent it gets ignored or paid lip service to, with 'flogging' of reports.
- Culture of non-compliance and hence organisations continue to operate in an unsafe manner;
- Taking a unilateral approach towards safety, leading to inconsistency among different sectors of the industry, and hindering the effectiveness of the safety system;
- Unsafe outcomes if pedantic commerciality is over-focussed and does not take safety as an integral element of operations.

These risks are closely related to the key safety issues discussed in the previous section. A safety plan or system without the commitment from senior management and the involvement of employees will be only superficial. The risk also persists if the safety environment is not established among organisations within the maritime industry and each of them takes its own approach to safety. Since safety of maritime transport involves various players operating in the same environment, the consistency in outcomes of regulations and requirements among sectors of the industry is critical for an effective system.

Respondents were fairly in agreement with members of the focus group regarding the risks related to key safety issues. In this respect, there is a high level of consensus among respondents to the statement that effective safety management is compromised if there is over abundance of safety planning but ineffective implementation or monitoring (mean response = 4.40). In order to be effective, the management of safety cannot simply rely on good planning but also implementation and monitoring. Thus appropriate legislation and working procedures are essential. Following the same argument, respondents also agreed that it would be dangerous for effective safety management to be over reliant on paperwork or on adjusting procedures to fit an existing culture. Moreover, it was agreed among respondents that safety should be integrated into operational practices so as not to be onerous, otherwise it will be paid lip service and thus will not be effective. Besides, any safety system should be consistent and demand realistic requirements. Unless good processes are set, the culture of non-compliance to safety requirements leading to unsafe outcomes will continue (mean response = 4.43). Table 6 presented respondents' attitude toward risks related to key safety issues in the MSMS.

Insert table 6 about here

Once the activities, relationships, main players, key safety issues and associated risks are identified, an effective safety management plan can be devised. The following section describes such a plan.

Contents of an effective maritime safety plan

The contents of an effective maritime safety plan should include the following:

- Operating systems for day-to-day operations from offshore navigation to bringing a vessel into a port and operations in the port area, i.e. harbour-master, pilotage, port operations etc.;
- Emergency response procedures;
- Environmental management plan;
- Occupational Health and Safety (OH & S) management plan;
- Security management plan.

The survey revealed that elements identified from the focus group discussion are very relevant and should be included in a good maritime safety plan. The lowest mean score is 4.09 and the highest one is 4.77; all are higher than 4, ('relevant'). This is illustrated in the table 7.

Insert table 7 about here

Specifically, it is found that 'standard emergency response procedures' received the highest mean score (4.77) as the relevant element of a good maritime safety plan. Apparently, a maritime safety plan is as good as any emergency response procedures included in it. In fact, these procedures should be worked out for all working environments in the maritime industry, not only on board the ship but also ashore such as in the port or channel areas. This is followed by 'standards of operating procedures for day-to-day operations of all shore-based activities' identified in the previous section of the study with the mean response of 4.70.

Security is closely related to safety issues in the maritime transport industry. While maritime security issues have persisted for several hundred years in the form of robbery and piracy, its magnitude has never been underestimated in the maritime transport industry. Today, together with traditional categories of maritime security such as piracy, cargo theft, stowaways etc, terrorism has become the new dimension and raised the importance of maritime security to a

new level of consideration. While implementing a security management plan, the objectives which are desired by safety management practices can also be achieved. In this regard, respondents also supported the argument that 'security management plan' is an indispensable element of a good maritime safety plan (mean response = 4.19). Occupational Health and Safety (OH&S) management plan also received similar support as an element of an effective maritime safety plan with the mean response of 4.13. Every system is designed surrounding the core element, the people. This is so, also, with a safety management system. As safety is always addressed in association with environmental protection, an 'environmental management plan' is critical to a good maritime safety plan. When an accident, for example an oil spill, occurs it is not only the company's shareholders who suffer, but also the stakeholders, for instance fishery and tourism industries who have to bear the consequences of such an accident. 'Environmental management plan' is thus also a relevant element of a good/effective maritime safety plan as supported by respondents (mean response = 4.09)

Requirements for success of a good maritime safety plan

The following system requirements were gathered from the focus group discussion:

- Inculcation of a safety culture to minimise the negative effect of human factors on safety;
- Recognition of the inevitability of operational errors and establishment of a series of defences to minimise the occurrences and their consequences;
- Clear involvement and accountability of management;
- Employees' involvement and acceptability of the system;
- Risk identification and reporting procedures;
- Clear, concise, simple and appropriate procedures providing risk control measures;
- Simple and functional standards of operating procedures to gain acceptance across the industry, essentially Code of Practices;
- Procedures clearly documented and training provided;

- Clear policy and best practice identified;
- Concise deliverables and objectives;
- Measurable, auditable and manageable outcomes/non-conformity;
- Supported by legislation.

The analysis of the responses indicated that the inculcation of a safety culture and minimisation of the effect of the human factor on risks is the most important requirement to a good maritime safety plan with the mean score of 4.62. This result reaffirms the fact that a positive safety culture, along with eliminating all risks related to human factor, is the core of any maritime safety management system. Respondents were also fairly in agreement with members of the focus group towards the recognition of the inevitability of operational errors and establishment of a series of defences to minimise consequences as the second most important requirement for a good maritime safety plan. The application of risk management techniques in maritime safety plan was also supported by the respondents. In this respect, respondents viewed the 'inclusion of risk identification and reporting procedures' as the third most important requirement for an effective maritime safety plan (mean score = 4.49). The important role of management is also supported (mean score = 4.49) by respondents considering this involvement and accountability as the fourth most important requirement. Even the least important requirement, 'concise deliverables and objectives', also has a mean score of response of 4.13 indicating that all requirements identified and discussed from the focus group discussion are considered as important to a good maritime safety plan. The importance of requirements is presented in table 8.

Insert table 8 about here

In general, it can be said that the contents and requirements for an effective maritime safety plan identified and discussed in the focus group discussion are supported by the wider international shipping community.

Other factors for the success of the MSMS

There are some other factors which are considered important by members of the focus group to the success of the MSMS. First, while the ISM Code was promoted by the IMO to provide international standards, it has been found that ISM certified ships' bridge teams are highly variable in quality with many appearing to lack training, attitude, culture and appropriate management. Intensive education and training are hence critical to the success of any maritime safety management system for operators to take ownership of any plan/system and to the process of inspiring the safety culture in organisations. This was, in fact, confirmed and supported by the international shipping community as one of the requirements for a good maritime safety plan as analysed in the previous section. Another perception is that the ISM Code should be refined before being extended to have a broader coverage since it is seen as not being a success and provides little incentive for further extension in its current form.

When asked to provide input on other possible issues or factors that may have impacts on the successful implementation of the MSMS, one respondent suggested that 'as majority of the collision incidents occurred during the pilotage, the liability should rest more on pilots instead all on ship's master'. Another respondent commented that 'international legislation and firm VTS management are necessary to create a culture where safety, security and swiftness go hand in hand'. This is further added by another respondent that 'MSMS is only as good as people attitude towards it, as they must believe in it and openly support it'. Clearly, these comments and perceptions have reinforced some of the important findings of this study, indicating that VTS managers and pilots, among others, are critical players in the maritime safety related activities viewed from the perspective of a global MSMS. In addition, a positive safety culture plays the vital role as the cement to bond all other elements necessary for the effective management of maritime safety, and this can be created and inspired by the commitment from senior management, involvement of employees and effective communication within and among organisations in the maritime industry.

One respondent also commented that ‘safety management and standards should be consistent with the socio-economic condition of a particular state’. Nevertheless, it is also perceived that safety of maritime transport is an international issue and cannot be dealt with by any single country. In this respect, it is very important that consistency and harmonisation of standards should be achieved not only within the sectors in the maritime industry, but also among countries participating in the international maritime transport activities as is the case in aviation. Another respondent also stressed that there should be cooperation among nations/regions sharing common marine environment in safety policies formulation. As far as this is concerned, it is perceived that any bilateral agreement should also be within the framework of international agreements so that consistency and harmonisation across countries can be achieved. Again, this emphasises some of the essential requirements for success of an effective global Maritime Safety Management System.

The scope of activities to be included in a global Maritime Safety Management System, main players involved, key safety relationships among players, key safety issues, related risks and contents and requirements for success of such a system are summarised in Figure 1.

Insert figure 1 about here

Conclusion

In this paper, we present the findings of a study investigating basic elements of a global Maritime Safety Management System. These elements have been identified, analysed and discussed, taking into consideration the need to extend the ISM Code which is currently applied only for the linkage between the ships and their operating/management companies. The study begins with the identification of key shore-based activities, main players involved, main safety-relationships among players, key safety issues together with associated risks. Based on this, main contents and essential requirements for an effective safety plan have also been identified. It

is expected that the findings of this study provide essential insights to the formulation of such a global Maritime Safety Management System for 'safer ships and cleaner oceans'.

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Figures and Tables

Table 1: Consensus on key safety issues

Key safety issues	Mean	Standard deviation
The safety culture should be inspired and communicated to all sectors within the MSM	4.68	1.52
A positive safety culture is a key determinant of a successful MSMS	4.66	1.54
In order to inspire the safety culture throughout the organisations, there should be high level of commitment from senior management and involvement of all staff	4.66	1.67
The role and commitment of senior management are vital in the management of safety	4.64	1.68
The effective communication among players at operational levels and between players at operational and management levels is viewed as very important in the management of safety	4.60	1.59
Safety should be a part of the work practice in every operation	4.60	1.59
Safety and commerciality issues should be treated on the equal footing in the maritime industry because safety is an indispensable part of all operation systems	4.49	1.63
It is essential to have appropriate legislation/working procedures involving safety for the successful implementation of any safety management plan	4.49	1.96
Consistency in all sectors of the maritime transport is essential to achieve an effective MSMS	4.38	1.70

Note: 1 = Strongly disagree, 5 = Strongly agree.

Table 2: The importance of activities in a global MSMS

Activities	Mean	Standard deviation	Rank
VTS/AIS and general waterway management	4.70	1.62	1
Aids to navigation	4.66	1.78	2
Pilotage	4.58	1.84	3
Port emergency response	4.34	1.89	4
Tug and towage	4.30	2.06	5
Channel and basin management	4.30	2.42	6
Ship berthing/unberthing	3.98	2.32	7
Shore-based security	3.91	2.03	8
Marine environmental management	3.85	2.04	9
Stevedoring	3.72	2.64	10
Safety surveying and consultancy	3.45	3.13	11
Ballast water exchange	3.32	2.74	12

Note: relative ranking based on factors' mean scores; 1 = not at all important, 5 = very important.

Table 3: The importance of key players in a global MSMS

Key players	Mean	Standard deviation	Rank
VTS managers	4.83	1.51	1
Pilots	4.81	1.42	2
Port authorities/Harbour masters	4.79	1.59	3
Tug and towage providers	4.45	2.15	4
Port and terminal operators/Stevedoring companies	4.30	2.50	5
Ship and cargo agencies	3.57	2.93	6
Marine environmental managers	3.47	2.33	7
Independent contractors (mooring, security, etc)	3.32	2.35	8
Marine surveyors and consultants	3.30	2.33	9
Port worker unions	3.04	2.90	10
Regional councils	2.96	2.60	11
Fishing industry	2.92	2.89	12

Note: relative ranking based on factors' mean scores; 1 = not at all important, 5 = very important.

Table 4: The matrix of communication relationships in maritime transport chain

Dimensions Levels	Vertical	Horizontal
Operational	Communication among players on board the ship	Communication between players on board the ship and agents ashore or with players beyond the ship such as tug operator
Management	Communication between players on board the ship and its operating/ management company ashore	Communication between the ship operating/management company and the flag state; and between the flag state and peak bodies/organisations

Table 5: The importance of relationships in a global MSMS

Relationships	Mean	Standard deviation	Rank
Between pilot and master/ship officers	4.87	1.10	1
Between ship staff and VTS manager	4.75	1.66	2
Between master and ship officers	4.62	1.81	3
Between ship staff and Harbour master	4.53	2.06	4
Between master/ship officers and crew	4.40	2.03	5
Between ship staff and tug operator	4.21	1.72	6
Between ship staff and port staff	4.08	1.88	7
Between port staff and independent contractors/visitors	3.57	2.49	8

Note: relative ranking based on factors' mean scores; 1 = not at all important, 5 = very important.

Table 6: Consensus towards identification of safety risks

Risks related to key safety issues	Mean	Standard deviation
The culture of non-compliance to safety requirements leading to high operating costs and unsafe outcomes will continue as long as good processes are not set	4.43	1.61
It is dangerous for effective safety management to be over reliant on paperwork or adjusting the procedures to fit the existing culture and believe that it is satisfactory	4.40	1.93
If there is over abundance of safety planning, but ineffective implementation or monitoring, then effective safety management is compromised	4.40	2.31
If the safety system is onerous it will be ignored or paid lip service and will not be effective	4.38	2.02

Note: 1 = Strongly disagree, 5 = Strongly agree.

Table 7: Appropriateness of elements of a good maritime safety plan

Contents of a good maritime safety plan	Mean	Standard deviation
Standard emergency response procedures	4.77	1.36
Standards of operating procedures for day-to-day operations of all shore-based activities listed in the previous section	4.70	1.62
Security management plan	4.19	1.80
OH & S management plan	4.13	1.68
Environmental management plan	4.09	1.82

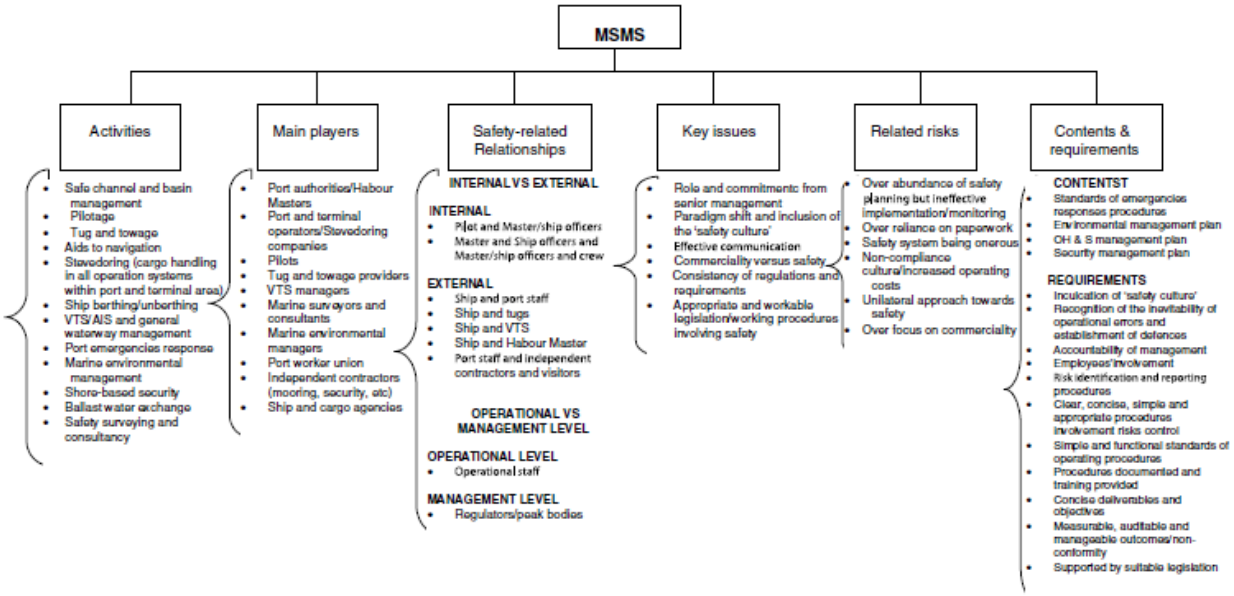
Note: 1 = Very irrelevant, 5 = Very relevant.

Table 8: The importance of requirements to a good maritime safety plan

Requirements	Mean	Standard deviation	Rank
Inculcation of a safety culture and minimisation of the effect of human factors on risks	4.62	1.58	1
Recognition of the inevitability of operational errors and establishment of a series of defences to minimise consequences	4.55	1.62	2
Inclusion of risk identification and reporting procedures	4.49	1.75	3
Clear involvement and accountability of management playing the principal role	4.49	1.86	4
Clear, concise, simple and appropriate procedures providing risk control measures	4.49	1.96	5
Simple and functional standards for operating procedures	4.45	1.74	6
Procedures documented and training provided	4.42	1.84	7
Employees' involvement and ownership of the plan	4.36	2.20	8
Clear policy and best practice identified	4.34	2.09	9
Supported by legislation	4.23	1.96	10
Measurable, auditable and manageable outcomes/non-conformity	4.13	2.10	11
Concise deliverables and objectives	4.13	2.28	12

Note: relative ranking based on factors' mean scores; 1 = not at all important, 5 = very important.

Figure 1: Features of a Maritime Safety Management System (MSMS).



APPENDIX: THE POSTAL QUESTIONNAIRE

STUDY OF MARITIME SAFETY MANAGEMENT SYSTEM

1 = Not at all important 2 = Not important 3 = Neutral

4 = Important 5 = Very Important

A. SAFETY-RELATED ACTIVITIES IN THE MARITIME SAFETY MANAGEMENT SYSTEM (MSMS)

1. Please indicate the importance of the following activities in a global MSMS.

(a) Channel and basin management	1	2	3	4	5
(b) Pilotage	1	2	3	4	5
(c) Tug and towage	1	2	3	4	5
(d) Aids to navigation	1	2	3	4	5
(e) Stevedoring (Cargo handling in all operation systems within port and terminal area)	1	2	3	4	5
(f) Ship berthing/Unberthing	1	2	3	4	5
(g) VTS/AIS and general waterway management	1	2	3	4	5
(h) Port emergency response	1	2	3	4	5
(i) Marine environmental management	1	2	3	4	5
(j) Shore-based security	1	2	3	4	5
(k) Ballast water exchange	1	2	3	4	5
(l) Safety surveying and consultancy	1	2	3	4	5
(m) *Others (please specify)*					
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5

B. SAFETY-RELATED PLAYERS IN THE MSMS

2. Please indicate the importance of the following players in a MSMS.

(a) Port authorities/Harbour Masters	1	2	3	4	5
(b) Port and terminal operators/Stevedoring companies	1	2	3	4	5
(c) Pilots	1	2	3	4	5
(d) Tug and towage providers	1	2	3	4	5
(e) VTS managers	1	2	3	4	5
(f) Marine surveyors and consultants	1	2	3	4	5
(g) Marine environmental managers	1	2	3	4	5
(h) Port worker unions	1	2	3	4	5
(i) Independent contractors (mooring, security, etc)	1	2	3	4	5
(j) Regional councils	1	2	3	4	5
(k) Fishing industry	1	2	3	4	5
(l) Ship and cargo agencies	1	2	3	4	5

(m) *Others (please specify)*					
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5

C. SAFETY-RELATED RELATIONSHIPS IN THE MSMS

3. Please indicate the importance of the following relationships in a MSMS.

(a) Between Pilot and Master/Ship Officers	1	2	3	4	5
(b) Between Master and Ship Officers	1	2	3	4	5
(c) Between Master/Ship Officers and crew	1	2	3	4	5
(d) Between ship staff and port staff	1	2	3	4	5
(e) Between ship staff and tug operator	1	2	3	4	5
(f) Between ship staff and VTS manager	1	2	3	4	5
(g) Between ship staff and Harbour Master	1	2	3	4	5
(h) Between port staff and independent contractors/visitors	1	2	3	4	5
(i) *Others (please specify)*					
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5

4. How do you view the relationship between players at the operational level and their regulators/peak bodies at the management level as far as maritime safety is concerned?

   (a) *As the key safety relationship affecting the safety environment* ❑

   (b) *As normal as other relationships* ❑

D. REQUIREMENTS OF A GOOD MARITIME SAFETY PLAN

5. Please indicate the importance of the following to the success of a good maritime safety plan.

(a) Inculcation of a safety culture and minimization of the effect of human factors on risks	1	2	3	4	5
(b) Recognition of the inevitability of operational errors and establishment of a series of defenses to minimize consequences	1	2	3	4	5
(c) Clear involvement and accountability of management playing the principal role	1	2	3	4	5
(d) Employees' involvement and ownership of the plan	1	2	3	4	5
(e) Inclusion of risk identification and reporting procedures	1	2	3	4	5
(f) Clear, concise, simple and appropriate procedures providing risk control measures	1	2	3	4	5
(g) Simple and functional standards for operating procedures	1	2	3	4	5
(h) Procedures documented and training provided	1	2	3	4	5
(i) Clear policy and best practice identified	1	2	3	4	5
(j) Concise deliverables and objectives	1	2	3	4	5
(k) Measurable, auditable and manageable outcomes/non-conformity	1	2	3	4	5
(l) Supported by legislation	1	2	3	4	5
(m) *Others (please specify)*					
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5

1 = Strongly disagree 2 = Disagree 3 = Neutral 4 = Agree 5 = Strongly Agree

E. KEY SAFETY ISSUES IN THE MSMS

6. Please indicate your view on the following key safety issues.

(a) The role and commitment of senior management are vital in the management of safety	1	2	3	4	5

(b) A positive safety culture is a key determinant of a successful MSMS	1	2	3	4	5
(c) In order to inspire the safety culture throughout the organisations, there should be high level of commitment from senior management and involvement of all staff	1	2	3	4	5
(d) The safety culture should be inspired and communicated to all sectors within the MSMS	1	2	3	4	5
(e) The effective communication among players at operational levels and between players at operational and management levels is viewed as very important in the management of safety	1	2	3	4	5
(f) Safety and commerciality issues should be treated on the equal footing in the maritime industry because safety is an indispensable part of all operation systems	1	2	3	4	5
(g) Safety should be a part of the work practice in every operation	1	2	3	4	5
(h) Consistency of regulations and requirements in all sectors of maritime transport is essential to achieve an effective MSMS	1	2	3	4	5
(i) It is essential to have appropriate legislation, as well as working procedures involving safety, for the successful implementation of any safety management plan	1	2	3	4	5
(j) *Others (please specify)*					
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5

F. RISKS RELATED TO KEY SAFETY ISSUES

7. Please indicate your view on the following risks related to key safety issues in section E above.

(a) If there is over abundance of safety planning, but ineffective implementation or monitoring, then effective safety management is compromised	1	2	3	4	5
(b) It is dangerous for effective safety management to be over reliant on paperwork or adjusting the procedures to fit the existing culture and believe that it is satisfactory	1	2	3	4	5
(c) If the safety system is onerous it will be ignored or paid lip service and will not be effective	1	2	3	4	5
(d) The culture of non-compliance to safety requirements leading to high operating costs and unsafe outcomes will continue as long as good processes are not set	1	2	3	4	5
(e) *Others (please specify)*					
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5

G. CONTENTS OF A GOOD MARITIME SAFETY PLAN

8. How relevant are the following to a good maritime safety plan?

1 = Very Irrelevant 2 = Irrelevant 3 = Neutral 4 = Relevant 5 = Very Relevant

(a) Standards of operating procedures for day-to-day operations of all shore-based activities listed in section A	1	2	3	4	5
(b) Standard emergency response procedures	1	2	3	4	5
(c) Environmental management plan	1	2	3	4	5
(d) OH & S management plan	1	2	3	4	5
(e) Security management plan	1	2	3	4	5
(f) *Others (please specify)*					
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5

9. In order to achieve successful implementation of the MSMS do you perceive any other issues or factors to be considered? (*Please attach a separate page if more space is needed*)

.....

.....

10. Do you have any other comments on this study? (*Please attach a separate page if more space is needed*)

.....

.....

H. GENERAL INFORMATION

Your name: ..... Designation: .....
Organisation: .....

You are a:

Port authority/Harbour Master ❑ *Pilot authority* ❑ *VTS manager* ❑

Port operator/Stevedoring company ❑

Marine Aids to Navigation/Lighthouse authority ❑

Other (Please specify) ❑ .....

Would you like to receive a copy of this report?

Yes ❑ *No* ❑

Address for correspondence: .....

.....

Thank you very much for your valuable contribution to this questionnaire.