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Safety Culture: Enhancing Shipping Safety through Better Near Miss Reporting

By

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This thesis has resulted from the author's own efforts. It has been created for the purposes of the PhD award and not been submitted for any previous examination, nor been awarded for any other degree.

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Abbreviation	Meaning
KPI	Key Performance Indicators
2nd Eng.	Second Engineer
2nd Off	Second Officer
3rd Eng.	Third Engineer
3rd Off	Third Officer
4th Eng.	Fourth Engineer
AB	Able Seaman
ATSB	Australian Transport Safety Bureau
B.Sc.	a Bachelor of Science degree
BA, B.Sc.	A bachelor’s degree
BIMCO	Baltic and International Maritime Council
BRM	Bridge Resource Management
BSMT	The Bachelor of Science in Marine Transportation
BW	Boatswain
CC	Chef Cook
Ch Eng.	Chief Engineer
Ch Off	Chief Officer
CHIRP	Confidential Human Factors Incident Reporting Programme
COC2	Certificate of Competency level 2
COC3	Certificate of Competency level 3
CS	Chief Steward
DC	Deck Cadet
DMAIB	Danish Marine Accident Investigation Board
DPA	Designated Person Ashore
EC	Engine Cadet
ERM	Bridge Recourse Management
ETO	Electro-Technical Officer
FAC	First Aid Cases
FAT	Number of Fatalities
Fit	Fitter
HND	A Higher National Diploma
HSE	Health, Safety and Environment Manual
HSE manual	Health, Safety and Environmental manual
LTI	Lost time incident
LTIF	Lost time incident frequency
LWC	Number of lost workday cases
MAIB	Marine Accident Investigation Branch
MPA	Master of Public Administration
MS	Marine Superintendent
MS	Marine Superintend
MSc	A Master of Science

MTC	Number of medical treatment cases
NMR	Near Miss Reporting
NTSB	National transportation safety Board of America
Oil	Oiler
OOW	Officer of the Watch
OS	Ordinary Seaman
PCM 10+2	Candidates, who have studied the combination of physics, chemistry and mathematics (PCM) in the high school class.
PPE	Personal Protective Equipment
PSC	Port State Control
PTD	Number of permanent total disabilities
PTEC	It is an abbreviation for a process technology degree. This is a degree path to getting a Process Operator job.
RE	Resilience Engineering
RORO	Roll-on Roll-off
RWC	Number of restricted work cases
SCA	Safety Climate Assessment
Std. Dev	Standard Deviation
TRCF	Total recordable cases frequency
TSB	The Transportation Safety Board of Canada
VHF	Very High Frequency

Abstract

The history of the maritime industry is full of catastrophic accidents. These accidents are attributed to human and organisational factors. The new trend for the enhancement of shipping safety is by increasing the Safety Culture of the shipping industry. Thus, implementing an effective Safety Culture mitigates the feasibility of the reoccurrence of the same unsafe acts. Such an implementation is a requirement by the International Safety Management (ISM) Code. The ISM code also requires shipping companies to develop a system for reporting 'Near Misses' as they are the root causes of any catastrophic accident. However, the ISM Code does not provide a standardised method for the Near Miss Reporting (NMR) system. This leads the shipping companies to create their own system without paying attention to the impact and without taking the maximum advantage of the lessons learned. Therefore, this thesis aims to develop a novel and standardised NMR System that helps to enhance the overall Safety Culture as the NMR is considered a tool to identify the human weaknesses in the socio-technical system and to manage them to mitigate the reoccurrence of the similar gaps. This aim was achieved via conducting NMR assessment through interviews of the key personnel in a shipping company and a reporting culture questionnaire, which was distributed among the seafarers at the same shipping company. Another method, which is utilised to measure the leading factors that influence the NMR, is the KPI assessment for the same shipping company. After gathering those data, a newly designed NMR form and framework were proposed and tested via a confidential link among the company crew to compare its outcome with the existing reporting form. When all the assessments were completed, and all the data was gathered, appropriate analyses were conducted to identify the gaps and to propose solutions for them. Those methods have resulted in existence of the blame culture at

the shipping company and the existing NMR system at the shipping company requires significant improvement. The ineffective NMR system at the shipping company leads to unexpected KPIs result.

1. Introduction

1.1. Chapter overview

This chapter demonstrates the importance of the shipping industry and its positive contribution to global trade. The improvement to the Maritime Regulations is also included in this chapter. The last section outlines the structure of the thesis.

1.2. The Importance of the Shipping Industry

The world seaborne trade has noticed a significant increase throughout the years; from 1983 to 2016, except the year 2009 when worldwide economic crises happened. This increase was in parallel with the increase in world trade and the world domestic products, as shown in Figure 1-1 below. This harmonised increase is a reflection of the importance of the seaborne trade and the shipping industry in general.

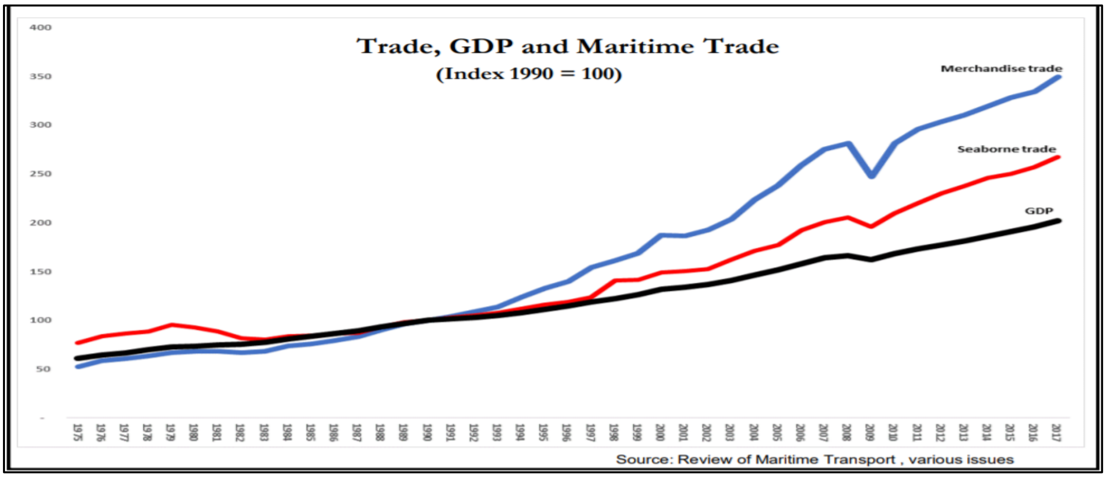


Figure 1-1 world seaborne transportation (UNCTAD, 2018) © UNCTAD

Throughout history, there have been many significant maritime accidents, which have increased over the years as the seaborne trade and the number of ships increased. Those accidents have had an impact on public awareness and the development of the maritime regulatory framework. Many of the maritime regulations and conventions under the general umbrella of the International Maritime Organisations IMO have come into force after significant marine catastrophic accidents. The paragraph below provides a brief summary of the most critical marine regulations that were introduced after a catastrophic accident:

- According to the U.S Senate (2020), the RMS Titanic, which sank into the Pacific ocean in 1912 and resulted in more than 1500 fatalities, had influenced the IMO to take action. Thus, the first version of the Safety of Life at Sea (SOLAS) convention was adopted accordingly in 1914. Due to the First World War, the convention was not introduced officially. However, in 1974 SOLAS came into force with its new amendments (IMO, 2020a).
- According to the Wells (2016), the SS Torrey Canyon struck Pollard's Rock on Seven Stones reef, between the Cornish mainland and the Isles of Scilly in 1967. It caused an environmental disaster and a significant oil spill. This accident resulted in the adoption of the International Convention for the Prevention of Pollution from Ships (MARPOL) in 1973 (IMO, 2019a).
- According to ITOPF (1978), MT Amoco Cadiz ran aground in 1978, causing a massive oil spill. This accident resulted in an amendment to the MARPOL convention.
- The RORO car and passenger vessel MS Herald of Free Enterprise had capsized in 1987 after leaving the port with a bow-ramp open. After this accident, the IMO had adopted a new resolution, the International Safety Management Code (ISM) under the section of the Safety Management System (SMS). The new resolution has some guidelines related to the shore-based management of the ships to ensure the safe operation of RORO ferries (IMO, 2019a).
- According to NTSB (1989), a single-hull tanker, 'the MT Exxon Valdez', ran aground on the1989, causing a massive oil spill. This accident forced the United States of

America to implement a new rule; any tanker sailing to its ports must be double-hull vessels. After that, the US Government has contacted the IMO to ask for making this rule as a part of the MARPOL and to be applied to all new-build tanker ships. Thus, in 1992, MARPOL was amended to make it mandatory for all tankers ships above 5000 DWT to be double hull.

- According to Duda and Wawruch (2017), MT Erika was broken into two parts due to a massive storm in the gulf of the Biscay. The bow section sank on the day of the accident in 1999. The stern section also sank in the following day. This catastrophic accident accelerated the adoption of a new resolution with regards to the double-hull tankers. Therefore, in April 2005, the double hull tankers came into force (IMO, 2020b).
- MT Prestige, which was a single-hull tanker, sank due to the fatigue-related damage to the starboard side of the hull while sailing in heavy weather in 2002 (Duda and Wawruch, 2017). This event led to further calls of amendments to phase-out scheduling of the single-hull tankers (IMO, 2019a).

All those accidents must lead to a significant improvement in the regulation to make the maritime industry safer. On the other hand, several pieces of research have been carried out to investigate those accidents and to identify the root causes as 75%-96% of the accidents are attributed to human error (Rothblum, 2000), (Hanzu-Pazara *et al.*, 2008) and (Perrow, 2011). The general approach within the shipping industry has been blaming and punishing the seafarers for their errors. However, recent studies identified that the accidents are shaped and motivated by the organisational factors that affect the choices of the seafarers (Chauvin, 2011).

These facts lead to the generation of the safety concept for ship operation to be followed by all the seafarers while serving on-board and by the managers in the shore-based office. The common concept is the International Safety Management code (ISM), which was introduced by the IMO and has come into force in 1998. The ISM code was not dealt with properly by the shipping companies as the safety culture has been lacking among shipping companies, including their employees and seafarers in the early of 2000. Safety culture can be defined as the shared attitude, perceptions, values and belief in the company (Cox and Cox, 1991). The core of the safety culture concept is to deal with the human factors as if they are the driving force for enhancing the overall safety rather than blaming the crew for their mistakes. To reach this ideal picture of applying a proper safety culture and to get rid of the blaming culture, a standardised and systematic Near Miss Reporting (NMR) is required to be implemented effectively.

Implementation of the NMR, in harmony with the requirement of the ISM code, was issued by the IMO under a specific guideline for NMR (IMO, 2008). In this guideline, the IMO has clearly written that all shipping companies should collect and analyse NMR from their fleets. Moreover, ISM code under section 9.1 states "The SMS should include procedures ensuring that non-conformities, Near Misses, incident, accidents and hazardous situations are reported to the Company, investigated and analysed with the objective of improving safety and pollution prevention (Safety4Sea, 2010). The active practice of the NMR improves the safety performance of companies and seafarers, resulting in safer vessel operations. Moreover, it helps in overcoming the blame culture phenomenon, which is a strong undesirable characteristic of the maritime sector. Definition of non-conformities, Near Misses, incident, accidents are listed in Table *3-3* in chapter three below.

Therefore, the aim of this study is to assess the reporting culture as a part of the safety culture of a well-known shipping company. As this shipping company is the biggest and has the stronger reputation comparing to others shipping company at the region. The chosen shipping company contain four different fleets, (Oil Tankers fleet, Chemical Tankers fleet, Multi purposes fleet and Dry Bulk fleet). In addition to that, a new systematic NMR framework will be proposed for the shipping company to identify the effectiveness of the existing and new reporting system.

1.3. Structure of the thesis

The structure of this thesis is formed as summarised below:

- Chapter 1: outlines the importance of the shipping industry, the improvement of the regulatory framework that regulated the safety of the shipping and the necessity of implementing a systematic NMR.
- Chapter 2: lists the aims and objectives of this research. The motivation behind this study is mentioned in this chapter, as well.
- Chapter 3: presents the critical review of the literature related to the Reporting Culture, type of errors, and comparing different Near Miss reporting system around the world.
- Chapter 4: presents NMR assessment and the methodologies that are utilised to build up the data of this thesis. The development of each methodology is included in this chapter, as well.
- Chapter 5: contains the detailed analyses of data collected for the shipping company, which are utilised as a case study. The data were grouped under five different domains of reporting culture assessment. In addition to that, the semi-structured interview results are also provided in this chapter.
- Chapter 6: presents the description of the Key Performance Indicators of the safety performance of the shipping company. The chapter also includes the assessment for the KPI with a correlation between them and between the KPI and the survey domains.

- Chapter 7: presents the development of the new reporting form and framework for the Near Miss that was proposed to the shipping company. This chapter also presents the results obtained from the implementation of the new NMR form and the efficiency of it.
- Chapter 8: presents the comparison of the outcomes from the Newly designed reporting form and the existing reporting form. The comparison was made after capturing the opinions of experts about the contents of the two reporting forms.
- Chapter 9: Details the key contribution of the research reported in this thesis to the general safety of the shipping industry. Furthermore, how the aims and the objectives were achieved within this study and the recommendations for future work are also included in this chapter.
- Chapter 10: summaries the main findings and outcomes from this study, including key conclusions.

2. Research Aims and Objectives

2.1. Chapter Overview

This chapter demonstrates and presents the motivation behind this study which leads to the aims and objectives.

2.2. The motivation behind this work

While reading the literature related to human factors, human errors, safety culture and organisational culture, the percentage of accidents related to human errors directly or indirectly was remarkably high. The percentage of maritime accidents due to human errors is 80% (Hetherington, Flin and Mearns, 2006) and (Perrow, 2011), while another study related to maritime accidents has stated that on average 85% of maritime casualties are caused by human errors (Rothblum, 2000). In addition, many researchers in the field of maritime technology have invested in automated systems, reliable hull designs and regulatory frameworks to eliminate the maritime accidents (Hetherington, Flin and Mearns, 2006).

Unfortunately, human errors, possibly due to organisational factors such as lack of recruiting or lack of work related procedures, play a significant role in maritime accidents and fatalities (Xi *et al.*, 2009). Another factor which motivated this research is the lack of implementation of Near Miss Reporting (NMR) culture and practice. There is no standardised method for reporting, receiving and analysing the reports to achieve the best results and to benefit from lessons learned. Consequently, seafarers are still repeating the same unfortunate errors without being aware of the consequences.

2.3. Aim and Objectives

The main aim of this study is to enhance shipping safety by assessing the reporting culture in a specific shipping company and proposing a more effective Near Miss Reporting (NMR) procedure. The assessment for the reporting culture helps to improve the overall safety culture and to increase company resilience. Creating a standardised reporting method for a Near Miss is considered as a novelty for this study. The standardised reporting system for a Near Miss is inspired by Near Miss reporting systems in the aviation domain and from well-known NMR systems within the maritime industry such as CHIRP, REPCON, EMCIP, MARS. Unfortunately, all the existing systems for a Near Miss do not include all the necessary aspects that are required to be covered while reporting or dealing with the Near Misses after submitting the report. Thus, a new comprehensive system for reporting the unsafe acts/conditions is required to assure a higher safety culture among the shipping industry. The specific objectives to achieve the main aim of this research are listed below:

- Review the literature related to the reporting culture as part of the safety culture, type of failures that lead to accidents (mainly human errors) and Near Miss reporting systems within the maritime and aviation sectors. By using this method, it is possible to identify the gaps which could be solved by applying an effective, feasible and standardised NMR system.
- Measure the effectiveness of the existing NMR system in a shipping company. The measurements aim to evaluate the weaknesses and strengths of the current system available in the shipping company. Two different techniques were used to perform the assessment; a questionnaire, which is distributed to the company's seafarers and; a semi-structured interview with key personnel in the shipping company.

- Assess the shipping company's KPIs to determine the safety culture level of the shipping company in general and how the NMR is influencing the overall safety culture in the shipping company.
- Create a new reporting form for Near Misses and implement it in the shipping company for a short period of time as a testing mode to evaluate its feasibility and effectiveness compared to the existing NMR form.

2.4. Chapter Summary

This chapter has outlined the motivation behind this study while presenting the main aim and the objectives of this study.

3. Critical review

3.1. Chapter Overview

A Critical review of the literature was carried out and reported in this chapter, which includes safety culture, reporting Culture, NMR systems and resilience engineering, as they are the main areas of this research. A critical review of the topic will help the author to identify the progress in the field as well as the knowledge gaps that will form the basis of the research and the structure of this thesis.

3.2. Introduction

The maritime shipping industry is one of the most complicated sectors among the transportation industries such as rail and aviation sectors due to the numerous marine stakeholders involved in this field (Parviainen *et al.*, 2017). The marine transportation mode covers 80% of the international trade around the globe (UNATAD, 2018). For those reasons, the maritime industry has grown by 240% in the past three decades. However, despite all the growth and the impact of the shipping industry, the number of accidents and the incidents have shown a significant increase (Morel, Chauvin and Langard, 2013). As continuous growth constitutes new challenges to maintain the safety of the complicated shipping sector, this triggers more mobilisation of the entire maritime regulatory bodies to take preventive actions to eliminate catastrophic marine accidents (Arslan, 2018).

The new safety challenges that have appeared after the significant growth was due to neglection of the human factors by the scholars over developing new technologies on-board ships. Thus, the vessels' systems get more complicated, and most of the equipment at the bridge are integrated compared to the old fashion vessels. On the other hand, the seafarers who are operating the ships are from different background, nationalities, qualifications and different level of understanding of safety culture. Moreover, the number of crew who are operating these complicated systems on-board ships has decreased over the last two decades. All those factors have played a significant role in increasing the number of maritime accidents which are related to human factors directly or indirectly.

The maritime industry attempted to mitigate accidents, which are caused by human factors by using several techniques. Those techniques are focusing on the accident or the incident investigations to identify the root causes behind the unfortunate occurrences of these accidents/incidents. Many regional and governmental investigation bodies are involved in the analysis and monitoring the causation of the maritime accidents, such as; Marine Accident Investigation Branch (MAIB), Danish Maritime Accident Investigation Board (DMAIB), National Transportation Safety Board of America (NTSB), Transportation Safety Board of Canada (TSB) and Australian Transportation Safety Bureau (ATSB). All those investigation boards are investigating and producing a high number of accident investigation reports. Those reports have been analysed and extracted in many research studies such as (Hänninen, Ståhlberg and Kujala, 2012) and (Tirunagari, 2015) to determine the causal factors for the accidents and to find a way to mitigate the maritime accidents.

Recently, shipping companies from different sectors have been investing in new approaches to assess their performance and to find leading indicators for the accidents in a proactive approach rather than taking the reactive measures. The new approach aims to develop intervention strategies to prevent the accidents. Those approaches are the safety culture assessments in general, and improvement methods to gain insight into the safety relates issues (Tomlinson, Craig and Meehan, 2011). The proactive preventive measures are required to be taken in ample time to avoid the occurrence of the accidents as Håvold (2007) has argued in his study. In addition, he mentioned that developing a tool to measure safety within a shipping company should include an assessment of the safety culture as a proactive approach. The reason behind this is that the reactive approaches such as; Analyses of root causes and accidents/incidents investigation did not provide the desired improvement in maritime safety. In this thesis, the reporting culture as a part of the safety culture will be assessed (Proactively) in order to enhance shipping safety by improving the NMR culture to manage human errors proactively.

The development of the accident attribution was suggested by (Håvold, 2007). Figure 3-1 below shows how the author understands the stages for the historical development of the accident attribution.

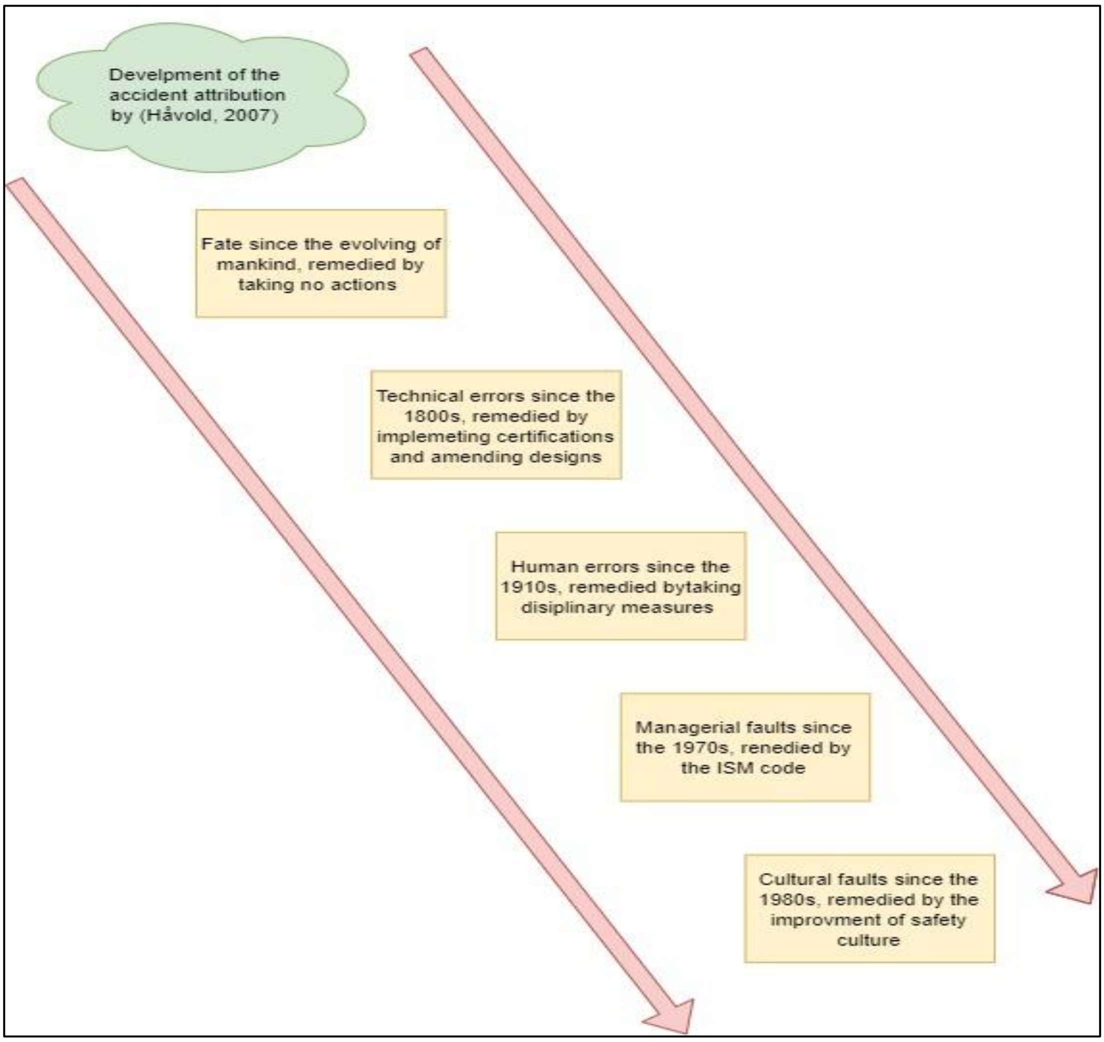


Figure 3-1 Development of the accident attribution by (Håvold, 2007)

3.3. Near Miss Reporting Culture as Part of the Safety Culture

The term safety climate or safety culture was introduced for the first time by (Keenan, Kerr and Sherman, 1951). After that, the term Safety Culture has become more frequent and used by the International Atomic Agency after the Chernobyl Catastrophic Accident (IAEA, 1986). Hence, there was no specific definition for the term Safety Culture. After that, many researchers have published their research in this field, and each of them has designed his/her own definition. Table 3-1 below shows some of those definitions:

Table 3-1 Definition of safety Culture by different authors

Reference	**Definition of safety culture**
Zohar (1980)	A summary of moral perceptions, which employees share about their work environment.
IAEA (1986)	*``that assembly of characteristics and attitudes in organisations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by significance."*
HSC (1993)	the product of individual and group values, attitudes, competencies, and patterns of behaviour that determine the commitment to, and the style and proficiency of, an organisation's health & safety programmes.
Ostrom *et al.* (1993)	The concept that the organisation's beliefs and attitudes manifested in actions, policies, procedures, affect its safety performance.
Zohar (2010)	the shared perceptions concerning practices, procedures and behaviours that work for a common strategic focus.
Reason (2016)	Safety Culture as a highly informed culture where people can report any safety-related issue without the fear of the blame or the punishment.

Guldenmund (2000) has mentioned in his study that the term Climate and Culture were being used interchangeably in many pieces of research. However, after the 1970s, they started to have a different meaning in safety research. Safety Climate was described by Zohar (2010) as the shared perceptions concerning practices, procedures and behaviours that work for a common strategic focus. The meaning of Safety Climate is different from the meaning of the Safety Culture, which is seen to be a part of overall culture in organizations and it reflects shared belief and values amongst the members of organizations as mentioned earlier.

Another definition of Safety Culture, which is morphologically different but fundamentally more profound, was provided by Reason (2016). He described the Safety Culture as a highly informed culture where people can report any safety-related issue without the feeling of the fear of the blame or the punishment. On top of that, companies can utilise these reports to enhance safety. This leads to the concept of the NMR and its importance in enhancing any complex organisations' safety culture. Ostrom et al., have emphasised the importance of the collaboration between the employees and the managers in any decent organisations by any means to assess their safety and then improve their safety culture level. In this case, the NMR is highlighted as the appropriate mean of collaboration between the managers and the employees to ensure the improvement for the overall safety.

Arslan (2018), in his study, has highlighted the influence of the subculture such as the age, qualification, and nationality on the safety culture. He also mentioned it could be a threat to safety. Therefore, shipping companies should apply the training to the seafarers to raise the level of maturity of each group of the seafarers in terms of safety culture. Subsequently, the safety culture will be enhanced. This is achievable in the maritime sector by applying an active NMR culture, as it is considered as a learning and training opportunity for all the crewmembers if they take it seriously.

Havold, described the safety culture as a social glue among crewmembers, as the junior officers will absorb the high level of maturity and safety culture from the senior officer through socialization. Therefore, it is better for the senior staff in any critical organization to start the adoption first and to take most of the NMR benefits and then set the example for the younger crew. By this way, they will influence and motivate the junior staff to follow/copy their behaviour and improve the overall safety among the organisation. On top of that, the managers, who impose and evaluate the safety among the organisation, will have their opportunity to share the same understanding of safety as the rest of the employees through analysing the NMR collected.

The importance of learning and taking lessons lies in improving the safety culture within any organisation. Pidgeon and O'Leary (2000) illustrated the importance of learning from past mistakes as it is considered as one of the critical factors of safety culture. He also listed the factors that could play a role in elimination the active learning within any organisation such as the lack of communication, blame and the political pressure. Those factors were the main reasons behind the well-known disaster in history, the *Challenger*. Before the launching of the *Challenger,* a discussion was held between NASA and the manufacturer regarding the functionality of the O-rings in low temperatures and possible risks that might occur due to the O-ring. However, the decision-makers at NASA have ignored the possible risk and decided to proceed with the launching due to the political pressure (Weick and Vaughan, 1997). Therefore, organizations need to have an appropriate safety culture and risk assessment to evaluate the feasibility of operating the system without any losses. Moreover, reporting the political pressure to concerned bodies as a Near Miss would avoid similar catastrophic accidents.

An appropriate safety culture can be achieved through the utilization of procedures, written instructions, and reporting Near Misses; however, it highly depends on the common mindset of the organization. Ship and shore staff should be ensured, encouraged and inspired by the management to gain the envisaged attitudes and competency levels to achieve the same safety objectives (Berg, 2013).

The safety culture, which was proposed by Guldenmund (2000) has three levels, as presented in Figure 3-2 below. levels are; the *outer shell* level at which, the organisations propose safety meeting, inspection reports and dress code. The visibility of this level is hard to comprehend. The second level is the *filling layer*; at this level, the safety management system is taking place where polices, training, procedures and regulations are introduced by the organisation. This level is relatively explicit and visible compared to the *outer shell* level. The most advanced and visible level is the *hardcore layer* of the safety culture. At this level, safety is perceived as a core value, at which, the observation and understanding are considered to develop safety within the organisation.

The third level would be more successful by applying an effective NMR system to allow the organisation to utilise the unfortunate occurrences accurately and intelligently to avoid similar events by taking preventive actions and lessons learned by all staff. By this way, the resilience of the safety culture would be very effective.

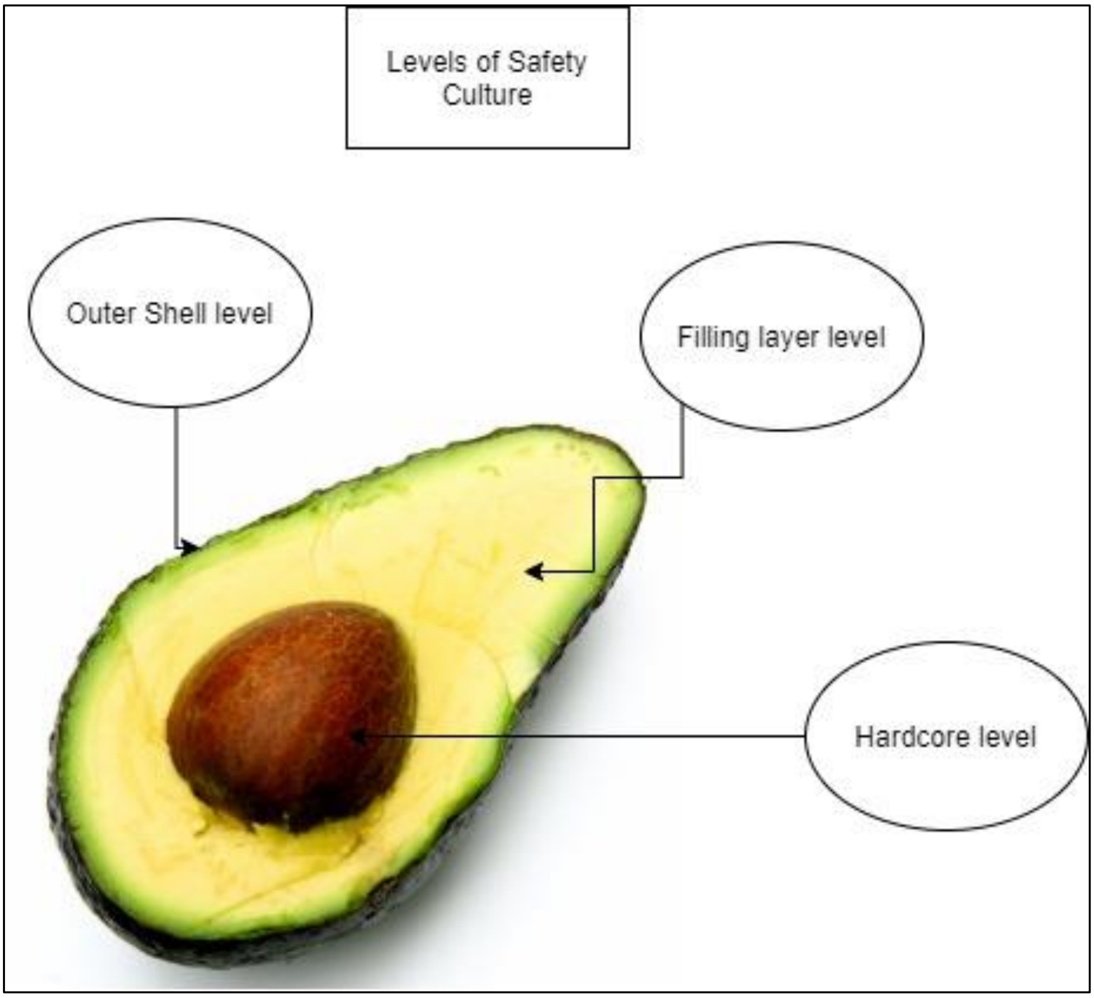


Figure 3-2 Safety Culture levels

Stemn *et al.* (2019) have adopted a maturity level of safety culture in their study as presented in Figure 3-3 below. The Safety Culture maturity level is more advanced than the level of culture proposed by (Guldenmund, 2000). The first stage of the maturity level is the basic level, where there is no culture at all, any accident will be acceptable, and no action will be taken. The final stage is the resilient stage, where the safety culture is put in place in a systematic way to improve the understanding of safety among the employees and to prevent an accident from happening. The Figure 3-3 below shows the stages of the improvement of the safety culture maturity level.

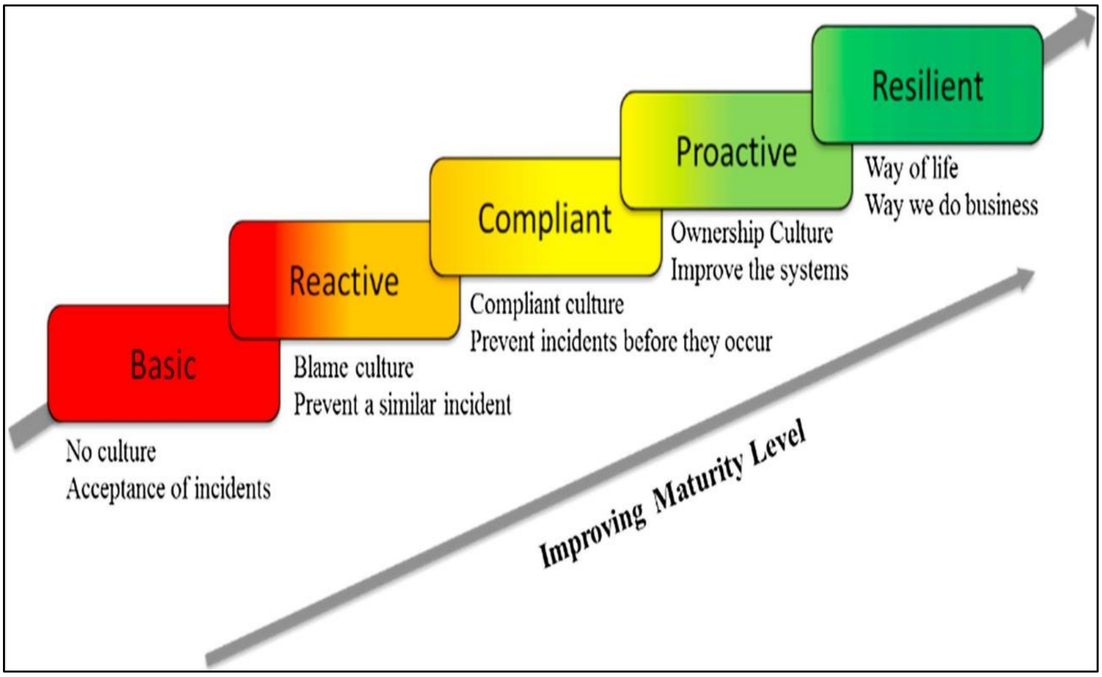


Figure 3-3 Safety Culture maturity level (Guldenmund, 2000)

It is a top priority for any organisation, which deals with safety critical operations, to have a dynamic safety culture where they can improve their performance on safety according to the present circumstances. When the organizations climb on the safety culture maturity ladder, the level of addressing the consequences of the unfortunate events, trust between managers and employees will increase continually. Moreover, the employee will be more responsible for commencing their duties professionally. This level of the resilient cannot be completed without a successful NMR system. Therefore, the attitude of the employees toward risks and understanding of safety at any critical organisation should be evaluated to determine at which level of Maturity ladder the organisation is?

Some researchers such as Groeneweg et al., 2013, cited in (Arslan, 2018) have stated that the concept of safety is not fully understood. Therefore, evaluating the level of safety is not an easy task, and it needs continuous planning and engagement as the risks at shipping companies are inherent. Thus, some shipping companies have a low accident rate compared to other companies. This does not mean their level of safety culture is high, and their likelihood of the occurrence of a catastrophic accident exists (Arslan, 2018). For this reason, the NMR system should be maintained continuously by managers in the shipping companies to have better picture of the unidentified and unexpected events, its consequences and corrective actions taken. Thus, the safety culture level of a company can also be assessed by comparing the outcome of the NMR assessment against other shipping companies.

The IMO (2008) stated in their Near Miss reporting guideline that the unexpected and unidentified event could lead to a significant accident. A good and useful Near Miss Reporting would provide an excellent opportunity for the shipping company to address the reasons behind the Near Misses so that potential accidents and the repetition of similar Near Misses are prevented. However, a productive reporting culture must overcome the concept of blame culture and punishment, as this is the only way to increase the maturity level of the safety culture.

As stated by Veiga (2002), the existence of the blame culture among the shipping industry is a well-known fact that prevents the maritime industry from leaping forward as far as safety is concerned. The concept of the blame culture is to blame and punish the individuals for their unintentional actions, which lead to accidents/incidents. Based on this fact, we can estimate the level of the safety culture among shipping companies to be at a reactive level according to the maturity level of safety culture. This level is not acceptable as there are three more levels to climb on. Gorini, Miglioretti and Pravettoni (2012) have highlighted the consequences of the blame culture among seafarers, as the existence of the blame culture leads the seafarers to follow the procedures but not taking any additional measures or being resilient in performing the duties to avoid any unintentional incidents.

Ek (2003) has mentioned in his study that good organisation is required to adopt Learning Culture to provide a learning opportunity for the staff. Through this journey, the staff should be willing to adopt changes. The Learning Culture then will guide the organisation to implement Reporting Culture where any staff members can report a Near Miss without any fear. However, the reporting Culture is strongly connected with the Just Culture, which is required to eradicate the blame and the punishment culture to increase the reporting and learning. While applying the Just Culture, an organisation is responsible for making taxonomy for the acceptable and not acceptable behaviours (IMO, 2008). However, the distinction between acceptable and non-acceptable behaviour should be defined and communicated clearly by the company so that managers will be able to implement the just culture properly.

Reason (2016) has mentioned in his study the relationship between the safety culture and the contributory components that lead to an effective safety culture. He said an effective Safety Culture cannot succeed without the mature and effective reporting culture. Especially when it comes to an organisation with people who work in direct contact with sources of hazards, operators and workers need to report their unintentional errors and Near Misses without fear of punishment to avoid any consequences. All organisations need to adopt a Just Culture instead of the blame culture. Just culture is an atmosphere of trust in which people are encouraged, even rewarded for providing essential information related to safety. They should distinguish the line between acceptable and non-acceptable behaviour in the just culture environment (Reason, 2016). However, if the principles of Just Culture are not implemented properly, this approach leads to Blame Culture, especially if the consequences of the errors by the workers were uncontrollable.

Therefore, NMR was made mandatory for all shipping companies to improve the trust and the concept of the just culture. However, the significant majority of the companies is not following an anonymous reporting system. Therefore, the shipping companies are maintaining the same level of just culture, which blocks the improvement to reach a higher safety culture. (Arslan, 2018) states that just culture is part of the safety culture, and therefore, just culture means managers should tolerate the unintentional mistakes that are made by the seafarers during daily routine tasks. On the other hand, deliberate violation in applying safe practice can result in severe consequences and losses. Just culture should be implemented properly for unintentional and intentional incidents to be able to reap the benefits. Risk on-board vessels is an integral part of the operations of the shipping industry, and reporting the mistakes are considered as a learning opportunity for seafarers. Therefore, shipping companies are advised to implement an anonymous NMR to reach a resilient level of safety culture. Thus, an accident can be avoided, and crewmembers would be educated better by taking the chance of learning from mistakes.

3.4. Reporting Culture

Highly complex organisations such as shipping companies need to develop a very good understanding among all employees regarding the importance of NMR to overcome any undesirable consequences for any unsafe act. Such improvement will not happen by presenting the idea only. The workers need to be trained about the company values in order to be persuaded to apply the reporting culture (Reason, 2016), especially when it comes to reporting every single unsafe act against a co-worker. Even if the workers are convinced to report their mistakes, the issue of mistrust between employees and managers will be standing as a barrier for implementing active reporting culture (Cox, Jones and Collinson, 2006). According to Reason (2016) Mistrust issue on the worker's mind is formed as a question such as; will my colleagues or I get into serious trouble? Does any of the workers will be punished or exposed to revenge?

Persuading a worker to adopt reporting practice is not an easy mission for managers, due to its direct relation with many factors. First of all, most of the workers tend to ignore reporting if they are sceptical that managerial level will not consider their reports seriously as they expected (Reason, 2016). Secondly, one factor which may also play a significant role to discourage employees from participating in Near Miss reporting is that the reporting is seen as an extra workload for employees mainly if reporting is performed in paperwork (Tapaninen, Storgard and Erdogan, 2012). (Reason, 2016) also mentioned that human nature has a desire to forget any incident, which has occurred to avoid stress.

Effective reporting systems exist in many sectors, such as the aviation sectors (Beaubien and Baker, 2002). However, those reporting platforms are required to have good criteria to address the concern of the users to overcome any issue that stands against a successful NMR practice. The NMR system needs to be designed in a way that guarantees the user the full anonymity and a systematic way of giving the reporter an acknowledgement. Thus, the reporter will not feel that the reporting was a time-wasting activity or a threat to his career. If the users feel that these reports might be threatening their career as they may be used against them, then the reporting system will be a major failure. Reason (2016) has examined some successful reporting systems in the aviation sector. His findings were concluded in five main contributory points of achieving a successful reporting system. If these points are included in the overall criteria of any of the reporting systems, then it will be successful in term of the quality and the quantity of the reports generated by the users. These contributory points are:

- Corrective action must be taken whenever a wrong behaviour is observed to eliminate the consequences.
- All reports must be set up by taking confidentiality into the whole process.
- The collection and analysis department for all reports needs to be entirely separated from the department who has the authority to impose any disciplinary action if required.

Those three factors will lead to mutual trust among the workers and their managers.

- Feedback after analysing the reports to the reporter should be prompt, useful and accessible.

- The process of generating reports should be smooth and standardised.

Mutual trust is going to be developed in the long run and in the continuity of adopting these contributory factors. Users may hesitate to report their mistakes until the system is proven that it will not threaten the career of any of the reporters.

3.5. Importance of reporting Unsafe act

According to the IMO (2008), '*Learning the lessons from Near Misses should help to improve safety performance since Near Misses can share the same underlying causes as losses'*. Reporting hazardous occurrences in order to create lessons learned from other mistakes is a widely accepted approach in most of the complex organisations such as aviation, health and nuclear power industry. It is proven that establishing such a reporting system has affected safety performance positively (Lappalainen *et al.*, 2011). The maritime industry is one of the complex sectors that requires a robust, effective NMR system. This requirement is strictly listed in the ISM code to adopt reporting culture for any occurrence on-board any ship. Corrective action must be taken as well to prevent a similar incident from reoccurring in the future (Tapaninen, Storgard and Erdogan, 2012). Reporting incident and investigating the root causes of the incidents may contribute to enhancing maritime technology, modifying organisational structure and routine by improving crew training. In other words, powerful reporting is leading to better safety performance (Lappalainen *et al.*, 2011).

According to Storgård *et al.* (2012), there are 29 minor incidents and 300 Near Misses for each severe accident. Now we can understand the importance of reporting the Near Miss and taking corrective action toward the elimination of severe accidents and managing human errors. Each shipping company is required by the ISM code to make sure that their SMS is properly functioning by maintaining an effective reporting system for Near Misses and incidents to ensure that the human errors which may lead to catastrophic accidents are prevented.

3.6. Barrier against good reporting practice

Satisfaction level for each reporting system can be measured. One of the measurement methods is to check the collected number of reports, whether it is according to the minimum targeted number or not. The quality and reliability of the reports are also required to be examined. Wang (2006a) has mentioned that ignoring reporting in any high reliable industry is considered as a significant limitation for that system. For instance, according to Harper and Helmreich (2005) in the healthcare sector, many of the doctors failed or were reluctant to report medical errors. The last statistics related to the under-reporting for Near Miss showed that 96% of medical errors were unreported. This significant percentage of cases without reporting could lead to loss of lives. Thus, there must be several barriers that prevent the staff on any organisation from reporting a Near Miss. However, more importantly, underlying reasons for such high under-reporting should be identified and mitigated.

For instance, a Voluntary organisation in the UK has launched the Confidential Human Factors Incident Reporting Programme (CHIRP) to collect NMR from both the aviation sector and the maritime domain. In the first year after launching, they received only 70 reports (Wang, 2006a). This kind of underreporting is common in all reporting systems in any sectors. After investigating the underreporting phenomenon, we can identify some barriers against conducting a good reporting practice. The next section is exploring those barriers.

3.6.1. Excessive paperwork

Since the ISM code have been implemented, it had contributed to turning the seafarers' life into a very complicated one (Knudsen, 2009). The significant amount of paperwork, such as very detailed checklists for every single task, and reporting every single event to mitigate complicated consequences, are the most critical issues which usually maritime personnel used to complain about. Andersen *et al.* (2002) have mentioned in their study that reporting to authorities had increased the workload of the operator. If the operator needs to report several times during the working hours, then a significant amount of time would be spent, especially if the reports need to be handwritten. When it comes to a reporting form in the maritime sector, filling the form with full details in critical navigational or operational condition will be challenging, as it is a time-consuming exercise and it will distract the operator from his primary duty. However, in minimum manning requirements, paperwork is not taken into account. Wang (2006a) argued, seafarers already face excessive paperwork, as they are required to fill lots of checklists, **a**nd it reflects negatively on performing other essential tasks. Therefore, the safety of the navigation could be in danger while conducting paperwork.

Knudsen (2009) has conducted a study on how paperwork could affect general safety after the implementation of the ISM code. The main finding was that unsafe reporting act, and paperwork is regarded as an extra load for seafarers as they considered it as time-wasting. That is due to the difficulty of focusing and concentrating on important tasks such as critical manoeuvres and filling reports or checklists at the same time.

Moreover, Lappalainen *et al.* (2011) in their study have found that Near Miss Reporting is considered as a deficiency in the ISM code. Since the beginning of the reporting process, most of the shipping companies used to report unsafe acts by using paper reporting forms which created an extra load of paperwork. In addition to that, each company needs to create its own safety management system SMS in order to comply with the ISM Code. The managerial level is taking part in writing procedure and giving feedback to seafarers who are working on-board ships. Unfortunately, both managers and seafarers on-board ships have a different understanding and perception of on-board safety as the managers are away from the working environment on-board the ships (Storgård *et al.*, 2012). Sometimes the written procedure does not match operational realities, maritime personnel needs and their desire to perform their duties with full capability. That is why seafarers are respond to written procedures in their own way that matches the nature of their work (Dekker, 2003). This is due to a lack of communication between seafarers who are on-board ships and people who sit in their offices, making a significant amount of polices to make seafarers' lives more complicated.

From this point of view, Tapaninen, Storgard and Erdogan (2012) mentioned in their study that maritime personnel started to build some barriers between themselves and the ISM code to stay protected from any extra load coming from high authority. However, while all ships are operated by a minimum number of seafarers that is determined by IMO’s minimum manning regulations, the paperwork remains at the same level as it is not considered as part of minimum manning requirements. This point works against the ISM code, as it diverts the ISM code from achieving its primary goal, which is having a safer shipping industry. Researchers, who have investigated this matter, Tapaninen, Storgard and Erdogan (2012) have mentioned that reducing paperwork by having a computerised system could make a significant contribution towards increasing the efficiency of the seafarers while reporting unsafe acts or filling checklists. However, having such a system is not the only thing that can reduce paperwork. Some computer systems cannot be operated unless the operators had training on how to use the system. Managers at shipping companies are usually satisfied if they installed a new technology such as; a software for reporting the Near Miss and leaving the maritime personnel with the operating manual only without proper training. They expect seafarers to operate it without any challenges. The best practice is to observe how seafarer is reacting to the new technology and find the weak points to enhance their performance, because not all software is user-friendly or easy to understand. Therefore, a standardised reporting system for Near Miss is required for the shipping industry to save the employees’ time when they move from one company to another, avoiding learning a new system.

3.6.2. Bias for superior safety issues

Bias for superior safety issues by the organizational managers means giving priority to the critical safety issues that may result in severe consequences. Many people tend not to report Near Misses believing that the reports will not be read, analysed, or even no feedback will be provided by the organisation's managers (Wang, 2006a), (Evans *et al.*, 2006) and (Williamsen, 2013). A study was conducted by Evans *et al.* (2006) on a hospital to assess the efficiency of the NMR system. The survey was distributed for over 773 doctors and nurses, 61% of them agreed that the lack of feedback is standing as a barrier between them and the excellent reporting process. From that point of view, Near Miss reports need to be dealt with sincerely, professionally and timely, including feedback. Then, feedback with possible preventive actions for a similar case and recommendation would be appreciated by the seafarers. Consequently, seafarers will be encouraged to continue to report all events to assure having a safe working environment. If there are no such recommendations or feedback, seafarers would prefer to take corrective action by themselves without reporting what they have done wrong (Wang, 2006a). Therefore, the corrective action could not be enough, as no one will learn from others' mistakes or best practices.

Van Der Schaaf and Kanse (2004) have stated in their book that most of the people think that mistakes are part of their job, and Near Miss cannot be avoided. Authors also argued that lessons resulted from Near Miss reports are not as much valuable compared to the lessons learned resulted from accident reports. However, these arguments by Van Der Schaaf and Kanse are not fair, as Near Misses are giving valuable lessons which play a significant role in avoiding catastrophic accidents. On top of all that, decision-makers usually pay less attention to Near Miss when comparing to accident reports as mentioned by (Wang, 2006a). He also said that people do not know the value of Near Miss reporting unless they were informed about how many accidents have been prevented due to proper reporting. Therefore, publishing newsletters and safety bulletins to seafarers with some statistics and potential accidents prevented due to NMR will motivate the seafarers to utilise NMR more regularly. Moreover, the analysis team who investigate the Near Miss reports must not ignore any of the reports and should be fair in evaluating every single Near Miss as an individual case. Then, the whole organisation's safety culture will accelerate to the next level. The trust between the seafarers and the managers will increase, and they will share the same understanding of safety through analysing and providing feedback for each Near Miss report.

3.6.3. Fear of blame and punishment

Fear of being blamed or punished or losing reputation among the fellow seafarers is also one of the factors that influences the Near Miss reporting practice (Vrbnjak *et al.*, 2016) and (Haw, Stubbs and Dickens, 2014). Blame culture can be defined as the tendency to look for one person or organisation that can be held responsible for any unsafe act or error such as; Near Miss or even accident. This blame culture has divided the maritime personnel into two categories. The first category of seafarer tends to react poorly with the reporting process or even not to report any event (Withington *et al.*, 2006). The second category of the employees is not concerned about being accused or even being ashamed in case if they report an incident (Van Der Schaaf and Kanse, 2004). This variation in seafarers' minds about such a sensitive topic leads us to develop a standard way of reporting which reflect the concept of just culture without blaming and with mutual trust among the organisational staff. It is commonly known that people tend to cover their mistakes to avoid any kind of criticism or punishment. This is because of human nature, seafarers would tend to blame their co-workers for any mistakes they have done, and they think by this way, they will encourage fewer errors (Wang, 2006a). The negative impact of blaming has been observed clearly among seafarers while reporting a Near Miss if the report was not anonymous as the number of the reports are less than the expected number. Thus, blaming will never encourage people to make fewer errors. On the contrary, the blame will lead to covering mistakes to avoid punishment. When it comes to reporting Near Misses, people will prefer not to communicate/report to avoid punishment by the top-level managers. Therefore, most of the well-known and successful reporting systems tend to hide the identity of the reporter to keep them protected by the organisational policy of confidentiality and anonymity. In reality, the reporter still worries about being identified despite being anonymous while reporting Near Miss (Wang, 2006a).

Vrbnjak *et al.* (2016) have recommended in their study some methods that would help to overcome the fear of the blame. An anonymous, effective and uncomplicated reporting system will help the reporter to feel free to report every single unsafe act or condition. Besides that, the managers are required to be as supportive as they can by providing feedback to the reporters. Here comes the importance of building mutual trust between employees and their managers. Building this trust can be achieved through the training courses for the seafarers on the working process of the system. This is considered as transparency between the managers and the seafarers (Badokhon, 2018). Showing the seafarers an example of the analysis process of the received reports is also considered as a part of the transparency. In addition to that, the blame culture must be eliminated by applying an anonymous reporting system for Near Misses. The seafarers should trust their marine superintendent and should be able to approach him in case any unsafe situation occurred. Receiving feedback and acknowledgement from marine superintendents is one of the ways to improve the communications and the mutual trust between the seafarers and their superiors at the shore-based office (Arslan, 2018). Then the seafarers will feel reassured that their identity will be hidden in any Near Miss reports. Therefore, more reports will be generated, and no one will be punished, or none of the seafarers' career will be affected, resulting in safer shipping organisation.

3.6.4. Business pressure

Maritime personnel are dealing with pressure from different sources. As Arslan (2018) stated the stakeholders are putting pressure on shipping companies which may affect the safety negatively. Cargo needs to be delivered on time due to the contractual requirements to avoid any economic sanctions. Sometimes shipping companies take additional risks to avoid penalties due to the delay and continue their operations even sailing through rough weather. Although sailing according to the schedule is of paramount importance for the shipping organisations, an operation should immediately stop if safety is at stake. Each ship should clearly indicate that the Estimated Time of Arrival (ETA) can be delayed if there is a safety concern.

Especially when they arrive at a harbour, they could not just focus on the primary goal of safety first while the officer in charge is taking care of cargo handling and other duties. The duties at the ports are as follow as mentioned by Wang (2006a); all ships while at berth must deal with a pilot, tugs, stevedores, agent, port state control, and loading/discharging master. Besides those pressures, shipping companies are also committed with tide schedules which puts the seafarers under pressure that leads to taking some risky actions (Arslan, 2018). Thus, breaching the safe operating procedures and underreporting Near Misses by seafarers is not recognised by the shipping companies if no accidents are occurring. Therefore, managers in the office are compromising the safety of the ships by prioritising the time table not to lose the company’s reputation by maintaining the sailing schedule of ships. Williamsen (2013) and Smith *et al.* (2014) have argued, fear of losing a good reputation is one of the barriers against good NMR practice. Williamsen (2013), also mentioned in his report that, peer pressure in one of the most common barriers of conducting effective reporting for Near Miss. Thus, educating the seafarers about the importance of prioritising safety over any other task whether at berth or while sailing will improve the overall safety culture, including the reporting culture of the shipping company (Pidgeon and O'Leary, 2000). Subsequently, the maritime accident rate among the shipping company is expected to decrease significantly.

3.6.5. Lack of trust

The framework of trust between employee and managers from a theoretical point of view can help the development of approaches to improve or maintain a certain level of trust to enhance the organizational safety and reliability (Currall and Epstein, 2003). According to Ashleigh and Stanton (2001), the level of trust is not measurable whether it exists or not. It is a dynamic phenomenon where the trust is moving upwards or downwards depending on attitudes, expectations and behaviour of the organization's individuals or managerial staff. Trust is built by making the decision while relying on another party in normal and risky/critical conditions (Currall and Epstein, 2003). It means that trust is based on two essential components, which are reliance and risk. Risk demonstrates there is a possibility that it may cost or harm the trusting party in case, the other party betrays the trust. Maintaining the trust requires continuous communication and a flow of information between both parties, as mentioned by (Currall and Epstein, 2003).

Shamir and Lapidot (2003) have suggested that managers, who are willing to share information when it is necessary with their employees, can be trusted. Moreover, active and supportive leadership can have a significant impact on building and enhancing trusted relations between managers and employees and encourage more NMR (Vrbnjak *et al.*, 2016). Thus, any shipping company that applies an effective NMR without fear of blame or punishment is categorised as a shipping company that applies the Just Culture effectively. Therefore, those shipping companies consider the NMR as a learning opportunity, as the trust exists between the company managers and the seafarers (Arslan, 2018).

By studying all these arguments made by the researchers and the facts about the trusted relationship in any organization, it can be confidently stated that reporting culture in any critical sector is an implementation of the Just Culture (IMO, 2008). Moreover, applying effective NMR is based on mutual trust. In case of the absence of mutual trust, a barrier against reporting Near Misses would be present, and it is detrimental to the enhancement of safety. Therefore, as Reason (2016) stated, at both employee and managerial level, the mutual trust needs to be socially engineered to overcome bureaucratic barriers.

3.7. The impact of the ISM code on Marine Accidents

International Safety Management code (ISM), came into force on the 1st of July 1998 (IMO, 2019b). This code aimed to provide a framework for the ship owners in the maritime sector to manage the safety of ship operations, including their employees' health and safety issue. In order to investigate whether this code has achieved the mentioned aim or not, there were so many studies, which investigated the efficacy of the ISM code. The results of these studies varied significantly. Bhattacharya (2012) has stated in his research that, across the industry, it is commonly argued that shipboard occupational health and safety OHS has not seen noticeable enhancements since the ISM Code was implemented. The underlying causal factors for the apparent lack of improvement were identified as seafarers' poor employment condition and the lack of trust between the seafarers and their managers. Additionally, in 2008, the International Union of Marine Insurance has introduced different results as sited in (Bhattacharya, 2012). One of the results stated that the total number of shipping accidents due to operational failure had been reduced since the beginning of the ISM code in 1998. On the other hand, the total number of ship collisions has increased in the same period of time (Bhattacharya, 2012).

Another positive study carried out by Tzannatos and Kokotos (2009) stated that the ISM code had provided a positive impact among the Greek shipping companies. They have analysed around 268 accident reports before and after the ISM Code was introduced. The analysis of accident reports indicated that the percentage of accidents due to human error decreased from

64% to 52%. However, the reduction among oil tankers and Roll on- Roll off (RORO) passenger ships was even higher (from 84% to 55%). Bhattacharya (2012) has shown that the positive impact of the ISM was more effective among seafarer than managers in the shore-based offices. More profoundly, the efficiency of ISM among the seafarers was higher in the Organization for Economic Co-operation and Development OECD countries than among the seafarers from the Philippines or India (Anderson, 2003). Thus, by knowing the fact that OECD countries have a more advanced education system which leads to better understanding and implementation of safety initiatives and applying regulations while working at the maritime sector.

Bhattacharya (2012) in his review mentioned that, the IMO has conducted another study to measure the efficiency of the ISM code. The result showed that between 96% and 99% of the participants have considered the ISM code is useful. Jouni. Lappalainen., Kim. Salmi. *et al.* (2009) in their report, have shown evidence about the influence of the ISM code on the safety culture since the early years of its implementation in the late 1990s. This study included a number of interviews with several shipping companies and contained a questionnaire. Their finding is concluded in the following paragraph:

The ISM code has made a significant improvement in overall safety. It helped in creating a systematic safety management system (SMS) as it is one of the company responsibilities (Lappalainen, 2008). Some of the crew have mentioned that the SMS is considered as guidance for them to recognise their daily tasks. Thus, the SMS is regarded as essential guidance for all maritime personnel. Therefore, by sticking to the SMS, the Safety Culture will be enhanced gradually. Moreover, Reporting deficiencies, non-conformities (an observed situation where objective evidence indicates the non-fulfilment of a specified requirement of the ISM code) and Near Misses are considered as a first step for improving the safety culture. However, Old seafarers, ordinary seaman (OS) and catering staff are very poor in reporting Near Misses

(Arslan, 2018). Thus, it is noticeable that any negligence in Near Miss reporting is considered as a deficiency in the ISM code itself. Therefore, it would be more beneficial if the ISM code recommended the anonymous reporting systems for Near Misses to be applied by shipping companies.

Some of the findings also indicated the importance of the ISM code for any shipping company. Some shipping companies, which believed they had higher standards of safety management, were found, after the external assessment, to have safety management level well below the average standards (Jouni. Lappalainen., Kim. Salmi. *et al.*, 2009). This indicates the importance of having an industry benchmark and independent external auditing. Especially small shipping companies have a shortage in safety management system SMS, and their documents are complicated or incomplete.

3.8. Underlying Reasons for Accidents

Rothblum (2000) has mentioned two examples of real maritime disasters caused by human error and led to significant damage to the environment. These examples demonstrate the meanings of active and latent conditions very clearly. One of the accidents was a collision between M/V SANTA CRUZ and USCGC CUYAHOGA. At that time the weather was calm, no traffic, no malefactor error with the equipment and no design error. They sighted each other by both naked eyes and radar. Unfortunately, and mistakenly, the USCGC CUYAHOGA turned in front of M/V SANTA CRUS. After the investigation of the accident, they found that fatigue and no communication between the master and the crew led to this disaster, which is considered as an active failure and latent condition (Rothblum, 2000). From this example, we can come up with a general understanding of active failures and latent conditions. Active failures are the unsafe act committed by the seafarers who have direct interaction with the system without any contributory factor from a higher managerial level (Reason, 2000). In this case, the lack of the communication between the master and the rest of the crew is classed as the active failure, while fatigue was classed as the latent condition caused by the company's rest hours practice.

Active failures can be described by giving examples such as; lack of communication between the crewmembers as mentioned in the accident that described earlier. Active failure is the activities or errors made by the first-line operators (crew of ships in this case) directly and effected the safety for the crew members. In some cases, an accident could happen while the master and his crew are fully capable of doing their duties. An example of a capable crew who caused a significant accident is the M.T Torry Canyon disaster which shipwrecked in March 1967. Due to business pressure, the Captain has decided to take a short cut by passing a dangerous route during high tide to arrive at the port. Unfortunately, the ship is known by this accident. The decision made by the master is considered as an active failure (Chauvin, 2011).

Another factor, which could influence human errors is the communication and the ability to take corrective action in a short time among the bridge team. This issue could be enhanced by attending the Bridge Resource Management course (BRM) (Chauvin, 2011). He also argued that this course encourages the representation and the quality of the brain to achieve better communication among the seafarers. This kind of error is considered as an active failure or human failure because it reflects the capability of the bridge team in performing effective communication. In general, active failure is the consequence of a deeper chain of events known as the latent conditions.

On the other hand, the latent condition reflects a wrong decision or action taken by the top managerial level who are at a distance from the accident. Those failures can exist in any system for a long time without interfering the safety of the system unless an active condition has been triggered (Reason, 2000). Thus, accidents can be prevented whenever trained and motivated crew are operating the ships even with the existence of the latent failures. Latent failures in some cases could trigger an active failure such as; business pressure, minimum manning, inadequate equipment which may lead to a long-lasting hole in the layers of the system. Moreover, providing a suitable working environment such as an appropriate ship to work on, quality food and exercise facilities to all crew members may help them to have a healthier mind (MLC, 2006). Additionally, it is commonly known that changing one-person's behaviour is not sufficient. If the work environment can be changed, and then it will impact positively on human performance (Reason, 2000).

Figure 3-4 below shows the hierarchy system for an accident to happen, examples of latent failure and human or active failure according to the author's understanding.

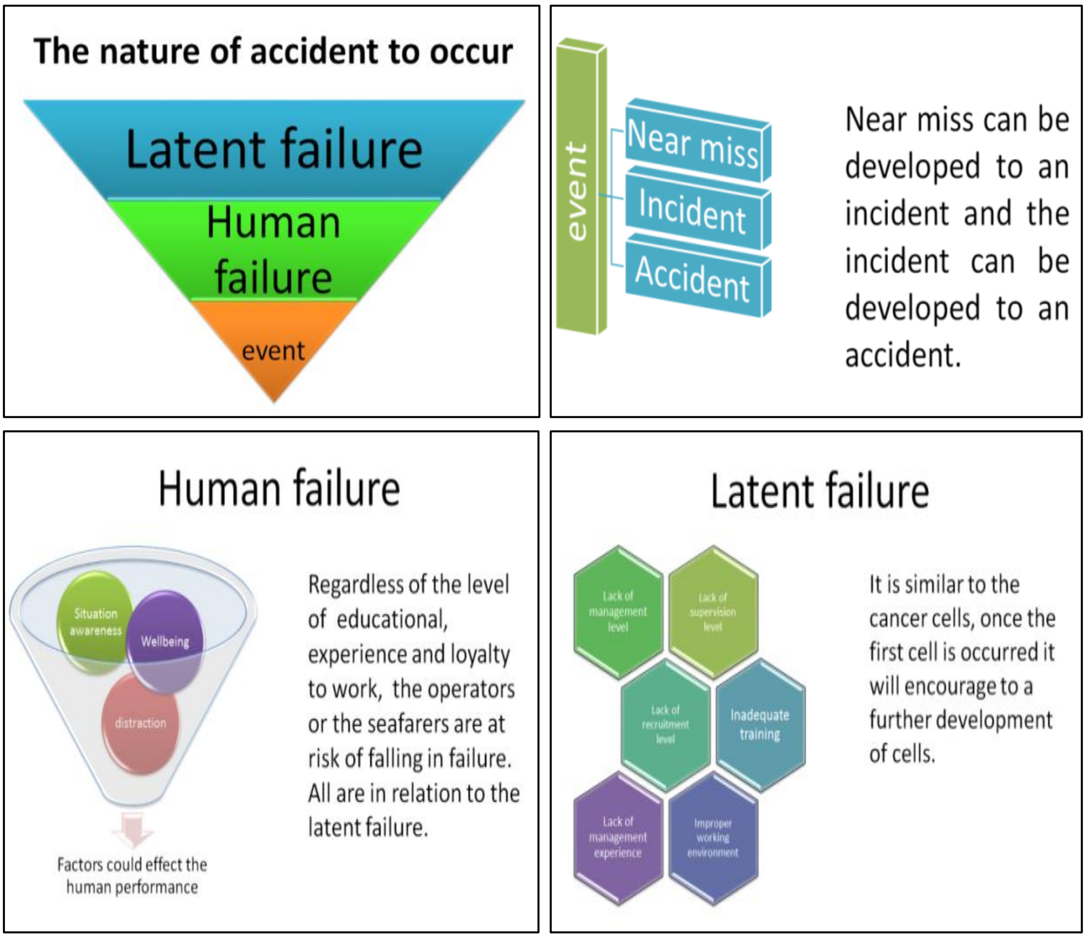


Figure 3-4 Type of Failure

3.9. Barrier management to prevent accidents

The main purpose of barrier management is to ensure that any system is working effectively and creating a safe working environment in any complex organisation. The techniques for barrier management should be included as a part of daily routine work. Especially in the maritime industry, due to its complicated organisational structure, some of the employees of an organisation are based in the company offices while the rest of the staff are on-board ships as seafarers. In addition to that, it is likely to find differentiation in understanding safety among the two groups of the employees. The different techniques for the barriers according to the PSA (2013), the Petroleum Safety Authority of Norway, could be designed in many forms.

They can be technical barrier such as water tide doors, operational, procedural such as; checklists, alarm systems, or organisational barriers like communication, training and organisational elements in a single or collective form, to minimise the likelihood of a specific error, risk or accident occurring or containing the damage. Accident investigations have captured that inadequate barrier has been the main cause of many accidents in some of the operational industry (Johansen and Rausand, 2015). Therefore, maritime organisations are required to build a barrier management systems that create and maintain safety barriers so that any risks encountered can be managed through avoiding an accident from occurring or by reducing the impact of the unsafe acts (Badokhon, 2018). NMR is one of the methods that manage barriers through handling human errors and mitigating the consequences of the root causes by preparing the seafarers to take immediate corrective action. Subsequently, the shipping companies will be able to find proper preventive actions for those root causes after studying and analysing the Near Miss Reports. Thus, any risks that are identified through Near Miss Reporting can be managed by developing appropriate barriers, which will prevent accidents from occurring or reduce the impact of the accident at least.

The idea of the Swiss Cheese Model by Reason (2000) has been introduced in 1997, which can be modelled by mimicking several layers of Swiss Cheese as protective layers for any system. Reason believes that accidents are an accumulation of active failures by the operators in the first-line and latent conditions by the employees who are at a distance from the accident. The active failures are unsafe acts that include latent conditions as root causes. The result of the accumulation of the events is shown as unsafe conditions, which are complex linear cause and effect. From this point of view, the incident can be prevented by strengthening and managing the barriers that stand between each of the causations of an accident (Reason, 2000). Those layers have dynamic holes that have the ability to change their positions depending on the nature of the error that breach the system. Some of the layers are engineered by an alarm or automatic shut down as a preventive action to eliminate the error. However, if the barriers or the layers have failed to prevent the chain of unsafe acts from happening, the result would be an accident. Therefore, each barrier is required to be engineered to eliminate the possibility of an unsafe act to breach the barrier.

The early stages of the holes in the defensive layers are demonstrating the latent failure, which could last for a long time if no preventive action were taken by managerial level. The holes of the second defensive layer of the cheese represent the active failure, which is caused by the seafarers themselves. The holes in the second stage can be prevented if corrective actions were taken as a follow up from Near Miss reporting. Reporting Near Misses is one of the ways that provides a robust contributory influence in preventing negative consequences for any unsafe act by the maritime personnel (Lappalainen *et al.*, 2011).

An unlikely event or incident occurs when all holes in all layers are aligned in a straight line, as shown in Figure 3-5. By then, the hazard will breach all defences to form an incident (Reason, 2000). As the organisation or the system becomes more complex, the defensive layers will become more in quantity and the possibility of the dynamic holes to get aligned is more likely as well, if the organisational management system is not appropriate. Therefore, applying a capable reporting system for Near Miss will give a significant advantage to manage those holes and prevent them from getting aligned. Subsequently, organisational resilience will ensure, as well.

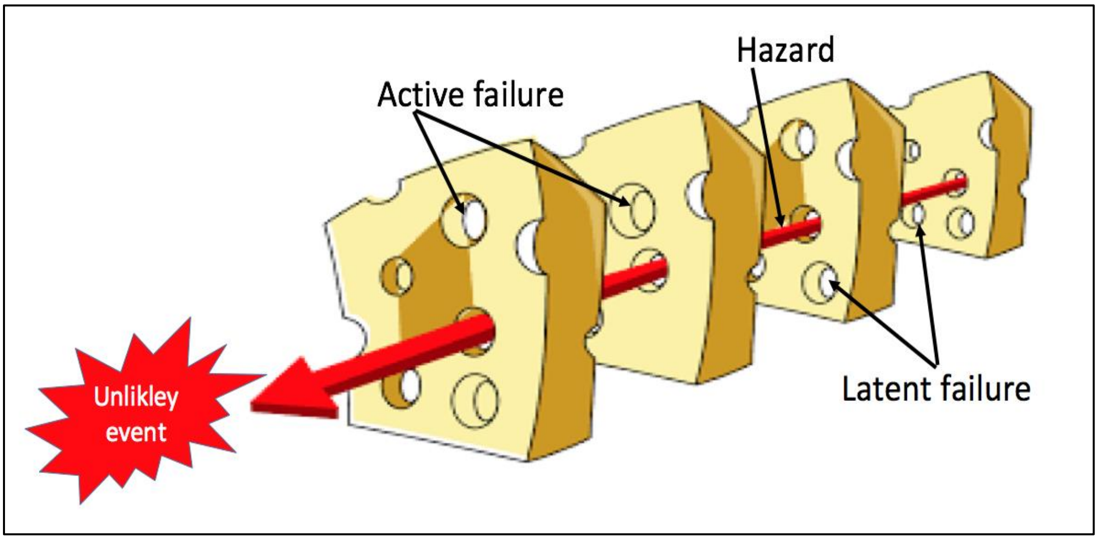


Figure 3-5 Swiss Chess Model (Reason, 2000)

The barriers against any accident are required to have a beneficial design, control, monitoring and maintenance to perform its task as an accident-prevention barrier (Øie *et al.*, 2014). Without those elements, the barrier will not function as it should be, and accident will happen. According to Jonassen (2016), the Swiss cheese model demonstrates the management barrier strategy as follows:

- Every barrier in the system should block risks from being released.
- In the case of the failure of one of the barriers, the following one should become active directly.
- Each one of the barriers should be as independent as possible from others.
- The barriers should be able to eliminate as many hazards and risks as possible
- Single failure should not cause a significant accident and break the whole defence system.
- Degradation in the barrier should not lead to many huge holes.

Implementing an active NMR system plays a significant role in rotating or even eliminating the holes in each barrier. Thus, alignment across the layers will be very unlikely to happen.

3.10. Aviation reporting system around the world

Database of Incidents and Near Miss reports for several confidential reporting systems have contributed to redesign aircraft, air traffic control systems, airports, and pilot training to reduce the likelihood of human error (Tamuz, 1994). Thus, aviation reporting systems have proven its efficacy in reduction of the accident rate related to human errors indirectly. This gives us a perception that the overall Safety Culture in the aviation sector is more advanced than the one in the maritime industry since the reporting culture is more active in the Aviation sector. Reporting process in aviation is mostly voluntary and open to everyone who would like to make a report, from the Captain to passengers, as it will be described in detail in the next section of this chapter. Regardless, most passengers are not aware of the existence of the Near Miss reporting systems, nor they do not know the meaning of Near Miss. However, having the opportunity to report Near Misses by passengers in some of the reporting systems such as Confidential Human Factors Incident Reporting Programme for the Aviation sector (CHIRP) CHIRP (2020a) and Confidential Aviation Incident Reporting (CAIR), Beaubien and Baker (2002) have considered this as an advantage for the reporting systems in the Aviation sector, unlike the maritime industry. Moreover, confidentiality and anonymity were identified in all the reporting systems for Near Misses and incident within the Aviation domain. Thus, the Aviation sector is complying with the Just Culture, as all crew are reporting without fear of blame or punishment. Subsequently, more reports are generated, and the probability of seeing valuable reports is high.

In the next section, some of the reporting system in the Aviation sector, along with its properties, are presented.

3.10.1. NASA's Aviation Safety Reporting System (ASRS)

The ASRS by NASA is based in the USA and established in April 1976 (ASRS, 2019). The system was designed to enhance the general safety of the aviation sector by encouraging pilots to report any unsafe act voluntarily. They deal with these reports confidentially and with no punishment policy. NASA team has a significant role in improving aviation's Safety Culture by analysing, classifying the reports and learning from errors. Pilots, air traffic controller, cabin crew, and mechanics may submit the report (ASRS, 2019) and government agencies have the authority to analyse and take corrective action. Feedback is distributed in the form of a newsletter to enhance the lessons learned. ASRS has a direct form of reporting which contains (flight type and phase, weather condition, causes of event, chain of events and any suggestions to prevent the incident) as mentioned by (Beaubien and Baker, 2002).

The reports are analysed at least twice independently. The analysts are retired pilots, air traffic controller or human factors researchers. Their tasks are to spot the causes of the safety-critical cases, errors and recognize the hazard that needs immediate action. ASRS reporting criteria has three strengths. Firstly, the reporter has the chance to describe the second aeroplane, which was involved in the event. Secondly, giving details about the chain of errors and how the problem has reached this level. The third strength is asking about the omission in doing the task. This reporting platform has succeeded in its mission in reducing catastrophic accidents (Wang, 2006a).

This reporting platform has inspired and contributed to the development of the new and standardised reporting system, which will be presented in Chapter 7. By knowing the other aeroplane that was involved in the Near Miss or the incident, the analysis of the report would be more precise and beneficial to deliver a lesson learned.

3.10.2. Confidential Human Factors Incident Reporting Programme for the Aviation sector (CHIRP)

The system was established in the 1980s and contributed to solving most of the safety issues in the UK with a policy of strict confidentiality and voluntary according to Wang (2006a). The report can be generated by anyone who has a link with the civil aviation authority such as (pilot, cabin crew, air traffic controller, engineering, design and production staff and even passengers). Feedback in the form of the newsletter is distributed four times a year with a highlight on the high priority issues. The newsletter also has a section for suggestion and recommendation. In case of an urgent incident, the reporter will receive a call, and, on some occasions, they arrange for an interview with the reporter in order to discuss the case with more details (CHIRP, 2020a).

CHIRP has a specific reporting form which contains (flight type and phase, weather condition and space for giving a brief on the situation). CHIRP focuses on human factors and provides suggestions on how their performance can be enhanced. Figure 3-6 below presents the flowchart for the CHIRP reporting system based on the author's best understanding. However, CHIRP has a limitation as none of the reporters can provide suggestions such as mitigating the event, suggesting corrective action and how the event was exposed as mentioned by (Beaubien and Baker, 2002).

Having a reporting system that deals with the severe cases by calling and arranging an interview with the reporter to acquire more details sound promising to increase the number of the collected reports. This method will encourage more reports as human nature tends to like appreciation. Moreover, the reporter will know that his effort and reporting such an unfortunate case was not a waste of time. Subsequently, the overall Safety Culture within the sector will increase gradually.

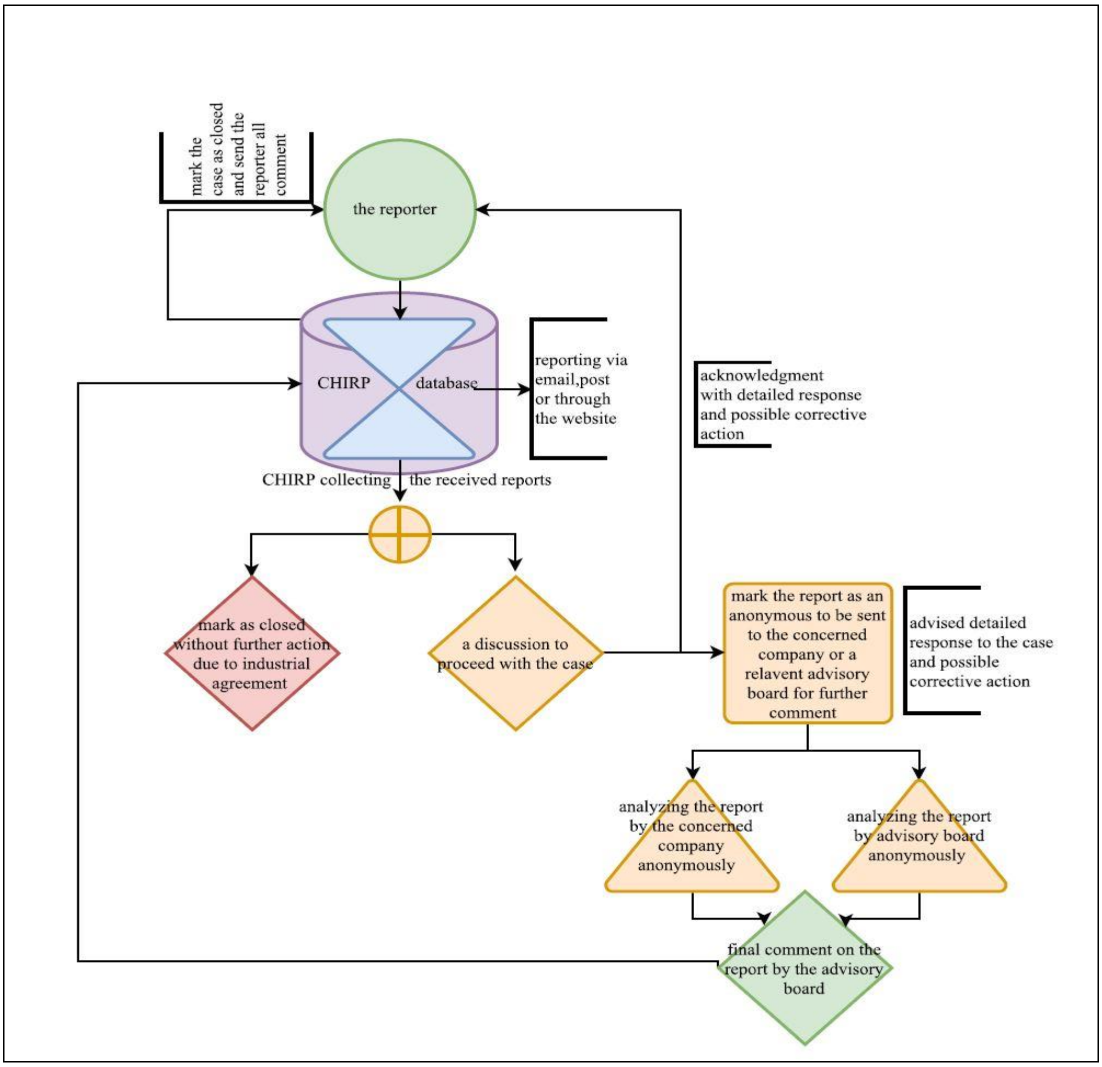


Figure 3-6 CHIRP Aviation (CHIRP, 2020a)

3.10.3. Confidential Aviation Incident Reporting (CAIR)

The CAIR is the Australian version of the ASRS and CHIRP with similar aim to identify safety-related deficiency issues and suggesting ways to solve them as per the study by (Wang, 2006a). They deal with the reports, which are voluntary, confidential and non-punitive, same as other systems. The system is open to anyone who would like to report even by the passenger.

After analysis of the report by the CAIR team, feedback is shared with Asia Air safety magazine and Flight Safety Australia magazine to make sure of educating people in the aviation community. CAIR has a reporting form with some fields for information like flight type and phase, weather condition and space for giving a brief on the situation, as mentioned by (Beaubien and Baker, 2002).

3.10.4. Aviation confidential reporting scheme (REPCON)

REPCON is a confidential, secure and voluntary reporting scheme. It allows all employees under the umbrella of the aviation at the Australian region to submit a safety-related concern to the Australian Transport Safety Bureau (ATSB) (ATSB, 2020). Once the REPCON staff receive the report, they will make sure that the report meets the requirement as a reportable safety concern. Then the report will be de-identified to be ready for the next stage. The following stage is to send the anonymous case to a relevant organisation to validate the case and then forward it to another third party such as the Civil Aviation Safety Authority (CASA) for further action. In some critical cases, REPCON uses the de-identified text to issue an alert to the concerned organisation such as CASA to take immediate safety action as listed in a study by (Beaubien and Baker, 2002).

After studying the report and the contents of the reporting form of REPCON, it was obvious to the author that CHIRP is more advanced in the way they deal with reports. The analysis team at REPCON are not providing feedback or recommendation unless the case was severe. This will leave an impression to the reporters that their reports and time were not appreciated.

3.10.5. SECURITAS confidential reporting in Canada

The system is operated by Canadian transportation safety board (TSB). Any unsafe act can be reported by (pilot, air traffic controller, dispatcher, flight services specialist, flight attendant, aircraft maintenance engineer and passenger) then the TSB will deal with it confidentially. Their goal is to identify the hazards which could affect the safety of the air traffic and to ensure a safe operation among the industry. Once the TSB receives the report, they mark it as anonymous and add a suggestion for corrective action. Then it is sent to the regulatory authority for further action to maintain safety. In some cases, TSB contacts a specific company or organisation if the case was worth for corrective action to be taken directly by this particular organisation, such as a specific airline (TSB, 2019).

Marking the report as an anonymous by SECURITAS is beneficial, as the anonymity of the reports will trigger more critical reports. Thus, the reporter will not face any blame or punishment. The result is, SECURITAS has implemented the Just Culture effectively. Subsequently, more reports are expected to be collected by the system operators, and less accident will happen.

3.11. Maritime Reporting systems

Having a reporting system for Near Misses in the maritime sector, on-board ships specifically, could enhance the shipping safety if the reporting system was effective and providing lessons to the seafarers. Those reports help the shipping company to enhance shipping safety by managing human errors. However, some systems are only accessible by the Designated Person Ashore DPA, which is considered as a deficiency in the system, and against the primary goal of having a Near Miss reporting scheme. The goal is to give seafarers the opportunity to capture their own and their colleagues' mistakes, report them, to take corrective action and avoid making the same mistake in the future. Some of the DPAs have said that most of the reports are ignored by them without being processed because they think it is not important from their point of view and it is a waste of time to report it further up.

The best practice for reporting a Near Miss is through the seafarers directly. Thus, they should have access to the system and write their reports freely without being restricted by getting back to the officer in charge, master or the DPAs. In addition to that, an acknowledgement of receiving the reports should be generated by the system and sent to the reporter as an appreciation for reporting the unsafe act. Afterwards, feedback and the recommendations about the reporting practice (the given rate, potential consequence, root causes and the corrective action) are also required to be provided to the reporter by the system operators in case if the report was generated in a wrong way. The individual feedback toward each Near Miss report will be adding value for the reporter by giving a learning opportunity to enhance the reporting practice. The next section presents the most popular reporting systems in the shipping industry.

3.11.1. Confidential human factor Incident Reporting Program for the maritime sector CHIRP

CHIRP is operated by the UK department of transport and civil aviation. CHIRP has been extended to deal with maritime safety-related issues since 2003 after it was used internationally among aviation to report any unsafe act (Wang, 2006a). The report can be generated confidentially online by anyone among the maritime sector when the unsafe act is observed. The reporting form contains some necessary information such as; (position, contact details, date, time, weather and a description of the event). The system operators publish a quarterly newsletter in a printed form and on their website all the reports they have received from the seafarers. In addition to that, feedback and recommendations are also included in the newsletter to ensure better reporting practice in the future. The online newsletter is available for all users and the public (CHIRP, 2020c).

However, the seafarers need the feedback and the recommendation in a shorter time than what they are doing to take better corrective action if their own corrective action was not enough. Moreover, this would help them avoid any predicted accident if the root causes were repeated in more than one occasion. In some of the critical cases, direct communication between maritime personnel and the system’s team is required to make the system more effective (Storgård *et al.*, 2012). The system would be more beneficial if the information about the other vessel involved in the incident was also given. Figure 3-7 below is demonstrating the process of any CHIRP Maritime report in a flowchart.

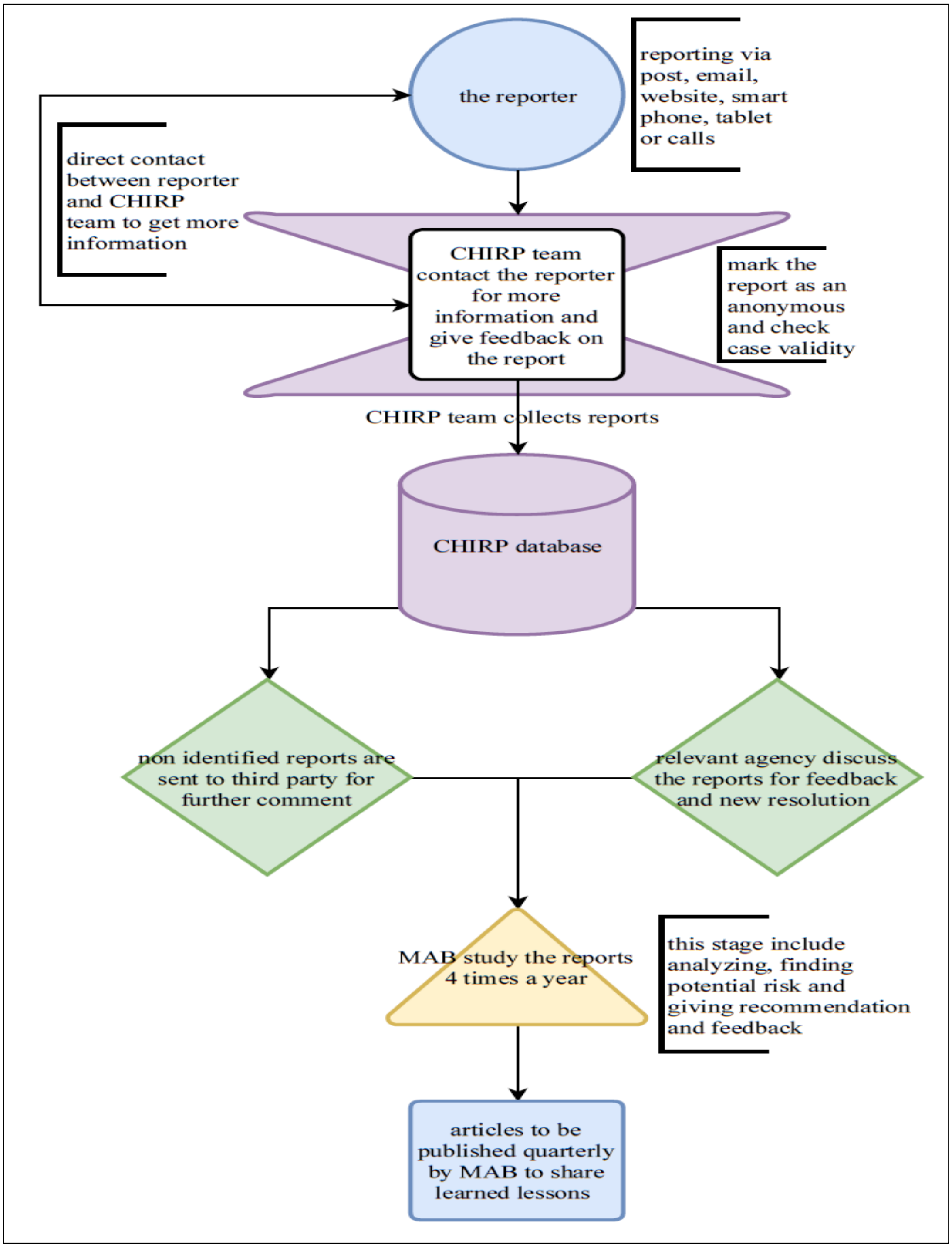


Figure 3-7 CHIRP Maritime (CHIRP, 2020c)

3.11.2. Maritime Confidential Reporting Scheme in Australia REPCON

The system is operated by the Australian Transport Safety Bureau (ATSB). The report can be generated by any of the crewmembers. All reports are dealt with in a confidential way by REPCON staff. Some of the reports are considered as safety concerns and recognised by the system as an alert in order to take immediate action. The reporter must provide some basic information such as; voyage phase, position, date, time, weather and a description of the event. Feedback and recommendations are released on their web site, including company name (Storgård *et al.*, 2012).

The system does not have any initiative method to motivate the seafarers to report unsafe acts. It would be more effective if an acknowledgement received by the reporter and newsletters is distributed to all ships to allow the crewmembers to have better lessons learned practice.

3.11.3. Confidential Reporting in Canada SECURITAS

According to the TSB (2019), SECURITAS is maintained and operated by the Canadian Transportation Safety Board (TSB) and deal with all modes of transportation nationally except land transportation mode. They deal with investigating accidents and forwarding the reports to the appropriate regulatory authority to consider the case if necessary. Any unsafe act can be reported by anyone belonging to the marine sector. Then the TSB will deal with it confidentially and with no blame policy. They don't have an officially reporting form like other systems and is considered as a deficiency in the system. The TSB releases recommendations on their web site, but they are irregular. However, seafarers need a specific form to make the reporting more accessible, and the feedback needs to be delivered personally to take corrective action or to take a lesson learned from the event (Storgård *et al.*, 2012).

3.11.4. INSJO-Sweden

The system was published in 2002 by Swedish ship owners in cooperation with the Swedish Transport Agency, and it is a national system. The system's main aim is to collect data about the accidents and Near Misses in the maritime sector. Report generation is the responsibility of the designated person ashore DPA. A third party (IPSO classification & control Ab) has the burden of deleting any duplication of data and send feedback to the DPA. The data bank is consisting of all entered reports to be accessible by anyone who has access to the website. A specific reporting form is available with four open-end questions which are (incident, consequences, causes and measures).

The form and the database are available online (Storgård *et al.*, 2012). This system is not available nowadays based on the last search on the web in January 2020. However, mentioning the pros and cons of the system helps the creation of the standardised Near Miss reporting form as it was planned to merge this reporting platform with other reporting systems (NearMiss.dk and ForeSea).

3.11.5. NearMiss.dk- Denmark

According to Storgård *et al.* (2012), NearMiss.dk was established in 2007 in Denmark with a general aim of enhancing safety and identifies the hazards within the Marine industry. This national system is funded to benefit Danish shipping companies, and it is not a governmental system. DPAs are taking charge of entering the report into the system after receiving the case from the ship's master or chief officer on a paper report or electronically. Third-party called Sea Health processes the information to remove the unnecessary reports. Safety alert reports are published on the *nearmiss.dk* website in two different languages Danish and English (NearMiss.Dk, 2020).

NearMiss.dk is following the minimum requirement for the Near Miss reporting according to the IMO guideline IMO (2008) as it shows in Appendix A at the end of the thesis. It recommends that reporting training and practice should be available for every crewmember on-board ship. Moreover, the reporters need some sort of motivation to report more cases which will widen the horizon to identify more Near Misses. Subsequently, fewer accidents will occur.

3.11.6. ForeSea – Finland

Finnish Transport Safety Agency (TRAFI) and ship owners within the country have developed the reporting system for crewmembers who work on-board Finnish ships. The system is used internally. The mechanism system is like INSJO and NearMiss.dk. Three of them were planned to be combined to create a larger base. All reports are kept in the data bank with some necessary information such as (the type of ship and event, event description and contact details). The DPAs have the option to make the report as a safety alert and give it a priority to be dealt with immediately. Lessons learned can be distributed to a wide range of audience nationally through the website for anyone who has access to the web. Contact details are used to send feedback to the reporter (Storgård *et al.*, 2012) and (Lappalainen *et al.*, 2011).

The option of distributing the lessons learned to a wide range of audience through the website is very effective, as many users from other countries may take advantage of those lessons. However, giving the opportunity to the DPA only to highlight the critical cases is not fair, as one DPA is not capable of generating Near Miss reports for the whole company's fleet. DPAs are having a different perspective on safety than the seafarers as well, especially if the DPA is a retired seafarer for a long time. Thus, the best reporting practice is to implement the just culture among the shipping companies and give the seafarers the opportunity to report every observed unsafe act and condition freely and give the appropriate rate to the case based on the severity of the potential consequences. Then, the given rate by the reporter themselves would prioritise the critical cases which will be shared among all the ships at the shipping company, and to other shipping companies in case of the Near Miss reporting system is serving more than one shipping company. Besides, it is important to reduce the burden of the DPAs, as they have lots of duties other than highlighting the critical Near Misses.

3.11.7. EMCIP – European Maritime Causality Information Platform

The European Maritime Causality Information Platform is a database for casualty information developed by (EMSA) the European Maritime Safety Agency and was established in Jun 2011. Their goals are a more in-depth analysis of the results of casualty investigations and taking lessons learned from previous accident reports. Data and information related to marine casualties and incidents are stored at the EMCIP database. It also produces a statistical analysis of the technical, human, environmental and organisational factors involved in accidents at sea. They use their data to generate annual reports and safety recommendation to all users as a learning opportunity (EMSA, 2020). EMCIP platform is different from the other reporting systems that were mentioned earlier. EMCIP does not provide a Near Miss reporting service for seafarers, as their primary goal is variant from the other reporting systems.

3.11.8. Mariners' Alerting and Reporting Scheme MARS

A full hazardous occurrence reporting system is run by The Nautical Institute to benefit mariners internationally. Their process with any serious issue is to send feedback to the ships with a recommendation. The system is accessible by maritime personnel through their website, and there is a specific confidential reporting form. Also, the reporter can print out the form and fill it then send it back to the system's email. The reporter must provide some basic information such as (contact details, location, weather, and ship's type, number of crewmembers, time and information about the voyage). The open-end questions are also available in the reporting form. All reports are available on their web site in order to benefit anyone who is interested in taking lessons learned from the previous incidents. MARS operators are publishing a Safety newsletter on a monthly basis, the journal called (Seaway) (MARS, 2020).

3.12. Comparison of parameters among different reporting systems

Table *3-2* below is showing all parameters for different Near Miss reporting system and accident investigation platform in the Maritime sector, which were mentioned above. The comparison also includes the existing reporting system that is used currently in the shipping company that cooperated with the author to conduct this study.

The parameters have been listed based on the information required in each reporting form for each system, and according to the procedure implemented in each system. The first section of the parameters in the yellow colour is meant to differentiate the operators' partner organisations that run the system, whether it is governmental agency or individuals. It is noticeable that the Near Miss reporting system at the shipping company that cooperated with the researcher in this study is the only individual system within the studied systems and not linked with another system. The author wanted to study more individual Near Miss reporting systems. However, due to the limitation of the sources, it was not possible to collect much data about the individual reporting systems that belong to shipping companies. The author was expecting to find the NMR system at the shipping company to be connected with a national investigation branch for maritime accident or another NMR system that run by an agency, as this connection is beneficial for the shipping company in terms of evaluating their system's outcomes.

The second part of the parameters in the green area of the table provides the reporting procedure and the contents of the reporting form. The reporting systems among the Scandinavian countries are found to be far behind the other reporting systems, whereas they are the only system that let the DPA generate the reports. Those three systems are still utilising the handwritten reporting form. The reason is based on the author's best understanding is that those three systems are facing a structural improvement plan, as they are supposed to be one regional system.

Regarding the Just Culture, it is perceptible that all the systems have implemented the no-blame and confidential policy. However, the seafarers will have some doubt regarding the no-blame policy if the reporting form is not anonymous. The rest of the parameters in the green area of the table is reflecting the contents of the reporting form if the system has a specific reporting form. Some of the systems are not having a reporting form. Those systems are receiving a written NMR on any blank paper.

The last section that in amber colour is reflecting the procedural part after submitting the report. All the systems are sharing recommendations and feedback related to the collected reports on their website, except INSJO and the case study. Another observation is all the system operators are analysing their Near Miss reports by themselves without dealing with a third party, except INSJo and NearMiss.dk who are dealing with partner that analysis the data. CHIRP, INSJI, NearMiss.dk, ForeSea and MARS have successfully created a databank for their reports. This initiative of saving the reports will allow the investigation partners such as EMCIP to utilise their reports and publish useful safety bulletins that benefit the seafarers in a wider range. None of the systems is sending an acknowledgement or feedback directly to the reporter to show them how to report better in the future. This feature has a positive impact on the seafarers, as they will feel appreciated, and their skill in reporting will be enhanced. Subsequently, more Near Miss will be resolved by taking effective corrective actions. The result will be less accident in the maritime sector. However, among the national or the international reporting system, it is acceptable not to send direct feedback to the reporter, as they are a third party who is offering a voluntary analysis for the Near Misses to benefit the maritime sector. However, it is not acceptable among the Near Miss systems that operated by maritime agency such as the INSJO, NearMiss.dk and Foresea, as they are the primary reporting platform for the shipping companies at the Scandinavian countries. Thus, the individual and the agency reporting system should provide the option of sending direct feedback to the reporters to educate them and enhance their reporting practice.

Table 3-2 Parameter comparison for different reporting system among the maritime sector

system / **parameter**	CHIRP-UK	REPCON-Australia	SECURITAS	INSJO-Sweden	NearMiss.dk-Denmark	ForeSea-Finland	EMCIP	MARS	The case study
Governmentally	√	√	√						
Agency				√	√	√	√	√	
Individually									√
Internationally	√						√	√	
Nationally		√	√	√	√	√			√
Connected with a national database									
Special reporting form	√	√		√		√		√	√
No blame Policy	√	√	√	√		√	√	√	√
Confidential	√	√	√	√		√	√	√	√
anonymous									
Accessible by all crew	√	√	√					√	√
Only DPA can report				√	√	√			
Paper reporting form (handwritten)				√	√	√			√
Voyage phase		√				√		√	
Position	√	√						√	√
Contact details	√					√		√	√

Date	√	√						√	√
Time	√	√						√	√
Weather condition	√	√						√	
Description of the unsafe act	√	√		√		√		√	√
Open-ended question in the form	√			√		√		√	√
Sharing recommendation for better reporting practice on their website	√	√	√		√	√	√	√	
Newsletter disruption	√							√	
Direct feedback to the reporter									
Reports to be analysed by system operators	√	√	√			√	√	√	√
Reports to be analysed by a third party				√	√			√	
Safety alert for urgent reports		√			√	√		√	
Share the reports with regulatory authority									
Reports to be saved in the data bank	√			√		√	√	√	
Total	**17**	**15**	**7**	**12**	**7**	**15**	**7**	**20**	**14**
				Planned to be one system					

3.13. The terminology used by the Reporting Systems

By looking into the analysis of the reports and the feedback, which are available on the web site of international reporting systems such as; CHIRP, Nautical Institute and EMSA, we will find the type of terminology they use for reporting. They almost use the same terminologies, which are commonly known in the maritime language. The author has studied the terminologies through the newsletters, recommendations and annual overviews for CHIRP

EMCIP, MARS, and the shipping company's Near Miss reports. The newsletters and the annual overviews are available on each systems' website. The Annual Review of Marine Casualties and Incidents consists of a high-level analysis of accidents reported by the EU Member States in EMCIP. They have five editions of overviews online to date. It covers accidents analysis for the period from Jun 2011 to April 2019. They released their first annual overview in 2014 and the second one in 2015 and their last glimpse was released in 2018 as mentioned by the (EMSA, 2019). Moreover, in 2016, EMCIP has generated a glossary for reporting attributes (EMSA, 2016). This glossary has different categories of terminologies. One of the categories is explicitly linked to erroneous human actions.

Regarding CHIRP data, they have on their website fifty-eight up to date feedback reports. Their reports cover accidents analysis for longer time comparing to EMCIP reports. Thus, the first one was released in November 2003, and the last one was in March 2020, as listed on their website (CHIRP, 2020b).

MARS's database is available on its website and covering a much more extended period, from 1992 to 2020. However, they have been using the same terminologies since the beginning of the reporting period, as mentioned on their website (The Nautical Institute, 2020). The Near Miss reporting system, which is being used at the shipping company, which cooperated with the author in conducting this study, uses the same terminologies that MARS uses in their reports. This was identified during the analysis of their Near Miss reports, which were collected during the data collection trip at the company's head office.

Table *3-3* below is showing the terminologies that are used by most of the reporting systems in their reporting forms. A deficiency among CHIRP, MARS and the shipping company has identified as they do not have specific terminologies for erroneous human actions. Those terminologies are listed in the table below and marked with faded blue colour.

Table 3-3 Terminologies used by various reporting systems

Terminology	Definition	CHIRP	EMCIP	MARS	The company
Accident	A risky occurrence has severe consequences to lives, environment or property in other word accident lead to a marine casualty	√	√	√	√
Alcohol use		√		√	√
Allison	The act of striking or collision of a moving vessel against a stationary object	√	√	√	√
Capsize	A casualty where the ship no longer floats in the right side- up mode due to initial negative stability (negative metacentric height), or transversal shift of the centre of gravity, or the impact of external forces. Capsizing when the ship is tipped over until disabled	√	√	√	√
Collision	A casualty caused by ships striking or being struck by another ship, regardless of whether the ships are underway, anchored or moored. This type of casualty event does not include ships striking underwater wrecks. The collision can be with other ship or with multiple ships or ship not underway	√	√	√	√
Contact	Casualty caused by ships striking or being struck by an external object. The objects	√	√	√	√

	can be: Floating object (cargo, ice, other or unknown); Fixed object, but not the sea bottom; or Flying object				
Damage to the ship or to the equipment	Damage to equipment, system or the ship not covered by any of the other casualty types	√	√	√	√
Damage to the hull		√		√	√
Explosion	Explosion is an uncontrolled release of energy which causes a pressure discontinuity or blast wave	√	√	√	√
Fatigue		√	√	√	√
Fire	Fire is the uncontrolled process of combustion characterised by heat or smoke or flame or any combination of these	√	√	√	√
Flooding	Flooding – refers to a casualty when a vessel takes water on-board and can be: - Progressive if the water flow is gradual. - Massive if the water flow is extensive	√	√	√	√
Foundering	Foundering will be considered when the vessel has sunk. Foundering should only be regarded as the first casualty event if we do not know the details of the flooding, which caused the vessel to founder. In the chain of events foundering can be the last	√	√	√	√

	casualty event in this case there is the need to add accidental events				
Incident	A risky occurrence has negligible consequences	√	√	√	√
Grounding	The event when a ship gets in contact with the seabed due to navigational failure or steering propulsion failure	√	√	√	√
Hull failure	A failure affecting the general structural strength of the ship	√	√	√	√
Hull fatigue	A failure affecting the general structural strength of the ship	√		√	√
Listing	A casualty where the ship no longer floats in the right side- up mode due to negative initial stability (negative metacentric height), or transversal shift of the centre of gravity, or the impact of external forces. • Listing when the ship has a permanent heel or angle of loll	√	√	√	√
Loss of control	a total or temporary loss of the ability to operate or manoeuvre the ship, failure of electric power, or to contain on-board cargo or other substances: • Loss of electrical power is the loss of the electrical supply to the ship or facility; • Loss of propulsion power is the loss of propulsion because of machinery failure;	√	√	√	√

	• Loss of directional control is the loss of the ability to steer the ship; • Loss of containment is an accidental spill or damage, or loss of cargo or other substances carried on-board ship.				
Missing	Casualty to a ship whose fate is undetermined with no information been received on the loss and whereabouts after a reasonable period.	√	√	√	√
Near Miss	Action by any of the worker which could contribute in accident or an incident if a series of Near Miss have been not distracted	√	√	√	√
non-conformities	an observed situation where objective evidence indicates the non-fulfilment of a specified requirement	√	√	√	√
Stranding	To run aground		√	√	√
Omission	An action that was not done at all (within the time interval allowed)		√		
Jump-forward	One or more actions in a sequence were skipped		√		
Jump-backward	One or more earlier action that has been carried out, it is carried out again		√		
Repetition	The previous action is repeated		√		
Reversal	The order of two neighbouring actions is reversed		√		
Wrong Action	An extraneous or irrelevant action is carried out		√		

Wrong diagnose	The diagnosis of the situation or system state is incorrect		√		
Incomplete diagnose	The diagnosis of the situation or system state is incomplete		√		
Induction error	Faulty reasoning involving interferences or generalisations leading to invalid result		√		
Deduction error	Faulty reasoning involving deduction leading to invalid results		√		
Wrong priorities	The selection among alternatives (hypotheses, explanations, interpretations) using incorrect criteria, hence leading to invalidate results		√		
Wrong decision	Making the wrong decision (typically about action alternatives)		√		
Partial decision	Making a decision that does not completely specific what to do hence creates a need for further decisions on complete the course of action		√		
No identification	Identification is not made in time		√		
Increased time pressure	Identification is not made fast enough, e g, because the reasoning involved is difficult, leading to a time pressure		√		
Unexpected state change	A state change occurred which had not been anticipated		√		
Unexpected side effect	The event developed in the main as anticipated, but some side-effects had been overlooked		√		

Process speed misjudgement	The speed of development (of the system) has been, so things happen either too slowly or too fast		√		

3.14. NMR systems in the aviation domain VS NMR systems in the maritime sector

Table 3-4 below is showing the highlighted pros and cons for the Near Miss reporting system among the Aviation and the Maritime sectors. The similarity between the two sectors also will be included in the table. It is noticeable that both sectors are having some deficiencies among their reporting systems. However, while investigating the Aviation reporting systems, it was remarkable how aviation is more advanced than the maritime industry in implementing the safety culture. This implementation was visible, whereas, crewmembers on the Aviation sector have the initiative to report the unsafe acts without any force from the organisation or the regulatory bodies. For this reason, the good practice of reporting among the Aviation is worth to be adopted by the maritime industry.

Table 3-4 Aviation Reporting system VS Maritime reporting system

Similarities of the aviation and the maritime reporting systems
• All the systems have a specific reporting form except SECURITAS and NearMiss.dk. • All the systems have their own confidentiality and no punishment policy as an encouragement way, as the just culture exists in both sectors. • Feedback, recommendation and lessons learned are shared in all the systems' website or in a local magazine to ensure that everyone in the industry is educated and gets the point of the feedback except INSIJO.

<table>
<tr><td colspan="2">• In some of the systems, all reports are passed through independent analysis and processes to insure the honesty in the result.
• None of the systems is anonymous.
• No standardised procedure for reporting</td></tr>
<tr><th>Maritime reporting system</th><th>Aviation reporting system</th></tr>
<tr><td>Advantages:
• Data bank is available on some of the systems’ website for further investigation.
• Some of the systems have the option of prioritising some incidents as a safety alert.
Disadvantages:
• Some of the systems organised the reporting entry, which can be made only to the DPA.
• The option of describing the other ship or party who were involved in the unsafe act is not available.
• Some of the systems do not have a specific reporting form, which leads to unclassified errors and non-standardized response.</td><td>Advantages:
• Reporting is voluntarily not mandatory.
• Reporting is available for all people within the Aviation.
• Contacting the reporter in case the unsafe act was critical.
• Some of the systems allow the reporter to write a narrative about the attention of the other aircraft, which was involved in the scenario
• The option of listing the chain of event that led to the unsafe act is available.
Disadvantages:
• None of the systems has the option of prioritising some incidents as a safety alert.</td></tr>
</table>

• None of the systems contacting the reporters in case the unsafe act was urgent.	• Some of the systems do not have the option of listing possible preventive/corrective actions.

3.15. Gaps with Near Miss reporting systems in maritime

The general aim of the ISM is to provide a safe working environment and to protect the environment and the ship from any damage by all possible means. Effective reporting system, its proper analysis and generous feedback in the form of lessons learned are one of the ways to achieve the goal of the ISM. Currently, there are many reporting systems among the industry in order to make reporting easier for maritime personnel. Those systems still have some deficiencies and gaps when comparing it with the reporting systems in the aviation sector, or even when compared within the maritime sector. One of the deficiencies is to report to the DPAs, who then enters the report into the system. This requires the DPA to have some certain level of experience, education and to be retired as an ex-expert seaman. Moreover, DPAs' safety perception must be much higher than the safety level on-board any ship. Otherwise, most of the reports will not be properly evaluated, as it should be. As a result, some issues will not be dealt with and may lead to deficiencies in safety. This issue is related directly to the aim and the objectives of the ISM Code.

Another deficiency in the reporting systems is that they are not sharing the same reporting standards. Thus, some of the companies have a specific reporting form, and others are reporting Near Miss by submitting the case description on a blank paper that does not have specific parameters to be included. This leads to a gap in reporting the error types, root causes, and what kind of corrective actions are taken. Leaving the reporter without guidance and procedural documents will lead to poor reporting with less value for the analyst. All of that will reflect on the quality of the outcome of the investigations. Space should be provided in the reporting form for extra information that is not included in the dropdown part of the form. One more deficiency is the way that the systems' team deal with reporters; reporters should receive appreciation or be directly contacted if more information is required for the Near Miss to improve the outcome of the investigation. Subsequently, the lessons learned, and the corrective action will pay off. More Near Miss reports also will be generated as human nature tends to like appreciation. The final result, the reporting process will be a habit for all seafarer.

3.16. Resilience Engineering

The term resilience Engineering RE was explained and defined by Nemeth *et al.* (2008), as he stated in his book, resilience is the capability of any system to adjust and modify its functioning before, during or even after any sort of disturbances. In addition to that, resilient systems can maintain any required functions even after a significant defect or after exhaustion in the system. Hollanagel and Wood (2006) have argued that, in order to implement resilience to safety, a constant performance monitoring is required besides the procedure, precautions and barriers against unfortunate events. Thus, RE is to design the systems to be able to anticipate and avoid mishap and manoeuvre away from failures (Madni and Jackson, 2009). To evaluate a system to be resilient or not, it just has the ability to respond, monitor, learn and anticipate. Then the system must demand perception on how to couple that four abilities together and make them rely on each other as argued by (Hollnagel, 2014).

RE symbolises an innovative approach to safety, whereas risk management methods rely on observation and error classification and calculation of failure probabilities. Resilience engineering research focuses on techniques to improve the capability of a system to create a robust and flexible operation that is able to monitor and review risk methods, and to utilise resources effectively during disruptions or ongoing operational and economic stresses (Dekker *et al.*, 2008). Failures of a resilient system are not concerned with its breakdown or malfunctioning of regular operation; instead, they illustrate that the system does not have the capacity for adaptation, which is essential in coping with the complexity of the real-world environment (Dekker *et al.*, 2008). Resilience is the more significant ability of how well a system can deal with disruptions and changes which exist outside of the base mechanisms/models, being as adaptive as determined in that system. In order to control a system, it is essential to know what has occurred in the past, what is occurring now and what will occur in the future, in addition to knowing what action should be taken and possessing the required resources for the action (Hollanagel and Wood, 2006). For that, it is necessary for a resilient organisation to attain the capability to anticipate, perceive and respond. Several studies have presented definitions, new models and extra enhancement in respect to the resilience engineering approach.

Resilient organisations mean the system is designed to remain stable, where groups and individuals are able to identify, adjust and engage invariants, modifications, conflicts, disorders and surprises that could result in a disruptive situation (Rasmussen, 2003) and (Sutcliffe, 2003). Efficient teamwork at any organisation should enable rapid reaction to a sudden and unexpected demand during operation, with the minimum loss. The employee must then return to the standard operating conditions as soon as they can (Woods, Cook and Nemeth, 2018). The resilience method eases teamwork, utilising valuable skills necessary for addressing extensive and variable demands to recover from the loss, obstacles, struggles or any other issue that may disturb crew's integrity (Morel *et al.*, 2008). The concept of resilience and safety are different. When a system is performing as it should be, then this system is doing its safety function correctly as argued by (Hollanagel and Wood, 2006). In the last decade, analyses of significant accidents indicate that organisations are required to address human and organisational errors by assessing their technical procedures and abilities to perform their tasks (Jackson, 2002). Those technical errors in an organisation include reporting relationships and processes to address the cultural and other latent conditions which may contribute to major catastrophic events. The concept of organisational safety is broader than an engineering model or personal model, as organisational safety is based on the interface of engineering and person aspects. Those aspects include but not limited to training, psychological aspects, reporting process for unsafe acts, management oversight, regulatory oversight, maintenance process, organisational structure, control complexity, tight schedules, lack of information, cultural aspects, financial pressures and communications, as mentioned by Werner and Smith (2001) and cited in Jackson (2002). The elevation of proactive resilience engineering applications can play an essential part in the system's operation because it entails finding the weaknesses in complex systems, thereby emphasising organisational and human operational risks. The success of a resilience system relies on its capability to monitor the risk of change and to select a suitable action to avoid the possibility of mishap (Madni and Jackson, 2009).

Lately, RE has been given extensive consideration among scholars who are interested in the safety field, as it proposes a new understanding of safety. Traditional risk management methods depend on past information, accident reporting and risk assessment quantification, and probabilities based on historical data. RE searches for techniques to improve the ability of a system to be resilient in the way it perceives, adapts to and absorbs differences, variations, disorders, disruptions and shocks (Steen and Aven, 2011). Madni and Jackson (2009) have stated in their study that operating systems have become more complex, imposing further challenges on risk management. The human factor is not the main reason behind errors all the times, and organisations also play a more significant role in creating accidents. Organisations face numerous challenges while applying the RE principles, e.g. making a decision between business pressures and safety. Madni and Jackson (2009) adapted a conceptual structure for understanding and analysing disruptions and provided principles and heuristics of lessons learned that might be utilised to design a resilient system. For an organisation to face challenges of complexity, the resilience system must be capable of avoiding, absorbing, adapting to and recovering from disruptions. The maritime industry should adopt the concept of resilience engineering to ensure that its safety system is able to defeat any disruption and avoid any mishap.

In order to create resilience among the maritime industry, it is essential for shipping companies to implement an effective and standardised NMR system. The NMR system will add value to the resilience principle for shipping companies, where the constant performance monitoring, procedure, precautions and barriers against unfortunate events and improvements will exist. Thus, a manageable barrier against potential failures will be achieved.

3.17. Key Performance Indicators (KPIs)

The concept of managing the indicators for any organizational performance has emerged in the 1980s as a reasonable response to several questions asked: “how is our organization performing”? and “you cannot manage what you do not measure? (Sharif, 2002). Thus, the importance of measuring the performance of any organization leads to improving the weak point and increase the efficiency of the organizational outcome. Konsta and Plomaritou (2012) have described the performance indicators as an assembling of information which is utilized to measure and evaluate the performance of the organization. Moreover, the performance indicators are giving the final evaluation of the efficiency and the effectiveness of the company. Therefore, the main purpose of the KPI is to initiate a benchmark for the industry’s performance (Konsta and Plomaritou, 2012). Besides those direct advantages, KPIs are considered as a useful method for the stakeholders to monitor the constant improvement of the company's performance (Vukomanović, Radujkovic and Nahod, 2010).

Valdez Banda *et al.* (2016) have conducted a study on the categorization of the KPIs into two different categories. The first category is the so-called leading indicators, and the second category is the lagging indicators. According to Reiman and Pietikainen (2012), leading KPIs aims to measure continuously by monitoring identified input, which is required to achieve a planned safety target. As for the lagging KPIs are measurements that conduct reactive monitoring to identify the reasons for a delayed or not achieved planned objectives or goal (Øien, Utne and Herrera, 2011). Thus, to ensure a resilient safety at the shipping companies, the leading indicators must be followed to trigger any insufficient performance. Moreover, the shipping companies should implement an assessment of their Safety Culture via conducting an improved methodology for assessing the Safety Culture to evaluate their current level of Safety (Arslan, 2018). By then, the shipping company, which successfully conduct the Safety Culture assessment along with recordings of the leading KPIs, would be able to cope with any kind of safety threatening issues in an ample time. Thus, the resilience engineering concept will be achieved.

Key Performance indicators have gone through several improvement stages. Volkan Arslan et al. (2016) have mentioned in their study that the Baltic and International Maritime Council (BIMCO) has provided the marine industry sixty-four KPIs to compare their business performance with other companies in the same field. Moreover, the classification society Lloyd's Register has provided seventy-three KPIs for the shipping companies that specified in the Oil and Gas transport. Those seventy-three KPIs aim to improve operational safety. Leading performance indicators are safety metrics that are related and lead to an unexpected consequence such as an operational incident, Near Miss or personal injury. Tracking and improving these safety metrics help to maintain, monitor and improve safety performance (ABS, 2020). Thus, American Bureau of Shipping (ABS) has proposed thirty subsidiary KPIs and twenty-nine core KPIs to achieve the monitoring, maintaining and improving the safety culture level of shipping companies as mentioned by (Arslan *et al.*, 2016). Therefore, any shipping company that has a set of KPIs that match any of the above-mentioned criteria should have a high safety culture level.

In 2010, the InterManager launched a standard for Shipping KPIs for general use. The databank for the shipping KPIs contains a set of data of more than 2000 ships as of the middle of 2013. Shipping KPIs are a set of standards and can be used as a benchmark to compare with other users (Rialland *et al.*, 2014). So, it is accessible for the shipping companies to compare their performance based on a well-known standardized set of KPIs data.

All of those efforts by the different organizations to set standardized and a list of proficient KPIs are being held in order to fulfil the requirement of the ISM in complying with the safety culture. In addition to that, an active recording for the leading and the lagging KPIs will provide a resilient system at any shipping company by overcoming any deficiency in the companies' safety system.

3.18. Key findings

Key findings from the critical review performed in chapter 3 can be listed below;

- A successful NMR system plays a significant role in enhancing the Safety Culture.
- Most of the shipping companies are at the Complaints level on the Culture Maturity Level, according to Stemn *et al.* (2019) as they are not adopting an anonymous NMR.
- The IMO guideline for NMR states that all reports must be anonymous, and at the analysis stage, the analyst must know who performed the unsafe act (IMO, 2008). This discrepancy leads the shipping companies to improvisation while creating their own NMR system. The flowchart for the IMO guideline for NMR is available in Appendix A.
- The level of mutual trust between the seafarers and the managers at the shore base is relatively low in most of the shipping companies, as the NMR is required to be

encouraged as argued by Vrbnjak *et al.* (2016), this does not create an ideal environment for the promotion of NMR.

- Some shipping companies are below the average standard in applying the ISM Code, and their SMS is incomplete or too complicated to be understood by the seafarers (Jouni. Lappalainen., Kim. Salmi. *et al.*, 2009).
- Latent and active failures can be solved by adopting an effective NMR system, as it plays a significant role in mitigating or even eliminating the deficiencies in each barrier. Thus, alignment across the layers will be very unlikely to happen.
- All Near Miss reporting systems that were reviewed are different from each other and do not ensure the maximum benefits from lessons learned.
- According to the concept of the RE, the safety on-board ships is far from being resilient. Therefore, a chain of Near Misses may lead to an accident without having the capability to adjust to the situation by taking corrective action automatically. Thus, implementing an effective reporting system for Near Misses will help in identifying those root causes for any accident and adjust the situation accordingly.

3.19. Chapter summary and Conclusion

A literature review on Reporting Near Misses, Safety Culture, different NMR systems and resilience engineering was made. In addition to that, the gaps and significant findings were listed afterwards. The main outcome was human errors are attributed to most of the marine accidents due to lack of safety culture. Thus, a considerable enhancement is required to eliminate human error and to reach a safer shipping industry by implementing an effective NMR system, which is the fundamental step for improving the safety culture maturity and the shipping safety

4. Methodology

4.1. Chapter overview

This chapter describes the approach adopted and the methodologies utilised to conduct the study of this thesis.

4.2. Introduction

Based on the nature of this thesis and the problems identified in the field of shipping safety, a sound approach and tailored methodologies are required to obtain relevant and rich data, in-depth analysis and solutions. Consequently, these solutions lead to the enhancement of shipping safety through managing human errors by proposing a standardised Near Miss reporting system. Four primary methodologies are utilised in this study, as presented in Figure *4-1* below. Two of them were utilised to assess the Near Miss Reporting Culture as a part of the safety Culture at the shipping company, which is defined as the case study company. The third methodology was applied to evaluate the company's safety performance through the KPIs assessment. The last methodology was testing the newly designed NMR form to compare its result with the existing form. All those methodologies aim to enhance the safety culture of the company, which will be kept as anonymous. The methodologies are listed below:

- NMR assessment through
    1. Reporting culture assessment via questionnaire.
    2. Semi-structured interviews with the company managers.
- Identification and assessment of company KPIs.
- Development and testing the new reporting framework and form for Near Misses.

Each of those methodologies goes through the development and the improvement step. After that, they are implemented to collect data. Each one of the methods has been applied individually, but not separately, as all of them are designed to be linked and to work as complementary to support each other. The individual application of the methods was through distributing the questionnaire and the new reporting form in two different Qualtrics links. However, the responses were linked to each other, whereas the target sample for this study is the same seafarers who work at the same shipping company. The collected data is categorised as quantitative data (questionnaire responses, KPIs and new reporting form responses) and qualitative data (the semi-structured interviews). The analysis technique that will be used to facilitate those data is a thematic analysis for the interview and statistical analysis using a statistical tool for the quantitative data. Various techniques will be utilised while doing the statistical analysis such as; correlation, One Way Anova test and descriptive analysis to have the outcome. After the analysis techniques are implemented, the outcomes of each of the methodologies will be combined to reach clear and solid conclusions and solutions for the main problem identified earlier.

The objectives which have been mentioned earlier in chapter 2 will be achieved through conducting the chosen methodologies. The first methodology will be the reporting culture assessment via a questionnaire, which will be distributed to the seafarers. This is inspired by an official and confidential safety climate assessment (SCA) which was conducted to measure the safety culture in the same shipping company in 2017. The safety climate assessment was designed by a classification society and the shipping company, as a joint collaboration. The development of the questionnaire was through selecting the most related statements within the SCA that are related to the reporting culture directly or indirectly such as the English Language barriers, communication and responsive of the shore-based office managers toward unsafe acts etc. The second methodology will be the semi-structured interviews with the key personnel at the shipping company. The semi-structured interviews will examine the process and feasibility of the company's NMR system.

The third approach will focus on the company's KPIs to find out the relation between different safety indicators with the reporting practice. Finally, and according to the gaps, which were identified with the reporting systems in chapter 3, the new reporting framework and form was designed and will be tested by distributing the form to the seafarers to compare its outcome with the existing Near Miss reporting system deployed by the company.

Further details of the overall structure of the methodologies are provided in the following paragraphs.

Firstly, reporting culture assessment questionnaire will be distributed to the company's crew members. In order to support the responses collected from the questionnaire, semi-structured interviews will be conducted at the company with the key personnel in order to capture the attitude and perceptions of the employees towards the NMR. Through these semi-structured interviews and the analysis of the questionnaire results, the gaps in the reporting systems will be identified. This will be utilised to design a new reporting form for the Near Miss, which will be distributed to the seafarers to test the efficacy of the new NMR form. Secondly, the company's KPIs will be collected and correlated with the survey data for further insight and possible links between KPIs and the survey results. KPI data will also be used for trend analysis to capture the KPIs which have a positive impact on the safety performance of a shipping company. Finally, after modifying the new reporting form for the Near Miss, the link will be activated to capture the feedback from the seafarers who are on-board their ships.

By the time when all the data are collected, and the assessment is completed, all gaps that lead to human errors will be clearly identified. The gaps identification process was designed through comprehensive methodologies, whereas, a statistic software tools were used to generate the

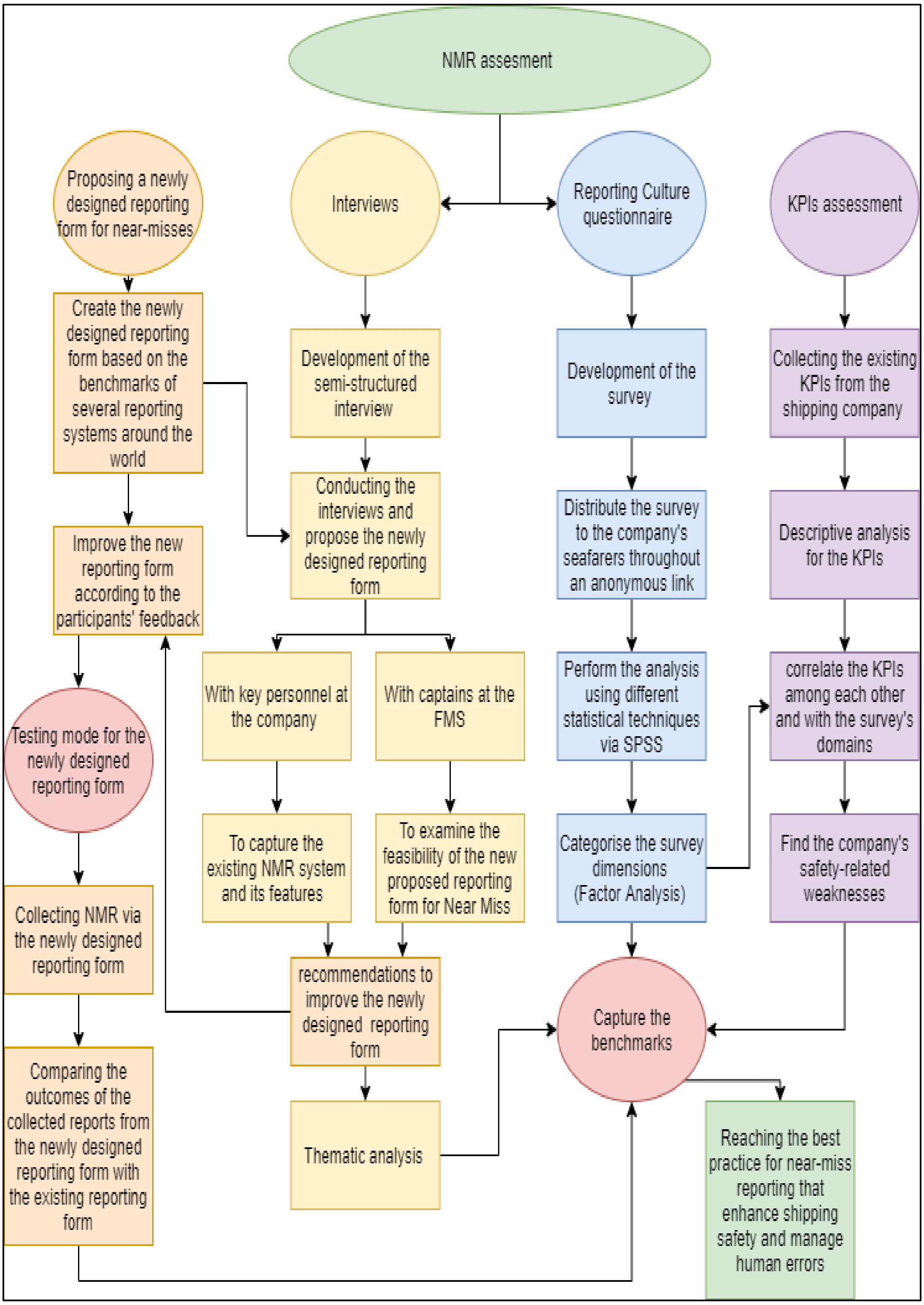


Figure 4-1 Research Methodologies

results. Moreover, a variety of statistical tests will be utilised as well to highlight the significant outcomes. In addition to that, the dialogues that are recorded during the interviews will be analysed in a systematic manner.

Details on each of the assessment and sub-assessment are provided in the following section of this chapter.

4.3. NMR assessment

The main aim of the NMR assessment is to measure the feasibility of the existing NMR system at the company compared with other standardised NMR systems. By this way, the strengths and the weaknesses will be identified, while perceptions of the seafarers and the staff in the main office will be collected to identify all the gaps that lead to unfortunate occurrences. Identification of the gaps and studying the perceptions of the employees would provide an opportunity for enhancement, which can reduce the unfortunate occurrences dramatically in any complex organisation as mentioned by (O'Toole, 2002). Thus, in order to identify those gaps and collect the crew members' perceptions, two different methods were applied:

- Reporting Culture Questionnaire.
- Semi-Structure Interviews.

4.3.1. The Reporting Culture Questionnaire

The questionnaire was designed and developed in a way to be directed to the seafarers at the company as their feedback towards the English Language skills, communications and NMR practice for themselves and their colleague will provide valuable insight. The questionnaire will be made available through an anonymous web-based online survey link. Although a variety of survey software tools are available, the Qualtrics Software is chosen as it is the official tool at the University of Strathclyde.

After the activation of the survey link and the collection of the responses from the company's seafarers, the analysis of the questionnaires returned will be processed and analysed using the following techniques:

- Firstly, factor analysis via the SPSS version 25 software will be utilised to conduct a dimensional reduction for the questionnaire. This step is necessary as the survey's new dimension relies on this step. Then the reliability test using the Cronbach Alpha test for each dimension will be utilised based on the new grouping after the factor analysis.
- The second step includes the calculation of the mean for each statement within the questionnaire and each dimension. Interpretation technique used during the latest Safety Climate Assessment (SCA), which was undertaken by a classification society in 2017, was also utilised. The interpretation used is shown in Table 4-1 below.

Table 4-1 Mean interoperation

The interpretation	**Colour code and mean score in percentage**
Significant improvement is needed	<69.99%
Medium room for improvement	70% - 79.99%
Small room for improvement	80% - 89.99%
No need for improvement	>90%

As Table 4-1 above shows, the statement and the dimension that is labelled by the dark and light green colour code is representing an agreement on the statement or the dimension. The agreement is designed for a range varying between strongly agree, agree, and part of the somewhat agree. The amber colour is covering the agreement level between the rest of the somewhat agree, neither agree nor disagree, and part of the somewhat disagree. The red colour code is covering the other part of the somewhat disagree, disagree and strongly disagree.

- In the third step, descriptive analysis for the demographic statements such as the rank, age range, qualification etc. are included as the frequencies and the percentage of the participants.
- After that, the demographic statements are linked to the rest of the survey statement via ANOVA test using the SPSS software. This test is utilised to identify statistical differences between different independent variables such as age, department, highest qualification etc. By using this method, the results are validated by removing the chance factor from the analysis. Post hoc tests are conducted on the statistically significant variables only. The statistically significant p (*p-value* < 0.05) means the independent variable has a significant effect on the rest of the questionnaire statements.

4.3.2. The Semi-Structured Interviews

Interviews are essential to validate survey results by getting a reliable comparison between the point of view of the participants on the survey and the point of view of participants during the interviews. As the interviews aim to collect responses from Marine-Superintendents regarding how they receive and analyse the NMRs that come from the seafarers. Interviews are arranged as semi-structured in order to give an opportunity to people to express their own opinions but not to divert them from the topics at the same time. The semi-structured interviews involve a general question from each reporting culture dimension. Firstly, to gain further insight into the problems specific to each dimension. Secondly, to compare the interview results with the survey results.

Several Marine-Superintendents will be interviewed to acquire a clear picture of the existing NMR system at the company, to ask about the seafarers' understanding towards NMR and the feasibility of the new NMR form. Before, conducting the interviews at the company, two captains at the Faculty of the Maritime Studies in Jeddah will be interviewed to consider their expert opinion in order to further enhance the new NMR form before proposing it to the company.

4.4. Key Performance Indicators (KPIs)

The nature of the KPI data is different than the nature of the reporting culture survey and the interview. The reporting culture survey and the interviews are subjective evaluations based on personal opinions provided by the participants. The company will provide KPI data. The identification and assessment of the KPIs aim to demonstrate three main areas:

1. Trend analysis.
2. KPIs VS KPIs Correlations.
3. Reporting Culture Dimensions VS KPIs Correlations.

4.4.1. The trend analysis

The trend analysis will be utilised to capture the changes in each of the KPIs for the duration the five years (if data is available). Thus, the trend allows the researcher to highlight where the focus is required. Moreover, it gives indications and expectations on some of the other KPIs. The SPSS software will be used to generate the trend analysis.

4.4.2. KPIs VS KPIs Correlations

The generation of the correlation for a different set of KPIs by using the statistical correlation function in the SPSS software allows the researcher to identify the KPIs which have a positive or negative impact on other KPIs. The Spearman's rho correlation test will be chosen as it is the appropriate test for this assessment since the KPI data is a non-parametric data and it does not come from normal distribution as mentioned by (McCrum-Gardner, 2007). The researcher aims to give a reliable report to the shipping company to invest on the right parameters to enhance safety and prevent unfortunate occurrences by making scientific assumptions on the impact of some of the KPIs on other KPIs.

4.4.3. Reporting Culture Dimensions VS KPIs Correlations

The final stage of the analysis aims to identify any correlation between reporting culture dimensions and the company's KPIs. This step gives an indication of which area of the survey dimension could lead to a better trend on any of the KPIs and vice versa. The Spearman's rho correlation test is chosen as the appropriate test for this correlation study since the KPI data is a non-parametric data, and it does not come from the normal distribution.

4.5. Testing the new NMR form

The new NMR form link via Qualtrics software will be activated directly after the completion of the interviews, whereas, all the modification and the recommendation will be put into consideration to reach the final version of the form. The aim is to collect several NMRs that equal to the total number of the company's ships from all fleets.

After collecting the required number of NMR, the link will be deactivated for the analysis purposes. The analysis will be done using the SPSS software and conducting a descriptive analysis to capture the trend of the reported Near Misses and the reporters' feedback. The written description was utilised to categorise the reports about unsafe conditions and unsafe acts. By the end of this stage, the data analysis of this thesis will be completed and ready to identify the gaps.

4.6. Chapter summary

This chapter presents the general methodology, which is utilised to build, collect and analyse the data that lead to the results of this thesis.

5. Reporting Culture Assessment Result

5.1. Chapter Overview

In This chapter, the Near Miss reporting Culture Assessment was performed to identify the gaps and the strengths of the existing reporting method, which is used in the shipping company and to evaluate the seafarers' attitude towards Near Miss reporting. The assessment was performed by developing and distributing a questionnaire to all seafarers from all departments within the shipping company to conduct this study. Besides, the researcher has performed a semi-structured face to face interview with the Near Miss reporting program operators at the shore base office of the shipping company. Due to the unavailability of some of the marine superintendents at the shipping company, only a few interviews were conducted. However, the main idea of the Near Miss program was captured, and the gaps were identified.

5.2. Introduction

The daily routine work on-board ships are full of risks. These risks can be mitigated if the root causes are identified and dealt with in a standardised way. This is proven and visible in other industries such as the aviation, health and nuclear fields. Besides that, the shipping industry requires a data bank that includes all the categories of risks and its consequences. So, the managers at the shore-based office will analyse those risks by utilising the data bank and classify the predicted consequences if the preventive actions are not taken. After that, the outcomes of the analysis will be shared with ship personnel. Thus, their safety performance can be enhanced according to the recommendations and feedback received from the shore-based managers. The questionnaire and the interview have been designed and utilised to capture some of the critical areas within the reporting culture for Near Miss. These critical areas, which may affect the efficacy of the Near Miss reporting practice, will be further discussed. Another area, which was examined through the questionnaire, and the interviews is the approach used in the existing reporting platform within the shipping company. It is important to emphasise that a complete and standardised reporting system for Near Miss is essential to assure its maximum efficacy.

5.3. Near Miss Reporting Assessment at the Shipping Company (Case Study)

This section of the study gives details about the Near Miss reporting assessment, which is used in cooperation with a shipping company. All the information collected through the questionnaire, interview, or other documents obtained from the shipping company is kept anonymous and confidential after taking the consent from each participant. The assessment aimed to explore the demographic characteristics of the participant. Then the seafarers' and marine superintendents' opinions about the existing Near Miss reporting program were examined. Finally, all the collected data is processed through proper analysis by using different statistical techniques to reach reliable conclusions.

5.3.1. Reporting Culture Questionnaire development

The questionnaire has been developed according to the Safety Climate Assessment (SCA) that was designed by a classification society in 2017 in collaboration with the shipping company. The questionnaire was developed by selecting the most related statements and questions within the SCA that related to the reporting culture directly or indirectly such as the English Language barriers, communication and response of the shore-based office managers towards safety issues. The direct questions and statements in SCA were expanded to investigate the reporting culture more in-depth, as the SCA was a general assessment for all aspects within the safety culture. Each statement and question within the questionnaire aim to collect responses in the form of agreement levels based on the Likert Scale (7 points). Starting by three different agreement levels, (strongly agree) which has the load of seven points, followed by (agree and somewhat agree) with loading points (six points and five points) respectively. Three different disagreement levels, strongly disagree, disagree and somewhat disagree, were included in the Likert scale; one point, two points and three points respectively. The seventh agreement level is the neither agree nor disagree, the load of the level is four points on the Likert Scale.

After the questionnaire was finalised and organised in a formal survey link, it has been sent to the shipping company to get the approval for the selected questions. The shipping company shows great interest to investigate the reporting culture in detail. However, they did not promise that the seafarers will be motivated to be involved in taking part of the questionnaire, as the shipping company already faces some difficulty to motivate the seafarers to participate in the previous SCA. Therefore, the questionnaire was approved, and the distribution was conducted through an official Qualtrics link.

5.3.2. Reporting Culture Questionnaire data collection

The questionnaire was distributed, using an anonymous link through a trusted survey platform, to the seafarers on-board their ships. One hundred eight (108) responses were collected out of nine hundred eighty-one (981) seafarers acting on-board. Considering the reality that the case study is for one shipping company, then this sample is enough to rely on its result.

The questionnaire contains a demographic domain which investigates the general characteristics of the participants and five other domains. Each domain was named according to the specific theme of the questions and statements within the domain. In total, the survey has thirty-three questions, and the whole sample collected has no missing data at all.

5.3.3. Demographics

This part of the chapter is presenting the demographics for all participants who took part in the questionnaire. The total sample contains one hundred eight survey responses. All of them are seafarers from different backgrounds, nationalities and holding different qualifications.

5.3.3.1. Age and gender

Age range and gender for the participants were asked in the questionnaire. Figure 5-1 below shows how the sample is distributed. Most of the participants are between 25 and 34 years old, as it represents 34.3% of the total sample size. Regarding the gender, 100% of the 108 participants were male as expected since the shipping company in this study doesn't recruit female crew on-board their ships yet.

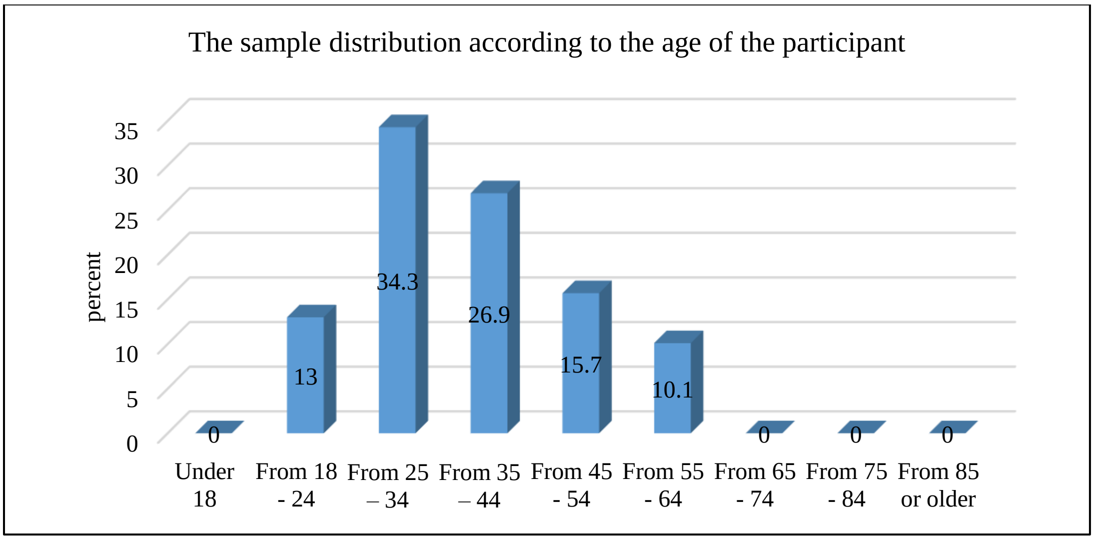


Figure 5-1 Age range distribution of participant

5.3.3.2. Department

The participants in the study are from all departments on-board of all the company ships. Figure 5-2 below shows the fluctuations in the percentage for the sample distribution within the different departments, where, the highest rate is 65.7% for the crew from the deck department, The Engineering department with 28.7% and catering department with only 5.6% make up the rest of the participants.

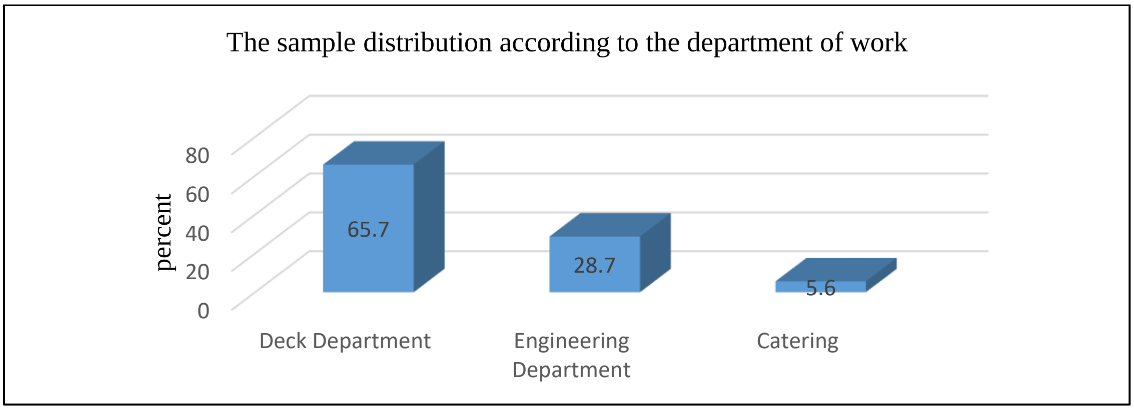


Figure 5-2 Distribution of the participants according to the Department

5.3.3.3. Rank

It is essential to collect responses from different ranks to capture the opinions of the seafarers the different ranks about the other survey questions and statements under the five domains. The following Figure 3-5 below shows the grouping of the ranks into three main categories, which are the senior officers, junior officers and the ratings. The majority, according to the cluster of the rank is the rating group, representing 34.3% followed by the Junior officers and then the senior officers. Figure 5-4 below shows the distribution of the crew among the various ranks, where the majority represents the Captains with 13.8 %.

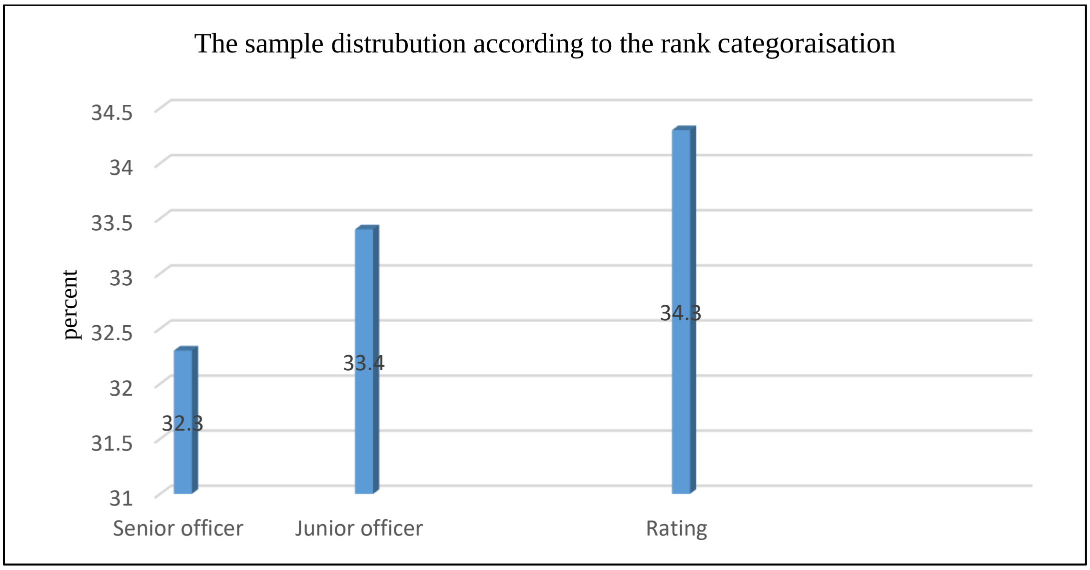


Figure 5-3 Distribution of the crew among the different ranks

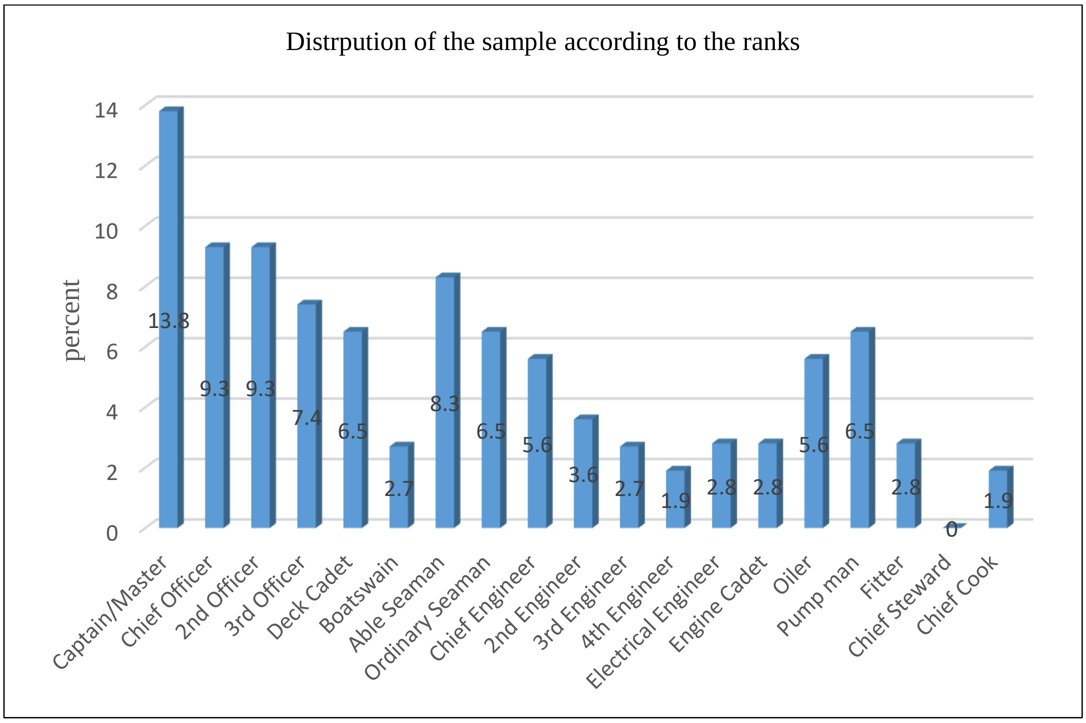


Figure 5-4 Distribution of the sample among the different ranks

5.3.3.4. First language

The first language of the participants is acquired to capture any potential deficiency in communicating and reporting in English as a common language in the maritime industry. Some of the languages are grouped together as they have something in common, such as all different languages spoken in the Indian subcontinent. The grouped languages are related to each other on regional bases, or people who speak those languages can understand each other to a certain extent. Figure 5-5 below shows the languages spoken by the participants. The most common language among the seafarers in this company is the language that is spoken on the Filipino Islands, with a percentage of 25%. This is followed by seafarers who speak the common languages in the Indian subcontinent with a percentage of 20.5%, English with 19%, Arabic with 13% and so on.

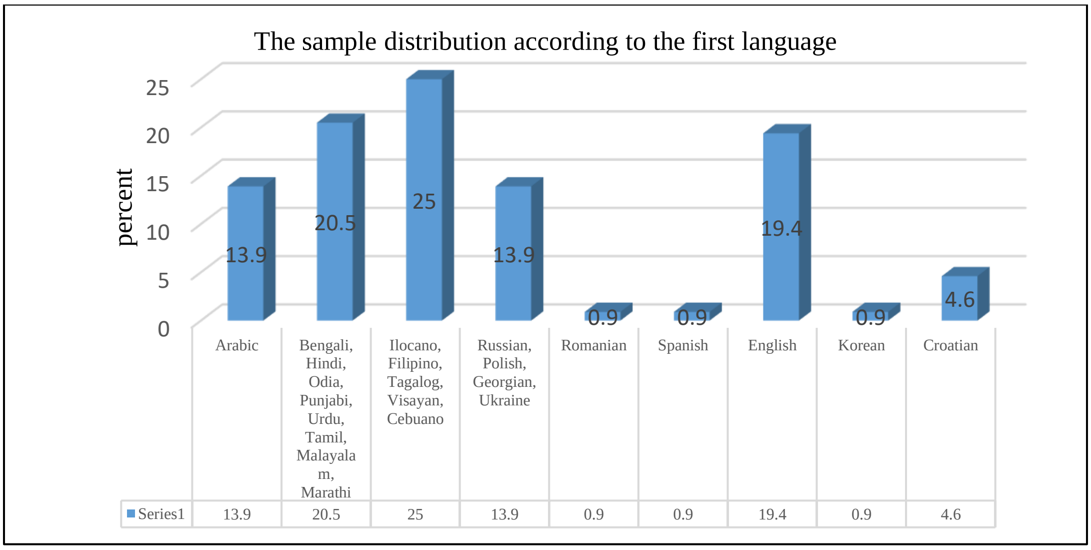


Figure 5-5 Distribution of crew according to the first language

5.3.3.5. Highest qualification

Qualifications for the seafarers were also important to capture in the survey. The percentage of each qualification is representing obvious variations. The majority of the participants are holding a qualification of B.Sc. or equivalent with a percentage of 50%. The other 50% of the participants are divided almost evenly among the other six categories of qualifications. Figure 5-6 below shows the distribution of the participants among the categories of qualification in details.

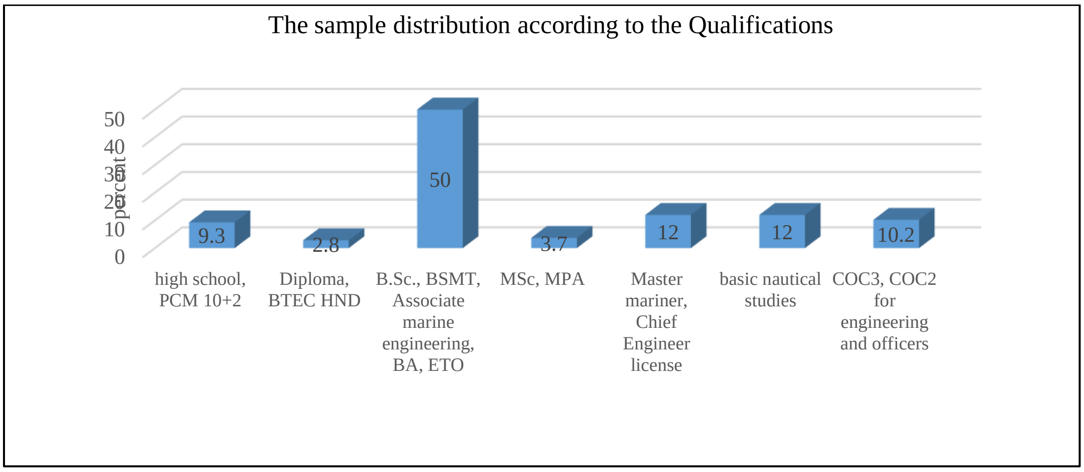


Figure 5-6 Distribution of crew among the qualification categories

5.3.4. Factor analysis

Exploratory factor analysis (EFA) is a statistical approach commonly used among researchers to perform reduction for the database or the variables within the questionnaire (Field, 2013) while retaining most of the original information within the questionnaire. The concept of the

EFA is to conduct a principal axis factoring and direct rotation for the original database (variables) as mentioned in (Fabrigar *et al.*, 1999).

The steps used within this study to perform the EFA are as follows;

- Pre-analysis: It is a correlation that needs to be done for all variables with consideration of the sample size. Table 5-1 below shows the sampling adequacy = 0.806, which is considered being an equated sample size. Moreover, Bartlett's test of Sphericity found a significance of 0.000, which reflects the existence of the variables' correlation.

Table 5-1 KMO and Bartlett's test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.806
Bartlett's Test of Sphericity	Approx. Chi-Square	1545.389
	df	351
	Sig.	.000

- The main analysis was the factor analysis, which takes place to explore the variables within the questionnaire to find out the validity of the questionnaire of the reporting culture assessment, by using the SPSS software as mentioned by (Tinsley and Tinsley, 1987). The rotation of a factor eases the process of result interpretation. During the execution of the factor analysis, the extraction was selected to be based on a fixed number of five factors. This gives a total of 60.401% of the variance. Therefore, five factors were retained from the questionnaire to be the main component, as Table *5-2* below shows.

Table 5-2 Retained factors after the Factor analysis

Component	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.934	29.386	29.386	4.674	17.310	17.310
2	3.222	11.933	41.320	3.894	14.422	31.732
3	1.831	6.780	48.099	3.826	14.169	45.900
4	1.747	6.469	54.568	2.148	7.956	53.856
5	1.575	5.833	60.401	1.767	6.545	60.401

According to Zwick (1986), each component must have three or more loadings to be a reliable component. Table *5-3* below shows how the loadings are distributed among the components. As Tabachnick, Fidell and Ullman (2007) and Brown (2014) suggested in their study, if the correlation coefficient is 0.3 and higher, then the variable is correlated with the component significantly. Table *5-3* below shows the distribution of the statements along with its loading into the components.

Table 5-3 Rotated Component Matrix

Rotated Component Matrix					
	Component				
	1	2	3	4	5
Q10	.770				
Q11	.758				
Q14	.704				
Q9	.704				
Q8	.635				
Q27	.631				
Q30	.614				
Q7	.551				
Q28	.341				
Q23		.728			
Q22		.724			
Q24		.695			

Q25		.681			
Q29		.562			
Q32		.520			
Q26		.371			
Q18			.855		
Q20			.850		
Q17			.841		
Q19			.838		
Q15			.622		
Q13				.781	
Q12				.756	
Q16				.528	
Q31					.774
Q33					.524
Q21					.339
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.					
a. Rotation converged in 6 iterations.					

The tables below (*Table 5-4*, *Table 5-5*, *Table 5-6*, *Table 5-7* and *Table 5-8*) are designed to group all the questionnaire statements under its component or factor according to the factor analysis. The grouping is based on the rotated component matrix that resulted from the factor analysis test. Each component groups the statements that have sufficient data loading of (0.3) or more (Brown, 2014).

Table 5-4 Competency and confidence in communication and reporting

Factor	statement	Question	Load
Competency and confidence	Q11	I can express myself and demonstrate the instruction clearly for all crew member in my team in English.	0.770
	Q10	The English language is never a barrier for me to ask for any unclear instruction or procedure.	0.758

	Q14	I'm able to fully understand and communicate effectively with another crew member from any nationality.	0.704
	Q9	I can establish, ask and follow up any discussion with any of the crew members without hesitation in English.	0.704
	Q8	There is no difficulty in using the English language as a dialoguing language between the crew members.	0.635
	Q27	The Near Miss reporting form is easy to use.	0.631
	Q30	I'm well trained to report Near Miss.	0.614
	Q7	Communication environment within my ship is good enough to ensure safety.	0.551
	Q28	The Near Miss reporting form covers all the safety aspects.	0.341

Table 5-5 Shore base personnel's responsive toward safety issues

Factor	statement	Question	Load
Shore base personnel's responsive toward safety issues	Q23	Staff on the shore base office usually give us proper feedback on any safety-related issues.	0.728
	Q22	Staff on the shore base office are supportive and responsive.	0.724
	Q24	Staff on the shore base office share the same understanding of safety like the seafarers.	0.695

	Q25	Staff on the shore base office are collecting Near Miss reports from ships to improve safety and give feedback to the seafarers.	0.681
	Q29	I believe that all reports are subjected to proper analysis by the managers on the shore base.	0.562
	Q26	Staff on the shore base office are collecting Near Miss reports not to blame the seafarers.	0.371
	Q32	Near Miss practice in the company does not need to be improved.	0.520

Table 5-6 Non-Native Speakers using the English Language

Factor	statement	Question	Load
Non-Native Speakers using the English Language	Q18	Indian or Pakistani seafarers are dialoguing effectively with other seafarers from other countries.	0.855
	Q20	Russian seafarers are dialoguing effectively with other seafarers from other countries.	0.850
	Q17	Filipino seafarers are dialoguing effectively with other seafarers from other countries.	0.841
	Q19	Arab seafarers are dialoguing effectively with other seafarers from other countries	0.838
	Q15	There is no gap in using the English language effectively between native speaker seafarers and non-native speaker seafarer.	0.622

Table 5-7 English enhancement program for Crewmembers

Factor	statement	Question	Load
English enhancement program for Crewmembers	Q13	The company has an English language examination program for new applicants.	0.781
	Q12	My company is interested in developing my English language skills.	0.756
	Q16	Language/dialect related issues among crew members are an issue for me.	0.528

Table 5-8 Near Miss reporting culture

Factor	statement	Question	Load
Near Miss reporting culture	Q31	The terms and the terminologies used in the reporting form are not confusing and standardised.	0.774
	Q33	I'm convinced that all safety-related issues must be reported.	0.524
	Q21	I can address any safety issue to the shore base office without any hesitation.	0.339

- Post analysis check: This reliability test needs to be conducted to check if each of the components or the domains is reliable by using the Cronbach's Alpha coefficient (Cronbach, 1951). *Table 5-9* below shows the Cronbach's Alpha coefficients for each domain and then for the total study.

Table 5-9 Cronbach's Alpha coefficient for each of the questionnaire's domains

Reporting culture domains	Cronbach's Alpha coefficient
Competency and confidence in communication and reporting	0.864
Shore base personnel's responsive toward safety issues	0.734
Non-Native Speakers using the English Language	0.88
English enhancement program for Crewmembers	0.525
Near Miss reporting culture	0.491
Total study	**0.698**

Table *5-9* above shows the Alpha coefficient which is the reliability score for every individual domain and for the total study. According to Nunnally (1978), a reliable study must have an Alpha coefficient of 0.6 and higher, and the overall reliability for this study is almost 0.7. by looking at the fourth and the fifth domain, it is noticeable that the reliability is below the accepted score. This is due to the small number of the statement under each of the two domains. However, most importantly, is the overall reliability score for the study, which is within the accepted score. Thus, sufficient reliability for the reporting culture assessment questionnaire has obtained after conducting the Expletory Factor Analysis.

5.3.5. Near Miss Reporting Domains Result

This section demonstrates the five different domains that were generated from the questionnaire after conducting the factor analysis. One hundred eight participants had completed the questionnaire with no missing data in any of the domains' statements. All responses are included in the analysis. The below tables (Table *5-12*, Table *5-13*, Table *5-14*, Table *5-15* and Table *5-16*) are showing the mean, standard deviation (Std. Dev) and the agreement score for each statement. All the statistical analyses were performed using the SPSS tool. The figures under the score column is highlighted by colour code.

The colour code that the researcher has used in this study is inspired by the SCA for the shipping company's colour code. The shipping company was implementing three colour code criteria (80% - 100% no improvement is required, 70% - 80% Small room for improvement is required and less than 70% represent significant room for improvement is required). However, the variation between 80% and 100% is high. Thus, a new category has been added by the author to expand the possibility of the improvement for all the reporting culture aspects. The new colour code is the light green colour which reflects the agreement score from (80% - 89.9%). By this way, more gaps and improvement will be highlighted. The dark green colour represents the scores from (90% - 100%) a satisfactory score, and no improvement is required. The amber colour is for the score held between (70% - 79.9%) and represents some room for improvement is required. The fourth code is the red colour, which represents scores 69.9% and below. Statements with the red code required significant improvement, as shown in Table *5-11* below.

Table *5-10* below is presenting the total scores for all domains. The trend and distribution for the colour code made it clear that the first and the fifth domains' scores are relatively higher than the other domains. Thus, a small room for improvement is required, which can be achieved by implementing a new and standardised reporting system for Near Misses. The second and fourth domains' score is showing less agreement. Therefore, a moderate room for improvement is required to enhance those two domains.

The third domain scores less than the other domains, which indicates a weakness of using the English Language among the seafarers. The structure of the statements in the third domain was asking the seafarers about their colleagues' communication skills in English. Thus, each participant had the chance to evaluate Non-English-speaking co-workers' skills while dialoguing in English. Therefore, the overall score for this domain is showing a disagreement on the efficacy of the non-native speakers while dialoguing in English.

The overall study scores the amber colour code, which means the seafarers' competency, communication level, Near Miss Reporting practice, and the crew enhancement program are requiring improvement to gain a higher reporting culture level. In general, this is the main concept of resilience engineering, where continual monitoring and enhancement are required to achieve a higher safety level.

Table 5-10 Questionnaire's domains score

The domain	**Mean**	**Std. Dev**	**Domain agreement's score %**
Competency and confidence among crew members in communication and reporting	6.16	0.65	86.06
Shore base personnel's response towards safety issues	6.08	0.84	**77.95**
Non-Native Speakers using the English Language and NMR	4.27	1.60	**60.73**
English enhancement program for Crewmembers	5.66	1.14	77.72
Near Miss reporting culture	6.16	0.68	86.00

Total study	**5.66**	**0.98**	**77.69**

Equation 5-1 below is showing the calculation method for the mean for Likert-type scale (7 points) is as follow:

$$Mean = \frac{(f*7)+(f*6)+(f*5)+(f*4)+(f*3)+(f*2)+(f*1)}{\text{sample size}} \qquad \text{(Eq 5.1)}$$

Where the f is presenting the frequency of the agreement level based on the Likert Scale (7 points) for each statement in the questionnaire.

Equation 5-2 below is showing how to convert the mean to a percentage. This equation will be used in the next section to calculate the score for each statement and each domain.

$$\text{Score in percentage (\%)} = \frac{\text{Mean}-1}{7-1} * 100 \qquad \text{(Eq 5.2)}$$

The mean limit which is presented in Table *5-11* below was obtained using Equation 5-3 below for the Likert-type scale (7 points). 0.86 is the range for each agreement degree as it is shown in mean limit column. The formula is:

(7-1) / 7 = 0.86 (Eq 5.3)

Table 5-11 Mean limits for each agreement degree and colour code

Agreement degree	Mean limits	Colour code
Strongly Disagree	1.00 – 1.86	<69.99%
Disagree	1.87 – 2.73	
Somewhat disagree	2.73 – 3.59	

Neither agree nor disagree	3.60 – 4.46	
Somewhat agree	4.47 – 5.33	70% - 79.99%
Agree	5.34 – 6.20	80% - 89.99%
Strongly Agree	6.21 – 7.00	>90%

5.3.5.1. The first domain: Competency and confidence among crew members in communication and reporting

Table 5-12 Competency and confidence among crew members in communication and reporting

Competency and confidence among crew members in communication and reporting			
Statement	**Mean**	**Stan. Dev**	**Agreement Score %**
Q10 The English language is never a barrier for me to ask for any unclear instruction or procedure.	6.33	0.641	88.83
Q11 I can express myself and demonstrate the instruction clearly for all crew member in my team in English.	6.3	0.534	88.33
Q14 I'm able to fully understand and communicate effectively with another crew member from any nationality.	6.14	0.662	85.67

Q9 I can establish, ask and follow up any discussion with any of the crew members without hesitation in English.	6.19	0.598	86.50
Q8 There is no difficulty in using the English language as a dialoguing language between the crew members.	6.06	0.835	84.33
Q27 The Near Miss reporting form is easy to use.	6.12	0.575	85.33
Q30 I'm well trained to report Near Miss.	6.11	0.824	85.17
Q7 Communication environment within my ship is good enough to ensure safety.	6.23	0.54	87.17
Q 28The Near Miss reporting form covers all the safety aspects.	5.99	0.677	83.17
Total domain	**6.16**	**0.65**	**86.06**

The domain of the 'Competency and confidence among crew members in communication and reporting' consists of nine statements. It is noticeable from Table *5-12* above that the mean of the sample study responses in this domain is = 6.16; this means that this domain is verified by an agreement score of 86.06%.

The overall trend for this domain tends to be almost successful regarding the competency and confidence of the company seafarers. Therefore, crew members can express themselves and understand whatever instructions were given to them in a good way. However, it could be further improved to reach an excellent level and a higher level of safety. Thus, seafarers are required to enhance their communication and English Language skills through English courses and attending the Bridge resource Management BRM course.

Moreover, seafarers can use the existing reporting form for Near Miss effectively to some extent. The different aspects of the reporting form and filling the required field correctly according to the Near Miss are conducted well by the seafarers. However, seafarers can do better with reporting practice and be more familiar with the reporting form by improving the existing reporting system at the company.

The moderate agreement score for this domain was expected as all the statements have been designed to evaluate the participant themselves rather than asking about other crewmembers' skills. This moderate score gives an indication of the moderate confidence level for the seafarers at the shipping company. This score can be further enhanced by improving the reporting system and offering the seafarers a relevant course to enhance their skills toward the competency and confidence among crew members in communication and reporting.

One of the following domains was designed to ask the participants their opinion about the other seafarers' skills in communications. In general, the English language-related statements meant to evaluate the participant himself, not the others' skills in using the English language. More details will be given in the next sections.

5.3.5.2. The second domain: Shore base personnel's response toward safety issues

Table 5-13 Shore base personnel's response toward safety issues

Shore base personnel's response toward safety issues			
Statement	**Mean**	**Stan. Dev**	**Agreement Score %**

Q23 staff on the shore base office usually give us proper feedback on any safety-related issues.	6.10	0.683	85.00
Q22 staff on the shore base office are supportive and responsive.	6.01	0.891	83.50
Q24 staff on the shore base office share the same understanding of safety like the seafarers.	6.07	0.924	84.50
Q25 staff on the shore base office are collecting Near Miss reports from ships to improve safety and give feedback to the seafarers.	6.25	0.763	87.50
Q29 I believe that all reports are subjected to proper analysis by the managers on the shore base.	5.98	0.957	83.00
Q26 staff on the shore base office are collecting Near Miss reports not to blame the seafarers.	5.58	1.58	76.33
Q32 Near Miss practice in the company does not need to be improved.	3.75	1.65	45.83
Total domain	**5.67**	**1.064**	**77.95**

The domain of the 'shore base personnel's response to safety issues' consists of seven statements. It is noticeable from Table *5-13* above that the mean of the sample study responses in this domain is = 5.67, this means that the shore base personnel response is verified by an agreement score of 77.95%.

The trend of all the statements except the last two questions is within the small range of improvements to bring it to over 90%, whereas the staff at the shore-based office are required to put more efforts to understand and deal with the safety issues on-board as mentioned by seafarers. The managers at the shore-based office seem to have some difficulty with understanding, supporting ships' crew as well as providing feedback. Moreover, the results indicate that those crew members do not trust the shore-based staff in conducting a proper analysis for all Near Miss reports and then provide appropriate feedback. It is important that crewmembers believe in their superiors' decisions at the shore-based office as it will improve the level of safety culture significantly. Thus, managers at the company are required to create transparent relations with the seafarers by understanding what difficulties they are facing in term of safety and providing the necessary support to eliminate their concerns. In this way, the safety culture in the company will be enhanced. A standardised reporting system for Near Misses will allow the managers to overcome this gap and help to build the common safety understanding between the seafarers and the managers at the shore-based office.

The score of the statement *Staff on the shore base office is collecting Near Miss reports in order not to blame the seafarers* = 76.33%. This gives the result that the seafarers at the shipping company somewhat agree that the blame culture does not exist and believe in the no-blame culture by a percentage of 76.33% with regards to the Near Miss reports. Thus, the blame culture exists by a percentage of 23.67%, which indicates ineffective implementation of the just culture. This score is not acceptable, as the just culture is supposed to be practiced at the shipping company more significantly. Therefore, just culture is required to be promoted more effectively at the shipping company by increasing the trust between the seafarers and the managers at the shore-based office. Thus, the phenomenon of the no-blame culture will be positively impacted by implementing an anonymous NMR system. This is the key to gain a higher level of the reporting culture and to increase the resilience of safety at the shipping company by adopting the no-blame culture. Therefore, the trust between the ship crew and shore-based staff should be improved urgently. This can be achieved by following an anonymous reporting system for Near Miss, and by explaining the process to the seafarers how the marine superintendent is dealing with the Near Miss reports. This will make the handling of NMR very transparent by the shore-based manages, including maintaining the anonymity of the reporters.

The last statement says, "*Near Miss practice in the company does not need to be improved"*. The mean score for this statement reflects a disagreement according to the mean limit table.

Thus, the Near Miss reporting practice and process is required to be improved significantly. By considering the fact that the existing reporting practice for Near Misses at the shipping company is not utilising a standardised form as seen in the developed countries, there would be a room for improvement to develop a more standardised reporting system. It is recommended that the company should put in considerable effort into improving the reporting practice, including the reporting platform, standardising the form, anonymity issues and feedback.

5.3.5.3. The third domain: None Native Speakers using the English Language and the NMR

Table 5-14 Non-native using the English language and the NMR

Non-Native Speakers using the English Language and the NMR			
Statement	**Mean**	**Stan. Dev**	**Agreement Score %**
Q18 Indian or Pakistani seafarers are dialoguing effectively with other seafarers from other countries.	4.92	1.60	65.33
Q20 Russian seafarers are dialoguing effectively with other seafarers from other countries.	4.71	1.56	61.83
Q17 Filipino seafarers are dialoguing effectively with other seafarers from other countries.	4.86	1.56	64.33
Q19 Arab seafarers are dialoguing effectively with other seafarers from other countries	4.73	1.63	62.16
Q15 There is no gap in using the English language effectively between native speaker seafarers and non-native speaker seafarer.	4.00	1.618	50.00
Total domain	**4.64**	**1.59**	**60.73**

The domain of the ‘non-native using the English language and the NMR’ consists of five statements. It can be seen from Table *5-14* above that the mean of the responses in this domain is = 4.64. This means that the non-native crew using the English language and the NMR is verified by an agreement level of 60.73%, which means a significant effort is required to enhance the English skills of the non-native speakers.

There is a disagreement upon the efficacy of dialoguing in English by seafarers from the Indian subcontinent, Russian, Filipino Islands and Arab countries. The score is fluctuating from (65.33% to 62.16%) respectively, which reflects a strong disagreement according to Mean limits for each agreement degree and colour code presented in Table *5-11* Mean limits for each agreement degree and colour code. This result gives a clear indication that the examination programme for the new joining crew is not robust enough and must be enforced with strict procedures. Moreover, an English enhancement program for the seafarers to train them in English, including how to understand different English accents is highly recommended, as the seafarers are communicating with people from all around the globe. This training courses will improve listening and speaking skills, resulting in much better communication performance within the company. Thus, seafarers will be able to understand and dialogue more effectively with all crew members from any nationalities.

The last statement in this domain "*There is no gap in using the English language effectively between native speaker seafarers and non-native speaker seafarer*" has been responded by the participants by less score than the other statements within the domain. Which means all participants regardless of their nationalities, are agreeing on the existing gaps while using the English language between the native speakers and non-native speakers. Those gaps in using the common language will result in a significant misunderstanding between the crew members. Thus, this misunderstanding could be the main root causes of an accident. This point can be solved by enforcing English training programs for the seafarers while they are off duty.

5.3.5.4. The fourth domain: Crewmembers' enhancement program

Table 5-15 Crewmember's enhancement program

English enhancement program for Crewmembers			
Statement	**Mean**	**Stan. Dev**	**Agreement Score %**
Q13 The company has an English language examination program for new applicants.	5.79	1.152	79.83
Q12 My company is interested in developing my English language skills.	5.73	0.973	78.83
Q16 Language/dialect related issues among crew members are an issue for me.	5.47	1.300	74.50
Total domain	**5.66**	**1.14**	**77.72**

The domain of the 'crewmember's enhancement program' consists of three statements. It can be seen from Table *5-15* above that the mean of the sample study responses in this domain is = 5.66; this means that the crewmembers' enhancement program is verified by 77.72%. It means the company's program for examining the English language skills for the new applicant and the development courses exist, but they are not enough and need to be improved. The company is required to set up a new and standardised examination system for the new applicant as well as a continuous development programme. First, the level of the new applicant using the English language is determined. Subsequently, any improvement courses would be directed towards the new recruits. By applying this to all crew, the level of using the English language, whether in speaking, writing reports or even dealing with port authority would be improved to a new level.

The last statement in this domain *"Language/dialect related issues among crew members are an issue for me"* is examining if there are communication issues among crew members in general regardless of the nationality or the first language of the participants. Therefore, the score for this statement reflects an agreement level based on Table *5-11* Mean limits for each agreement degree and colour code on the existence of several issues while dialoguing in English. Those issues can be categorised under the speaking and listening skills. Thus, the recommendation of enforcing English language programme is necessary to ensure a high level of communication in English among the company seafarers from different nationalities. Consequently, this will influence the seafarers' ability in writing NMR effectively by describing the unsafe act in a clear way. This will benefit the managers at the shore-based office while analysing those reports by understanding the whole scenario of the Near Miss. The final result will be a safer working environment among all seafarers despite their first language, as the understanding of safety issues will be at the same level among on-board staff and shore-based staff.

5.3.5.5. The fifth domain: Reporting Practice and Communication among crew members

Table 5-16 Reporting practice and communication among crew members

Near Miss reporting culture			
Statement	**Mean**	**Stan. Dev**	**Agreement Score %**
Q31 The terms and the terminologies used in the reporting form are not confusing and standardised.	5.98	0.797	83.00
Q33 I'm convinced that all safety-related issues must be reported.	6.38	0.559	89.67
Q21 I can address any safety issue to the shore-based office without any hesitation.	6.12	0.680	85.33
Total domain	**6.16**	**0.68**	**86.00**

The domain of the NMR culture among crew members consists of three statements. It can be seen from Table *5-16* given above that the mean of the sample study responses in this domain is = 6.16, this means that the crew members' reporting practice and communication are verified by an agreement level of 86%, which is considered good. This means with a small effort further improvement excellent level of agreement regarding the seafarers' ability in understanding the terms that are used in the reporting form. Moreover, the crew members are required to understand the main purpose of conducting the reporting for the Near Misses. Thus, they will be more convinced to report every single unsafe act without any hesitation.

5.3.6. Statistical result

In this section of chapter 5, the one-way ANOVA test in the SPSS tool (Post-Hoc Multiple comparisons) was utilised to generate some of the statistical results. The test aims to identify the Ƥ-value for each dependent variable (the statements under the five domains) concerning the independent variable (the demography) such as the Age, Department etc. According to Laerd (2018), the independent variable needs to have three or more categories in order to give reliable Ƥ-value, whereas, an examination of the independent group means finding the statistical differences. If the resulted Ƥ-value < 0.05, then there is a significant statistical difference between different groups responded to a statement within the questionnaire. A faded red colour code will be used in the following tables to identify the values that are < 0.05.

5.3.6.1. Effect of the Age

Table *5-17* below is showing the Ƥ-value for each statement in relation to the effect of the Age groups. The highlighted values in a faded red are reflecting the significant statistical differences between the different age groups and their responses to the rest of the statements in the questionnaire. Surprisingly, there is not any Ƥ-value less than 0.05 in the effect of the age groups in relation to the questionnaire. This means, regardless of the age of the participants, there will be no significant deviations in the responses toward the rest of the dependant statements.

Table 5-17 One-way ANOVA for the Age groups

Statement	Ƥ-value	Statement	Ƥ-value	Statement	Ƥ-value
Q7	0.791	**Q16**	0.324	**Q25**	0.485
Q8	0.361	**Q17**	0.505	**Q26**	0.424
Q9	0.927	**Q18**	0.234	**Q27**	0.84
Q10	0.953	**Q19**	0.493	**Q28**	0.577
Q11	0.951	**Q20**	0.341	**Q29**	0.844
Q12	0.833	**Q21**	0.776	**Q30**	0.667
Q13	0.226	**Q22**	0.356	**Q31**	0.388
Q14	0.647	**Q23**	0.960	**Q32**	0.130
Q15	0.747	**Q24**	0.97	**Q33**	0.794

(Ƥ-value < 0.05 is highlighted in red and reflects a significant statistical difference)

It can be seen that there are no significant differences between the Age group and the other statements within the questionnaire. That means the mean limit is higher than 0.05 for each statement in relation to the different group of age, which is considered acceptable.

5.3.6.2. Effect of the department

Table *5-18* below is showing the Ƥ-value for each statement in relation to the effect of the Department groups. The highlighted values in a faded red is reflecting significant statistical differences between the different Department groups and their answers to the rest of the dependant statements in the questionnaire.

Table 5-18 One-way ANOVA for the Department groups

Statement	Ƥ-value	Statement	Ƥ-value	Statement	Ƥ-value
Q7	0.443	**Q16**	0.238	**Q25**	0.476
Q8	0.591	**Q17**	0.049	**Q26**	0.230
Q9	0.426	**Q18**	0.269	**Q27**	0.820
Q10	0.730	**Q19**	0.533	**Q28**	0.918
Q11	0.519	**Q20**	0.311	**Q29**	0.910
Q12	0.259	**Q21**	0.267	**Q30**	0.972
Q13	0.650	**Q22**	0.822	**Q31**	0.351
Q14	0.626	**Q23**	0.713	**Q32**	0.813
Q15	0.684	**Q24**	0.177	**Q33**	0.087

(Ƥ-value < 0.05 is highlighted in red and reflects a significant statistical difference)

It can be seen from Table 5-18 that there are no significant differences between the Department groups and the other statements within the questionnaire, except statement number 17. That means the mean limit is almost steady for each statement in relation to the different group of ages. Table *5-19* below is showing a summary of the post-hoc test for statement number 17. The scores are the percentage of the mean results in the test. The gradient in the red colour code represents the high or the low agreement score of the efficiency of the communication between the Filipino seafarers at the shipping company while using the English Language with other crewmembers. Whereas, the red colour code is reflecting a low agreement score of the efficiency of the communication by the Filipino crew.

Table 5-19 Summary of the finding of Post-Hoc test in relation to the Department differences

Statement	Deck Department	Engineering Department	Catering Department
Filipino seafarers are dialoguing effectively with other seafarers from other countries.	68%	59.67%	44.5%

The result shows the low level of the efficiency of the communication using the English language by the Filipino crew members with other members of the crew in the three different departments on-board company ships. Therefore, it is noticeable that the score is low for the deck and the Engineering department, and even lower for the Catering department. The reason behind this fluctuation is the intensity of the topics and the conversations that need to be discussed among those two groups, and the nationality differences in each department. The crewmembers at Deck department are dialoguing about every single task among themselves, and with other ships while manoeuvring or at a port. In addition to that, the influence of the BRM course should be taken into account as it requires ratings to repeat the helms orders given by the officer of the watch (OOW), Master or Pilot. Moreover, within the Bridge, VHF communication with another vessel or even the tasks on the deck have to be communicated in English. Thus, seafarers who belong to the Deck department are practising the English Language more frequently comparing to the other crewmembers from other departments. Besides that, crewmembers under the deck department are chosen from different nationalities mostly. This gives the Filipino seafarers the chance to improve their English Language skills while being involved in the daily routines.

Regarding the Catering department, they have limited interactions in term of the dialoguing with another crew. Thus, the only scenario when they face difficulty in dialoguing in English is when interacting with other crew members other than the Filipino seafarers. This mostly happens a few hours a day while serving three meals. The crew in the catering department are generally from the same nationality or the same region, so they don't practice the English language as much as the other crew in the deck department. This gives crewmembers in the catering department more time to speak in their own language; hence they have less score than the other departments. This phenomenon has a negative influence on the overall safety on-board any ship, as the catering staff are a part of the on-board emergency plan. If they are not qualified as much as the deck and engineering crew, then they could not perform their tasks effectively during any emergency situation. Moreover, the catering staff's ability to report Near Misses is less than the other crewmembers from other departments. Thus, the shipping company is required to pay more attention to the level of the English language of the new applicants before recruiting them. This requirement should be applied for all of the seafarers regardless of their department as all the seafarers are affecting the safety of the ship.

5.3.6.3. Effect of the crews' rank

Table *5-20* below is showing the Ƥ-value for each statement in relation to the effect of the rank groups. The highlighted values in a faded red reflect significant statistical differences between the different rank groups and their answers to the rest of the statements in the questionnaire.

Table 5-20 One-way ANOVA for the Rank groups

Statement	Ƥ-value	Statement	Ƥ-value	Statement	Ƥ-value
Q7	0.167	**Q16**	0.563	**Q25**	0.838
Q8	0.883	**Q17**	0.283	**Q26**	0.403
Q9	0.393	**Q18**	0.112	**Q27**	0.799
Q10	0.461	**Q19**	0.363	**Q28**	0.930
Q11	0.102	**Q20**	0.128	**Q29**	0.924
Q12	0.640	**Q21**	0.513	**Q30**	0.952
Q13	0.414	**Q22**	0.637	**Q31**	0.844
Q14	0.707	**Q23**	0.943	**Q32**	0.022
Q15	0.682	**Q24**	0.025	**Q33**	0.411

(Ƥ-value < 0.05 is highlighted in red and reflects a significant statistical difference)

It is noticeable that there are no significant differences between the different rankings and most of the other statements within the questionnaire, except statements number 24 and 32. This means the mean limit is almost steady for each statement in relation to the different groups of ranks. Table *5-21* below is showing a summary of the post-hoc test for statement number 24 and 32. The scores are the percentage of the mean that was obtained in the test. The green colour code represents the high level of the safety understanding between seafarers and shore-based staff and Near Miss reporting practice among seafarer at the company. The red colour is reflecting the lowest level of communication and Near Miss reporting practice.

Table 5-21 Summary of the finding of Post-Hoc test in relation to the Rank differences

Rank Senior Junior Rating	Statement 24 Staff at the shore base office share the same understanding of safety like the seafarers.	Statement 32 Near Miss practice in the company does not need to be improved.
Captain	82.22%	34.44%
Ch Off	95.00%	43.33%
Ch Eng.	91.67%	41.67%
2nd Eng.	83.33%	62.50%
Average	88.06%	45.49%
2nd Off	83.33%	46.67%
3rd Off	93.75%	50.00%
3rd Eng.	50.00%	55.56%
4th Eng.	83.33%	33.33%
ETO	88.89%	50.00%
Average	79.86%	47.11%
DC	80.95%	71.43%
BW	88.89%	66.67%
AB	81.48%	68.52%
OS	85.71%	78.57%
EC	83.33%	66.67%
Oil	83.33%	63.89%
Fit	88.89%	66.67%
CS	66.67%	83.33%
CC	83.33%	47.62%
Average	82.51%	68.15%

The table above is demonstrating the difference in the score of the means for the statements that have a P value < 0.05. The colour code at the rank column aims to categorise the different ranks into three main categories: senior officer, junior officer and rating. Regarding the statement number 24, which addresses '*the sharing of the same understanding of safety-related issues between the managers on the shore base and the seafarers'*, we find that the senior officers and the rating are having an acceptable score on their agreement level toward the statements. However, the junior officers had a lower score toward the same issue. Therefore, it is advisable that the trust between the junior seafarers and the managers at the shore base office should be improved. Achieving a strong relationship and mutual trust can be reached by implementing the just culture effectively and conducting and applying a standardised and a systematic NMR. The reason behind the relatively low score among the junior officer is that their interaction with the managers on the shore base office is limited. On the contrary, the senior officers are having direct contact with the managers at the shore base office via Emails or other alternative methods. Thus, they know how the managers are thinking toward the safety issues, unlike the junior officers who do not have any perceptions about the managers and their thoughts regarding the safety issues. For this reason, the senior officers are required to convey the messages from the managers on the shore-based office to the junior officers. Furthermore, if junior officers submit NMRs then shore-based managers should provide direct feedback to enhance the interaction with junior officers. By adopting such approaches, the level of the understanding of the safety issues between shore and ship will have a much better agreement.

Regarding the crewmembers under the rating group, it is not a priority for them to contact the managers at the shore-based office. Subsequently, they do not have a clear idea about the managers' perceptions and understanding of safety issues. In a nutshell, rating group do not bother themselves about this matter.

It was found that 45.49% of the senior officers, 47.11% of the junior officers and 68.15% of the rating think there is a room for improvement, which means almost half of the seafarers agreed that there is a need for improvement of the existing NMR system. This reflects the same opinion of the marine superintendents during face-to-face interviews at the headquarter office. This does not mean that they are not satisfied with the existing system for the NMR. It may mean they wish to have a system that allows them to include more details, anonymity and to be more user-friendly. Therefore, the newly designed reporting form for Near Miss is designed to reflect the feedback, and this will be discussed in detail in Chapter 7.

5.3.6.4. Effect of the crew's first Language

Table *5-22* below is showing the Ƥ-value for each statement in relation to the effect of the crew's first language groups. The highlighted values in a faded red reflect significant statistical differences between the different first language groups of the crew and their answers to the rest of the statements in the questionnaire. The post-hoc test is not performed correctly for all statements because at least one group has fewer than two responses. Therefore, the resulted Ƥ-value from the One-way ANOVA test is not reliable. For this reason, the Romanian, Korean and Spanish participant is going to be re-categorised under one category. So, the test will be valid.

Table 5-22 One-way ANOVA for the difference in the first language

Statement	Ƥ-value	Statement	Ƥ-value	Statement	Ƥ-value
Q7	0.432	**Q16**	0.031	**Q25**	0.348
Q8	0.024	**Q17**	0.859	**Q26**	0.127
Q9	0.179	**Q18**	0.399	**Q27**	0.247
Q10	0.360	**Q19**	0.549	**Q28**	0.501
Q11	0.328	**Q20**	0.791	**Q29**	0.288
Q12	0.053	**Q21**	0.421	**Q30**	0.007
Q13	0.137	**Q22**	0.507	**Q31**	0.743
Q14	0.397	**Q23**	0.341	**Q32**	0.132
Q15	0.720	**Q24**	0.022	**Q33**	0.061

(Ƥ-value < 0.05 is highlighted in red and reflects a significant statistical difference)

It is noticeable that there are no significant differences between the first language groups and most of the other statements within the questionnaire, except statements 8, 16, 24, 30 and 33. That means the mean limit is almost steady for each statement in relation to the differences of the first language for the seafarers. Table *5-23* below shows a summary of the post-hoc test for statement number 8, 16, 24, 30 and 33. The scores are the percentage of the mean outcome in the test. The green colour code represents the high level of communication and Near Miss reporting practice among seafarer at the company, and the red is reflecting the lowest level of the communication and Near Miss reporting practice.

Table 5-23 Summary of the finding of Post-Hoc test in relation to the crews' First language differences

First language	**Statement 8**	**Statement 16**	**Statement 24**	**Statement 30**
	There is no difficulty in using the English language as a dialoguing language between the crew members.	Language/dialect related issues among crew members are not an issue for me.	Staff on the shore base office share the same understanding of safety like the seafarers.	I'm well trained to report Near Miss.
Arabic	82.16%	58.83%	72.16%	74.5%
Bengali, Hindi, Odia, Punjabi, Urdu, Tamil, Malayalam, Marathi	85.61%	80.30%	87.12%	90.91%
Ilocano, Filipino, Tagalog, Visayan, Cebuano	86.42%	85.80%	83.95%	84.57%
Russian, Polish, Georgian, Ukraine	78.89%	73.33%	88.89%	86.67%
English	88.10%	65.87%	87.30%	88.10%
Croatian	90.00%	80.00%	93.33%	86.67%
Others (Romanian, Korean and Spanish)	61.11%	66.67%	77.78%	72.22%

In general, the seafarers from the Indian subcontinent, Filipinos Island and Croatian have a significantly higher average score in relation to all the statements compared to other first language groups. On the other hand, seafarers, who speak the language under the group of Arabic, Russia, English and other which are (Romanian, Spanish and Korean) think there is an issue in dialoguing among crew members and the mastering of NMR. Moreover, some difficulty in using the English language exists according to the opinion of the seafarers who speak the languages under the group of Russian and other which are (Romanian, Spanish and Korean). The results highlight the issues related to the communication in English among crew members and the mutual understanding of the safety aspects among crew members and shore-based managers, including the Near Miss reporting. Thus, the trust issues between the managers on the shore-based office and the seafarers can be solved by implementing an effective and standardised reporting system for Near Misses as it will be shown in chapter seven. Regarding the English language and the communication issues, it is advisable that the shipping company enforces some courses for improving the English language skills for the seafarers during their off-duty periods.

5.3.6.5. The Effect of the Qualification

Table *5-24* below shows the Ƥ-value for each statement in relation to the effect of the qualification groups. The highlighted values in a faded red reflect significant statistical differences between the different qualification groups and their answers to the rest of the statements in the questionnaire.

Table 5-24 One-way ANOVA for the qualification groups

Statement	Ƥ-value	Statement	Ƥ-value	Statement	Ƥ-value
Q7	0.749	**Q16**	0.535	**Q25**	0.821
Q8	0.533	**Q17**	0.214	**Q26**	0.483
Q9	0.340	**Q18**	0.042	**Q27**	0.713
Q10	0.796	**Q19**	0.087	**Q28**	0.738
Q11	0.263	**Q20**	0.150	**Q29**	0.463

Q12	0.684	**Q21**	0.165	**Q30**	0.494
Q13	0.913	**Q22**	0.263	**Q31**	0.980
Q14	0.450	**Q23**	0.569	**Q32**	0.099
Q15	0.065	**Q24**	0.212	**Q33**	0.637

(Ƥ-value < 0.05 is highlighted in red and reflects a significant statistical difference)

It can be seen in Table 5-24 that there are no significant differences between the first language groups and most of the other statements within the questionnaire, except statement number 18. That means the mean limit is almost steady for each statement in relation to the qualifications of different groups. Table *5-25* below shows a summary of the post-hoc test for statement number 18. The scores are the percentage of the mean giving in the test. The green colour code represents the highest level of communication among seafarer at the company, and the red is reflecting the lowest level of the communication and Near Miss reporting practice.

Table 5-25 Summary of the finding of Post-Hoc test in relation to the crews' qualification differences

Qualification	**Statement**
	Indian or Pakistani seafarers are dialoguing effectively with other seafarers from other countries
High School, PCM 10+2	55%
Diploma, BTEC HND	84%
B.Sc., BSMT, Associate Marine Engineering, BA, ETO	69.17%
MSc, MPA	75%
Master Mariner, Chief Engineer license	48.67%
Basic Nautical Studied	57.67%
COC3, COC2, for Engineering and Officers	77.34%

From Table *5-25* above, it is noticeable that there is a fluctuation in the distribution of the scores among the qualification groups toward the efficacy of the Indian crew dialoguing in English. Generally, all the different qualifications were not satisfied with the efficiency of the dialoguing skills of the seafarers from the Indian subcontinent. An exception was observed among the crew who hold Diploma, COCs and MSc degree, as they were somehow satisfied with the dialoguing skills of the Indian subcontinent's seafarers by a percentage of 84%, 77.34% and 75% respectively. The lowest score has been gained by the rest of the qualifications, who are forming the majority of the questionnaire's participants by a percentage of 83.3%, as shown in Figure 5-6 above. Thus, the weight of their judgment toward the crew members from the Indian subcontinent is more reliable than seafarers under other qualifications. Therefore, it is agreed by the majority of the participants that the seafarers who speak the languages used in the Indian subcontinent are struggling while communicating in English with other seafarers from other nationalities. This issue was highlighted during the interview as well with one of the Marine superintendents, as it will be demonstrated in the next section of this chapter.

5.3.7. Interview result

Conducting a face to face interview with some of the key personnel at the company and at the Faculty of the Maritime Studies was necessary to perform the study in a reliable way. The necessity of conducting the interview with some of the retired Captains who teach at the Faculty of the Maritime Studies lies on three main points. First of all, examining the feasibility of the interview' questions, whereas the retired Captains are aware of the existing systems of the Near Miss reporting at some of the shipping companies in the Middle-East region. The second point is to practice the semi-structured interview questions in order to be well prepared for interviews with the key personnel at the shipping company. Furthermore, it is important to determine which questions to ask during a semi-structured interview as the answers to those questions will be open-ended answers. For those reasons, the interviewer needs to maintain reasonable control of the interview. Otherwise, the interviewer will lose control over the overall interview topic. The last point aims to evaluate and assess the effectiveness of the newly designed framework for Near Miss reporting and the reporting form. The assessment is based on their experience as a retired mariner. In general, the first stage of the interview is considered as a pilot study for the semi-structured interview.

The second stage of the interview took place at the shipping company's main office. Due to travels and the limited timetable of the Marine superintendents at the office, only four interviews were conducted. The small number of the participants was enough to reach the main aims of the interview due to the consistency of the answers recorded. Full details on the framework of the current reporting system for Near Misses were acquired clearly from the participants. Consequently, the newly designed framework and the reporting form were proposed successfully. Some of the participants' feedback on the reporting form was taken into consideration.

The second stage of the semi-structured interview was performed at the company's headquarter as planned. All of the aspects of the questionnaire were covered during the face to face interview. One of the aims of the interview was to validate the seafarers' point of view, which is the questionnaire results. The second aim was examining the visibility of the newly designed Near Miss reporting form and the framework by comparing it with the existing Near Miss reporting system that is well known to the participants.

The interviews went smoothly and achieved all the goals. The common areas covered during the interviews were listed below; some of the areas were covered during stage 2 only.

- The process of the NMR
- Motivation towards NMR
- Differences in Terminology
- Corrective actions were taken by the seafarers
- The anonymity of the reporter

- Seafarer's opinion about NMR
- Barriers to good reporting practice
- Area of improvement

5.3.7.1. Exploring the experts' opinion at the Faculty of Maritime Studies regarding the NMR practice and the newly designed framework (stage 1 for the interview)

The interviews at the Faculty of Maritime Studies took place with two of the retired Captains from different shipping companies and different background as described below. The rest of the staff do not have a Master Mariner licence; that is why they were not involved in the interviews. Table *5-26* below gives a brief information about the participants who were interviewed.

Table 5-26 Participants from FMS

Participant	**Total number of years in the academic field**	**Total number of years at sea**	**Total number of years as a captain**	**Number of companies worked at**
Participant 1	12	21	9	10
Participant 2	18	16	3	3

During the interviews, the participants were asked about different aspects related to the Near Miss practice at the companies they worked for according to their best knowledge. Some of the given information was precise, and some others were not as the participants could not remember the details from a distant past.

In general, the researcher was able to acquire a common point regarding the Near Miss reporting practice during their days. The newly designed reporting form and framework for Near Miss also were discussed and verified by them.

5.3.7.1.1. The process of the Near Miss reporting

The first participant was not able to recall the procedure of Near Miss reporting for all the companies he worked for. For that reason, he only mentioned one of the systems. The report used to be filled in a hard copy and to be submitted to the Chief Officer or Chief Engineer who would instruct the corrective action to be taken. After that, all reports were discussed in the safety committee meeting that was conducted on-board the ships every two or three months. But if there was a serious Near Miss, it was immediately looked at and discussed with the concerned crew only. By this way, all Near Miss were collected and discussed during special safety meeting to conclude the information regarding these reports. Then this information used to be sent to the company. After that, the Master passed all of the instructions received from the company to officers and all crew to educate them. This information is related to the participant AS.

The process for NMR as per the second participant was reflecting a very old practice of reporting Near Misses. The old practice does not have a reporting form nor a framework to deal with the reports.

5.3.7.1.2. Motivation toward reporting

According to the first participant, the crew used to ignore the reporting, and they just saw it as an extra workload. However, the Master was encouraging the crew continuously during drills, as he was aware of the importance of the reporting. This encouragement is considered as a self-initiative from the captains. The second participant did not mention any particular motivation plan from the shipping company to influence the seafarers to report more Near Misses. However, the company's system was strict in term of collecting a certain number of reports, as he mentioned. Therefore, the seafarers were aware that they needed to report as much as they could without believing on the importance of the Near Miss reporting.

5.3.7.1.3. Differences in Terminology

Both participants were agreed on the big gap and misunderstanding of the meaning for some terminologies such as; accident, incident and Near Miss. That phenomenon was a normal result of recruiting a non-educated seafarer. However, the misunderstanding of the different terminologies has been overcome by the time as the uneducated crew started to differentiate between the meaning of each terminology, gradually after practising.

5.3.7.1.4. The barrier to good reporting practice

According to the information acquired during the interviews, there were two different types of barriers preventing a good reporting practice. The first one is the language barrier, where the reporter ignores the case and does not report to avoid any embarrassing situation during writing in English. This issue was stressed out in the questionnaire. The other barrier that prevents good reporting practice is a hierarchy system. Some of the Captains were surrounded by an invisible guard, as none of the crew could approach him personally or even submit a report to him. This kind of masters' mentality was common in the 1990s, as they did not accept any complaints or arguments from any of the crewmembers under their command.

5.3.7.1.5. The perception of the Maritime Studies' Staff toward the newly designed framework and reporting form for NM

The framework and the reporting form were explained to them very clearly, and it has been compared with the Near Miss reporting system in the companies that they have retired from. The finding after the comparison was positive and promising that the new proposal will attract the key personnel managers at the company at the next stage. They have mentioned the importance of having a system that notifies the reporter about the progress of their report. They have mentioned that enhancement at the reporters' skills would be noticeable as they are receiving feedback from three different points of views regarding their reporting practice. The point of view is received from the following parties:

1-Ship's management level (first filter),

2-Company's management level (second filter)

3-And a third-party level national system for Near Miss Reporting in the future when such a system is created (third filter)

As well as learning from other mistakes in other fleets and tracking the key underlying root causes that it will be avoided in the future, they welcomed the idea of adopting a standardised procedure and creating a national database for Near Miss. Finally, it is time to quit reporting using paper form, as there is a massive amount of paperwork on-board ships nowadays, as they mentioned.

The two experts' opinion regarding the reporting form was inspiring, and based on their feedback, some modifications have been applied accordingly. The participants were highly satisfied with the form as it was covering all the aspects that related to a Near Miss. As they indicated, the drop-down lists could save the reporter time, as many of the seafarers were mentioning that reporting was taking a long time and was considered as workload. Apart from the positive feedback, one of the participants has mentioned the difficulty of describing the possible underlying root causes if the report was written by a low-ranking seafarer. For this reason, he suggested making the underlying root causes to be optional for the low-ranking crew. Then the Master would complete the rest of the report while checking the case at the first filter stage. This suggestion is not feasible as it interferes with the main idea of the newly designed framework of Near Miss which is the anonymity. Moreover, it may allow the Captain to manipulate with the reports' contents.

5.3.7.2. Exploring the company's reporting system for Near Miss and proposing the newly designed framework and reporting form for Near Miss (stage 2 the interview)

The Designated Person Ashore (DPA) at the company's headquarter office arranged the interview schedule with four of the Marine Superintendents (MS) who were available in that week. Access to the company's system was provided to the researcher as well to check the flow of the Near Miss reports from the ships to the company in a real-time base. The interviews were organised over two days accordingly. Table *5-27* shows the qualifications and the experience of each of the four MS.

Table 5-27 Participants from the shipping company

Participants' initial	Job Title	Number of years in this position	Experience as a Captain	Other experience Qualifications
Participant 1	Safety MS	8 years	15 years	Not mentioned
Participant 2	Safety MS	8 years	13 years	MBA in logistics and supply chain
Participant 3	Safety MS	5 years	15 years	Offshore service

Participant 4	Operational MS	10 years	16 years	MSc Nautical Studies, Diploma in Auditing and offshore inspection CAT 1 for oil tankers and Diploma in Ship management

During the interviews, many aspects related to the Near Miss reporting were covered. In addition to that, the newly designed framework and form for Near Miss reporting were discussed successfully. Three of the participants gave detailed feedback. The fourth participant was called for an urgent meeting, so he tried to summarise what I required from him. The job description of the MS was asked as well, so the researcher could understand their role before preparing the relevant questions for them. The covered aspects are described below.

5.3.7.2.1. MS job description

Each MS in the company is responsible for eight ships on average. He is the first point of contact in case of an emergency case related to the health, safety or the environment. The crewmembers on-board the eight ships are aware of their MS's contact details and his duty. So, they can approach him without hesitation. From time to time, the MS conducts visits to the ships that are under his responsibility for the purpose of the internal auditing and the safety inspections. The Near Miss reports is another part of the MS's duty, and the MS is the first person, who receives these reports after submitted by the seafarer. The MS usually checks the given rate for each case to deal with the cases accordingly and examines the Near Miss description and the corrective action taken in priority order. As a follow-up, the most important cases will be flagged to be discussed in the safety meeting with the fleet manager in the next meeting for selecting the best report for the award.

5.3.7.2.2. The process and the flow work of the existing Near Miss Reporting system at the shipping company

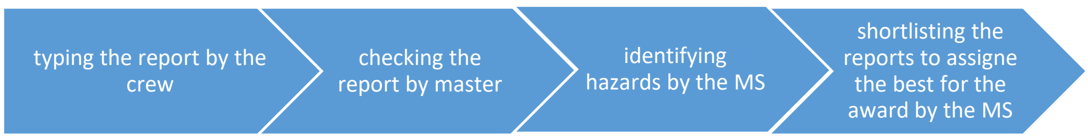
It was agreed by all of the four participants about the process of the reporting flow work. The crew members have one of two options to submit a report. The first option, which is available only at the old ships, is to take a hard copy of the reporting form from the ships' office. Fill the report manually and then leave it at the mailbox, which is located in the hallway on each vessel next to the ship's office. Then the Master will retype the report to the company's system. However, this method of reporting allows some of the Captains to interfere with the report's contents or even ignore the report completely. The other way and the most common way of submitting a report is through using the reporters' account on the company's dashboard, which detects the user and the ship's name. Thus, the company does not follow an anonymous reporting system, which affects the just culture negatively by allowing the managers to implement the blame culture.

The report after submission goes to the Master as the first point of a check for the contents of the report. The Master would check the case, corrective action taken by the crew and the given rate to the case from low to very high. If the Master noticed a wrong practice in the report, then he would notify the reporter about that verbally. The reports will be flown in the system regardless of any mistake in the report. After the master's approval, the report will be sent to the MS on the shore-based office. The Master's verbal comment to the reporter is the only way when the crew will receive feedback on their reporting practice. One of the participants said the MS do not give feedback or follow up with the reporter because we do not want to discourage them against reporting practice.

Once the report reaches the MS, the analysis will take place through two different stages. Firstly, the MS and the DPA all in parallel, identify the hazards and categorise them immediately to mitigate them. One of the participants said, 'my approach is including the identification of the root causes'. Then, on a monthly basis, the important cases will be discussed during the safety meeting. At that point, the reports will be filtered and shortlisted for the best report for the award. By following this kind of filtering, no report can be ignored or dealt with unfairly. Even the Master is not allowed to delete any non-convincing cases. Then the case will be closed. Figure 5-7 below demonstrates the process of the Near Misses from the very first stage to the selection of the best report for the award.

The reporting procedure for Near Misses at the shipping company is directed in one way from the reporter to the MS. The one-way procedure is not effective in educating the seafarers about Near Miss reporting and their wrong corrective actions. Thus, the main goal of the NMR, which is lessons learned, is not achieved. Therefore, the shipping company should implement a two-way communication procedure for the Near Miss framework instead of the one-way procedure.

Figure 5-7 NMR process at the shipping company



5.3.7.2.3. Motivation toward Near Miss reporting

Generally, the crew on-board the company ship is motivated and have the initiative to report the Near Miss. Especially, the company is running the award system for the best-reported case, as the participant said. However, some of the new crew in the company are not paying too much attention to the Near Miss reporting. This issue was brought to the attention of the management through some of the masters. Despite this fact, this sample of the crew who are not motivated is not compromising the safety target that the company set. The company is maintaining a minimum number of Near Miss reports from each ship, four reports per ship per month. This means the company is required to collect 4416 Near Miss reports each year, considering the 90 ships in the company. The next chapter presents the KPI for the company regarding the collected Near Miss reports. The total number of the received Near Miss reports will be compared with the company's KPI.

Another issue related to the initiative regarding Near Miss reporting is the level of the safety culture on-board the ship as one of the participants mentioned. Some of the ships are manned with Indian subcontinent crew and assigned for coastal voyages only. These ships are noted to be reporting less Near Miss Reports. After investigating further to find the reason, it was found that the management level on-board those ships are not as good as the management level on other ships. This statement from the participant reflects the result under section 5.3.5.5 of this chapter. All seafarers regardless of their qualifications, except the seafarers with Diploma or equivalent, think that the seafarers from the Indian subcontinent are struggling with communicating in English with other crewmembers. Consequently, their confidence in submitting a Near Miss report would not be as high as other seafarers from another region. Another factor behind their lower number of submitted reports is the massive workload, as the coastal voyage schedule is very tight. Thus, the coastal voyage is exhausting; the seafarers do not have the time to do all the necessary tasks and filling all the checklists effectively at the same time.

On the other hand, MSs indicated that they are receiving some good quality reports, which reflect the good understanding from the crew on-board the ships regarding the purpose of the reporting. In addition to that, some other cases have been addressed with a proper corrective action by the crew themselves. This can be represented in section 5.3.5.4, where the majority of the seafarers who participated in the questionnaire have responded positively toward "*I'm well trained to report Near Miss*". In general, MSs confirm '*we can say our crew is motivated and have the initiative to report appropriately*'.

5.3.7.2.4. Differences in Terminology

According to all of the participants, all seafarers on-board all the 90 ships know the difference between the accident, incident and the Near Miss as it is written in the company's Safety Manual System (SMS). As it is widely known, each rule has exceptional cases, whereas, some of the newly joined crew are mixing up between the accident and the incident. The reason is the borderline between them is confusing, as mentioned by one of the participants. However, with time, they will able to differentiate clearly.

In addition to all of that, the company's system has two different platforms for reporting unsafe acts. The first platform is for accidents and incidents. The other platform is specified for the Near Miss. So, each reporter is forced by the system to make up his mind and differentiate between the cases before reporting whether it was an incident or a Near Miss. By comparing the interview result with the survey result for the statement *"The terms and the terminologies used in the reporting form are not confusing and standardised"* which scores 83% on the agreement level. Then it is noticeable that the company's seafarers and the managers at the shore-based office agreed that there is no difficulty in the terminologies that related to safety issues among crew members, but this is not eliminating the idea of improving the seafarers' understanding of the different meaning of the terminologies. This is because of the recruitment of educated seafarers regardless of their different level of education. Thus, the company's seafarers are better than the seafarers at other shipping companies at the 1990s as the interviewees mentioned at the stage one of the interviews. According to one of the participants at the stage one of the interviews, the seafarers were struggling to differentiate between the meaning of accident, incident and Near Miss. Subsequently, the seafarers, according to the participants at the stage one of the interviews would be struggling to differentiate the unsafe acts and the unsafe conditions. The newly designed reporting form for Near Misses will examine the seafarers understanding of the meaning of the unsafe acts and the unsafe conditions while conducting the testing mode.

5.3.7.2.5. Corrective action by the seafarer

The participants agreed on the efficiency of the corrective actions taken by the reporters in some of the Near Miss cases. As one of the participants described that the corrective action might stop or minimise the hazard and, in some cases, avoid negative consequences (accident). Another participant claimed that the corrective action is only a corrective, and do not prevent the same occurrence from happening. In some cases, preventive action is required. This kind of preventive action is taken by the senior officers on-board the ships, after conducting a safety meeting or after receiving a recommendation from the MS. However, the strategy of the corrective and the preventive action is not the appropriate strategy. The preventive action must be taken according to the company's procedure rather than leaving the chance for the senior officer to improvise the preventive action. If this is the case, then the potential risk may still exist.

During proposing the newly designed framework and the reporting form for Near Miss, the interviewees were optimistic about having a more effective preventive action by applying the proposed work to reality as each preventive action will be well thought out at different stages before applying it. The process that is followed at the company nowadays when a Near Miss happens is demonstrated in the form of a flowchart in Figure 5-8 below.

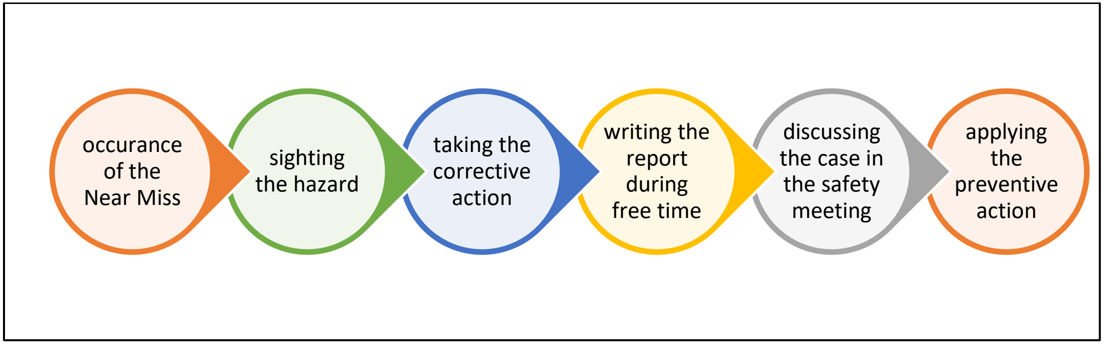


Figure 5-8 The process followed at the shipping company when Near Miss occurs

5.3.7.2.6. The anonymity of the reporter

While exploring how the company's Near Miss system works, it was noticed that they are not applying the anonymity in their reporting form. The reporter's name and the person who takes the corrective action are clearly known to the shore-based office managers as the reporter's name throughout the reporting form can be detected. With the concept of the anonymity and the no-blame culture followed at the company, such practice contradicts the anonymity principles as the reporter should be in the safe zone while reporting a Near Miss. However, after the exchange of dialogue with one of the participants and explaining the benefits of applying anonymous reporting form same as the maritime reporting system by CHIRP. The participant started to change his mind, and he mentioned the anonymity could be implemented in the company's system if there was a chance to modify to the current system. In chapter 7, full details regarding the newly designed reporting form and its efficiency in comparison with the existing one are demonstrated. The new form is anonymous in relation to the person who caused the Near Miss, who made the corrective action and who reported the case.

5.3.7.2.7. Seafarer's opinion towards NMR

According to the interviewees, crewmembers on-board the company ships are fully aware of the importance of the Near Miss reporting as it could protect the ship and the crew from certain risks. Moreover, most of the seafarer within the company believe in the reporting practice; there was no ship beyond the minimum number assigned for Near Miss reports. The reason behind this positive attitude is the high level of safety culture for the company and its ships as per the company's SCA. The MS on the company considers the number of the reports as an indication for the level of safety culture for any ship. However, in chapter 7, the quality of the Near Miss reports was examined, and the finding was that not all of the reports are presenting a high level of safety awareness or safety culture by the seafarers. Detailed analysis is presented in chapter 7.

Moreover, some of the old seafarers who are not educated enough, still think that reporting a Near Miss and filling the form is a waste of time. This sample of the crew members is representing the minorities of the seafarers and gradually will disappear with recruiting new crew with more advanced educational background, as mentioned by two of the participants.

5.3.7.2.8. The barrier to good reporting practice

Two of the participants think there are no barriers that prevent the crew members from reporting any unsafe act, once they observe it. They mentioned that no blame culture exists, and the reporting platform is open for all users. This is how the company succeeded in removing any barriers.

On the other hand, the other two participants have mentioned two different barriers. The first one is the hierarchical system of any organisation, where some of the crew members are afraid of reporting any unsafe act made by their superiors or a crew in a higher position. This phenomenon is on its way to disappear with regular recruitment of a new young generation of seafarers, as he mentioned. However, without implementing an anonymous reporting system for Near Miss, the idea of the hierarchical system will never disappear completely.

The second barrier is the language deficiency for some of the non-native English speakers. This issue affects only a minority, as the company is implementing a standardised level of English language before recruiting, as mentioned by one of the participants. However, the result of the questionnaire, which is presented in the above sections, is showing the opposite. Thus, 81% of the participants were not native English speakers, and all of them have disagreed on the effectiveness of dialoguing in English with other crewmembers from other nationalities. This issue was stressed out in the questionnaire under section 5.3.4.3 and 5.3.5.4. The seafarers who speak the common languages known in the Russian region, and English, Korean, Romanian, Spanish, Filipinos island and the Indian subcontinent are facing a language barrier with another seafarer who speaks different languages.

5.3.7.2.9. Area of improvement

When this topic was asked to the participants, two of them said our company has a very systematic way to report Near Miss, and no improvement is required as it could confuse the seafarers. Even after the comparison, they made with other systems in other companies; they insisted that this system is the best. They built up this satisfaction according to the outcome of the received reports. As they mentioned, *'our outcomes are outstanding'*.

On the other hand, the other two participants have a different opinion. One of them suggested a form with a feature of the voice recording option to save the reporter time and to record as much as details the reporter has related to the unsafe act. The fourth participant said, after seeing the proposed framework and reporting form for Near Miss, I think the anonymity of the reports would attract stronger Near Miss cases, rather than the cases that they used to collect. '*This idea never came to my mind before'*, as he mentioned. By linking his statement to the details given in chapter 7 related to the type of reports the company is collecting, a deficiency in the Near Miss reports can be identified regarding the kinds of the reports. Chapter 7 includes more details related to this matter.

If their views are compared to statement 32 under section 5.3.4.3., 54% of the respondents agreed that the reporting practice (including the reporting form) needs improvement. The same score was detected while interviewing the MS. This gives significant input to the proposed work to be accepted within the company.

5.3.7.2.10. The perception of the MS at the company towards the newly designed framework and reporting form for Near Miss

5.3.7.2.10.1. The proposed framework

The newly designed framework, which was developed according to the international standard of the Near Miss reporting in both the aviation sector and the maritime domain, was explained clearly to the participants. The explanation included the method that was carried out to reach this framework, including the recommendation taken from the participants in stage one of the interviews. Following the explanation of the proposed Near Miss Reporting framework as well as the detailed information at each step of the new reporting system and its benefits, all of the participants were very impressed and optimistic about applying such a system to the company as they never saw such a system that covers all the aspects related to NMR and the lessons learned. Their comment was fluctuated from suggestions to make the framework better to general feedback.

The flowchart begins by typing in the report into the soft copy of the reporting form by logging in to the individual account for every crewmember. Then the report will go to the Chief Officer or to the Chef engineer depending on which department the report comes from. At this stage, the feasibility of the case, the given rate and efficiency of the corrective action will be checked. Also, marking the report as anonymous for the next stage. If there was anything that needs to be corrected or to be done in a better way, the report would go back to the reporter with the recommendation to correct the wrong practice in the report. This is the first filter of checking the good practice of NMR.

Besides that, it is considered as a learning step for the crewmembers by amending the report. On the other hand, if the report was correctly carried out, then it will go to the next stage, to the Marine superintendent who is responsible for this particular ship. The Marine superintendents will send the reports to the analysis team who will carry out the second filter by conducting the evaluation of all the reports. The evaluation includes the feasibility of the case, the rating of the case, the feasibility of the corrective action, feedback to be given and recommendation for the future report and to share lessons learned. All of that will be sent to the reporter’s account on the company's dashboard. The analysis team then will broadcast important cases to the other ships within the company.

In addition to that, records of the statistical analysis and root causes will be performed and will be saved in the company's database. Then, it will be sent to the national database that receives Near Misses reports from all shipping companies within the region. The national database will carry out one more analysis, then share the learned lessons to all companies and all ships.

In a nutshell, the new flowchart is ensuring a good practice for the NMR by educating the reporter on how to report properly. Also, it provides the seafarers with the opportunity to take more effective corrective action by receiving a recommendation from the Marine superintendents. Finally, the lessons learned will be shared among a broader range of stakeholders to benefit all seafarers in the region. Figure *5-9* below is showing the flowchart for the new Near Miss system that was proposed to the shipping company.

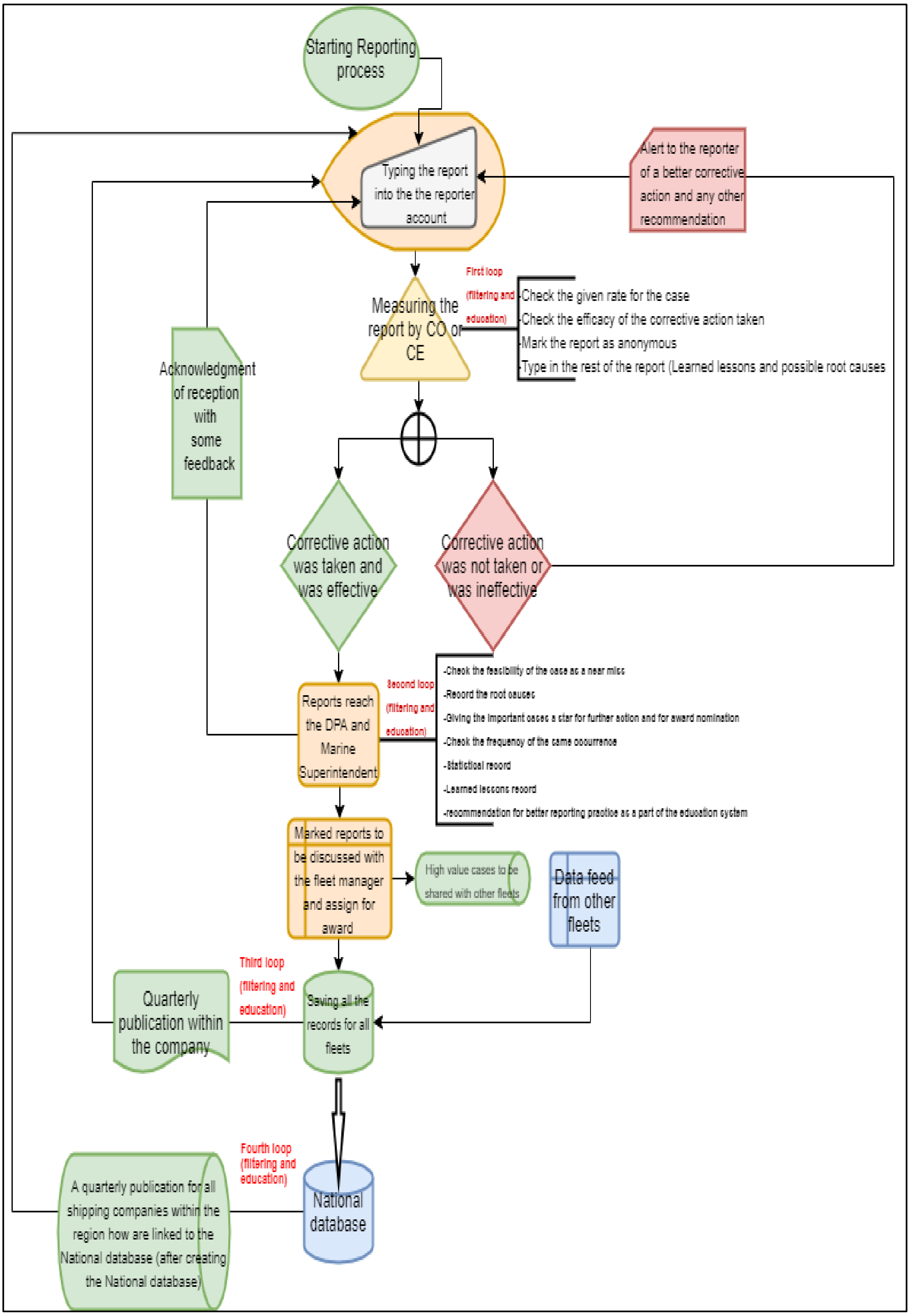


Figure 5-9 Newly designed NMR framework

One of the participants said this model seems to be very complicated, as there is no national Near Miss platform in the Gulf Cooperation Council (GCC) area. Even if the platform existed, the decision-makers in the company might not choose to participate and share their data with other companies. However, the participant claimed that he could convince the decision-makers in the company by explaining the benefit of learning from other mistakes is valuable to the company. Besides, '*seeing that other companies' level of safety culture is healthy, so we have to improve our company's level or at least we can observe where we are compared to other companies with regard to the safety culture level'*, as he argued. The participant has mentioned that the anonymity of the NMR will encourage the seafarers to report more Near Misses that contain more critical cases as the seafarers will not fear of being blamed or punished. This gives the author a clear indication of how important to maintain the anonymity of the reports as it builds the foundations of the Just Culture.

The other participant commented about the framework by mentioning the difficulty of sending feedback to each report, as each MS has at least eight ships, and the company's target is four reports per ship per month. Therefore, the total minimum number of received reports is thirty-two reports per month. If the MS is required to write a feedback for each one by mentioning the language, categorisation and understating the given rate mistakes, then the MS will face great work pressure. For this reason, the participant suggested sending one general feedback at the end of the month to each ship. By then, the number of written feedbacks will be eight letters, one for each ship. The feedback includes the wrong practice and good practice as well. Besides, announcing the best-reported case as a winner, this will be seen as motivation, learning opportunity and acknowledgement to the reporters.

The third participant admired the idea of predicting the accident before happening by categorising and recording the root causes in the databank. This will give the Captain of each ship a perception of what kind of accidents might occur if a specific sequence of event happened on-board his ship. By this way, he could prevent and eliminate those events through a series of measures to avoid an accident as he mentioned. Table 5-28 below summarises the strengths and the weaknesses of the newly designed framework for NMR according to the participants' points of view. Such evaluation is useful to improve the framework and make it ready for implementation by the shipping companies.

Table 5-28 strengths and weakness of the newly designed framework for NMR, according to the MS feedback

Strengths of the newly designed framework of NMR
• Accessing the other companies Near Miss data will allow the shipping company to evaluate their level of reporting culture and safety. • Accessing the other companies Near Miss data will allow the shipping company to take lessons learned from other shipping companies' NMR. • Predicting the accident before happening by recording the root causes in the company's databank. • The anonymity of the NMR will encourage more reports with more critical cases.
Weaknesses of the newly designed framework of NMR
• It is difficult to send an acknowledgement and feedback to each NMR.

5.3.7.2.10.2. The reporting forms

The new reporting form was designed by taking into account the needs of the crew members and the staff at the shore-based office. The time saving, anonymity and the kind of information that needs to be processed by the analysis team were considered as the key indicators while creating the new form. The first draft of the form was given very positive feedback in comparison to the existing form used by the company. During the field trip, the form was positively evaluated by the interviewees while some amendments were implemented after the feedback. Another opinion was taken from the crew members (the users) themselves during the testing mode as it will be shown in chapter seven. Generally, the outcome included some recommendations which are not feasible, such as the company's logo and some other technical issues that could be fixed by the IT department. Some other recommendations were mentioned that need to be addressed by the shore-based staff, such as preventive measures.

The new reporting form after the modifications consists of static information which would be acquired automatically, such as the ship's name and the type. The other kind of data is the dynamic information which needs to be entered by the reporter manually, such as the ship's location, cargo compartment statues, operation type etc. The last part of the reporting form is the description of the case with some details. The figure below shows how the form looks like exactly.

Ship's Name		Ship's Location	☐At sea ☐On berth ☐Anchor area ☐Dry dock ☐N/A	Operation Type	☐Loading ☐Discharging ☐Loading and Discharging ☐Maintenance ☐Measuring toxic gases ☐Inerting ☐COW ☐Piloting ☐STS ☐SPM ☐Pollution control ☐Tank cleaning ☐Purging ☐Gas freeing
Ship's Type	☐Chemical tanker ☐Oil Tanker ☐RORO ship (multi purposes) ☐Dry bulk	Cargo compartments status	☐Fully loaded ☐partly loaded ☐Ship is on ballast condition	Date of the Near Miss	Click or tap to enter a date. ☐Unsafe Act ☐Unsafe Condition
In case of another vessel was involved in the event, Give the name of the other vessel				Time of the Near Miss	
Type of the Near Miss	☐ Accident ☐ Incident ☐Near miss				
Near Miss Rate *(depending on how much it might cost*)*	☐Low ☐Medium ☐High ☐Very High				
Underlaying Root causes for the Near Miss *(tick more than one if applicable)*	☐Carelessness ☐Tools Deficiency ☐Equipment Failure ☐Failure to Comply with Procedure ☐Failure to use PPE ☐Housekeeping ☐Incorrect use of Equipment ☐Lack of maintenance ☐Lack of Competency ☐Failure to use LSA				
Potential Consequences of the Near Miss *(tick more than one if applicable)*	☐Damage to the Property ☐Damage to the Environment ☐Fire / Explosion ☐General Hazard to the Ship ☐Injury / Fatality ☐Navigational Hazard				
Near Miss Description					
Immediate Corrective Action					
Class for the Near Miss	☐ability, skills, knowledge of the people involved ☐personality (mental condition, emotional state) ☐physical condition (medical fitness, fatigue, use of alcohol or drugs) ☐activities prior to the accident/occurrence ☐assigned duties at the time of accident/occurrence ☐actual behaviour at time of accident/occurrence ☐attitude ☐division of tasks and responsibilities ☐composition of the crew (competence/nationality) ☐workload (both overload and underload)/complexity of tasks ☐work hours/rest hours ☐procedures and standing orders communication (internal and external) ☐on board management and supervision ☐organisation of on-board training and drills ☐teamwork ☐planning of work ☐level of automation ☐ergonomics of equipment and the working environment ☐adequacy of living conditions ☐adequacy of food ☐opportunities for recreations ☐vibrations, heat, noise ship motion ☐design ☐state of maintenance (not maintained, badly maintained) ☐equipment (availability, reliability) ☐cargo characteristics, including securing, handling and care ☐policy on recruitment ☐safety policy and philosophy ☐management commitment to safety ☐scheduling of leave periods ☐general management ☐assignment of duties ☐ship-shore communication ☐weather and sea conditions ☐Port and transit conditions (VTS, pilots etc.) ☐traffic density ☐ice conditions ☐regulations, survey and inspections				
Lessons Learned from the Near Miss					

*If the Unsafe act leads to potential damage of (250.000 US$ and more = Very High), (100.000 US$ and more = High), (10.000 US$ and more = medium) and (insignificant damage or estimated by less than 10.000 US$ = LOW).

Figure 5-10 newly designed reporting form for Near Miss

Proposing the new reporting form for Near Miss was the last thing during the interview with company managers. The comments on the form from the participants were very positive with some recommendations for modifications. The recommendations were considered, as it would improve the quality of the reporting as well as the practicality. The recommendations of the participants were given below.

- The option that says in case of other ship was involved in the event. To be rewritten in the following form to include any third party was involved. (In case of other ship or a third party such as (pilot) involved in the case, give the name of the ship or the job title of the third party).
- Under the option of operation type, it will include: At sea, Ballasting, DE ballasting, Gas freeing, pollution control and measuring toxic gases.
- The potential consequences and the lessons learned to be filled by the Master during the validation process. Because it is too advanced for low rating crew to fill in that information due to their relatively narrow experience, additionally, if the low rating is able to write this section, this will be an indication of the high level of competency.

In general, two of the participants were satisfied with the new reporting form. As they said, this form is very advanced, and it would give an excellent result. They praised the option of the potential consequences and the drop-down lists, which will save a massive time for the reporters. The last participant thinks that the current reporting form is easy to use, and the crew are familiar with it.

After considering these recommendations, the new reporting form was distributed to all ships within the company. The expected return is to get at least 90 reports, one report from each ship on average. The feedback from the crew members is valuable as well. Chapter 7 will demonstrate the seafarers' opinion toward the new reporting form.

5.3.8. Chapter summary and Conclusion

One of the shipping companies in the GCC area has cooperated with the researcher to conduct this case study. The questionnaire survey was distributed to the company's employees. The analysis was conducted in a way to study the human factors and to identify the weak points that are related to the Near Miss reporting practice. The results have highlighted significant outcomes. The general level of the reporting culture among the seafarers at the shipping company requires improvement according to the reporting culture survey conducted. Particularly, the crew from the Indian subcontinent need to improve their safety culture and their commitment toward the NMR significantly. Another issue is the Filipino seafarers who have some difficulties in communicating in English with other seafarers who speak other languages. According to the interview results, the reporting system for Near Miss needs some improvement, as well according to the interview results. Consequently, the current system for NMR at the shipping company was studied and found to be not as effective, whereas no anonymity is followed, and the seafarers are not taking lessons learned via one-way NMR framework. However, the shipping company is required to enhance its safety culture level by implementing an effective NMR system and improving the seafarers' English language skills by enforcing some training courses. Accordingly, the key personnel at the company have accepted the proposed framework for Near Miss in principle. The next chapter will present a comparison of the company's KPI and the acquired results, including possible consequences.

6. Assessment of Key Performance Indicators (KPIs).

6.1. Chapter Overview

Most of the complicated organisations keep recording their Key Performance Indicators (KPI) in order to make their operation more resilient and to improve their performance accordingly. The shipping companies, which come under the Marine industry's umbrella, are one of the most critical domains, and they need to monitor and record their KPIs. Consequently, they need to implement intervention strategies to address the organisational challenges after utilising and analysing the KPIs.

This chapter presents analyses of the safety-related KPIs that were collected from the company, then exploring the relationship between the KPIs and the Near Miss reporting practice within the company. Subsequently, the areas that need attention will be stressed out based on the correlation between the KPI and the NMR Assessment obtained from the statistical analyses. Therefore, the areas of improvement will be much visible to make the company's safety culture even better.

6.2. Introduction

All shipping companies are required to maintain the adaptation of the international safety Management (ISM) which was introduced by the IMO in the late 1990s (IMO, 2019b). The general aim of the ISM code is to provide an adequate level of operational safety for the maritime industry. Thus, the shipping companies are required to keep records of the Performance Indicators, including the KPIs, which also can be called the leading indicators for the accidents (OCIMF, 1997), as the leading indicators can be utilised to predict accident before happening (Grabowski *et al.*, 2007). The leading KPIs are beneficial for taking a proactive measure and predict a potential accident before happening. In this way, the shipping companies will have a tool to measure their safety culture level by comparing their KPIs with the standardised shipping KPIs (Rialland *et al.*, 2014). Therefore, shipping companies are required to identify which KPIs to record with the aim of trying to identify the areas that need improvement. Consequently, the organisation that keeps a close eye on the KPIs will achieve continuous improvement with safety.

After further screening the collected KPIs from the shipping company that was chosen for the research as a case study, it was found out that some of the KPIs were introduced in 2016; such as the total number of findings during Port State Control inspection. This may suggest that the company found KPIs introduced earlier were beneficial for the company, but not enough to measure the safety performance, as the managers in the shipping company have noticed a deficiency in the safety performance after recording high rate of Port State Control (PSC) inspections through the years as shown in Figure 6-9. That is why the company has introduced some more KPIs to capture the necessary information for the company's safety resilience regarding the high number of PSC inspections, such as the number of PSC inspections with findings and number of finding during PSC inspections. Those two KPIs were suggested by BIMCO (2018), as they have a compulsory list of KPIs that are related to the environment, health and safety, navigational accidents, HR, security, technical, operation and inspections. Yet, according to the author's knowledge, the shipping company does not manage to record all the KPIs that were listed by BIMCO. Therefore, the shipping company is required to update its KPI database according to the higher international standard. Otherwise, its safety performance cannot be compared against the highly-rated shipping companies.

The result of the case study in relation to the KPIs will be demonstrated in this chapter using the following format:

1. Descriptive analysis of the KPI trends.
2. KPIs vs KPIs correlation.

3. NMR culture assessment vs KPIs correlation.

6.3. KPIs trend and descriptive analysis for the shipping company

This section of the analyses describes the trend of the KPIs within the company as well as showing the performance of some of the safety aspects from 2013 to 2017. The company managed to record eighteen different KPIs, which is way behind the set of KPIs that was introduced by different organisations such as BIMCO and Lloyd's Register, as mentioned earlier in chapter three, critical review. The following KPIs are covered in this section with details regarding the trends.

1. Lost Time Injury Frequency (LTIF).
2. Total Recordable Cases Frequency (TRCF).
3. Number of first aid cases (FAC).
4. Number of navigational accidents.
5. Number of incidents.
6. Number of Near Miss Report (NMR).
7. Percentage of feedback for the (NMR).
8. Number of Port State Control inspection.
9. Number of deficiencies during Port State Control inspection.
10. Number of inspections by Port State Control with deficiency.
11. Number of Internal Audit (ISM) non-conformities findings.
12. Number of External Audit (ISM) non-conformities findings.
13. Number of safety inspection per annum by the marine superintendent.
14. Number of findings by the Superintendent during visits.
15. Number of safety meeting.

16. Number of safety bulletins distributed.
17. Number of newsletters distributed.
18. Number of days without accidents.

The company has records of its KPIs for the period from 2013 to 2017. It was collected in the middle of 2018. This period is enough to give an indication of the company's safety performance.

6.3.1. Lost Time Injury Frequency (LTIF)

LTIF is the number of lost time injuries occurring in a workplace per 1 million hours worked.

$$LTIF = \frac{(\text{FAT+PTD+LWC}) * 1{,}000{,}000}{\text{number of exposure (working) hours in the last year}} \qquad \text{(Eq 6.1)}$$

The factors that play a role in the LTIF are the Number of Fatalities (FAT), Number of Permanent Total Disabilities (PTD) and Number of Lost Workday cases (LWC). The company needs to make sure those factors are at their minimum level to reach near-zero LTIF rate. Thus, the highly-rated shipping companies are recording LTIF rate not exceeding 0.7 LTIF per million working hours, as it will be shown below.

The recorded LTIF for the company indicates a fluctuated trend rate, as Figure 6-1 below shows. The first year had the lowest rate of LTIF, and since then the rate has been increasing. This indicates possibly a non-satisfactory investment in safety as the company is required to monitor and decrease the numbers of PTD, FAT and LWC. Those factors can be maintained by implementing a more effective NMR reporting system to avoid the occurrences of those events. Thus, the safety performance of the company is not acceptable compared with the benchmark of the LTIF rate for other competitive shipping companies. If the shipping company continued to record a fluctuated LTIF rate without a continuous decrease in the trend of the LTIF, then the company is expected to record a significant number of deficiencies during any inspection. Subsequently, the shipping company's fleet might be in danger to be detained at some ports.

The benchmark of Shell oil tankers fleet is fluctuating between 0.2 and 0.4 LTIF per Million-man Hours (SHELL, 2019). In addition to that, Wilhelmsen (2017) has published the LTIF rate for the ships under its management. The rate was fluctuating between 0.35 and 0.67 Million-man Hours. It is noticeable that the shipping company is still required more efforts to enhance its safety performance to decrease the LTIF rate to match the acceptable benchmark of the other competitors.

According to a study which has been conducted in a similar field by Arslan (2018), any shipping company with a high level of safety culture should score a near-zero rate of LTIF. The result he obtained for a confidential shipping company was fluctuating between 0.46 and 0 LTIF Million-man Hours. By comparing the result of this shipping company with Arslan's results, it is noticeable that this company is working under the minimum level of safety culture, and they need to improve their safety performance significantly.

The company is required to give extra attention to the LTIF as it is a significant indication of the safety performance for any industry. The expectation was very high to see a reduction over the years in the LTIF rate as the company is rated highly during their safety culture assessment that had been carried out in cooperation with a classification society.

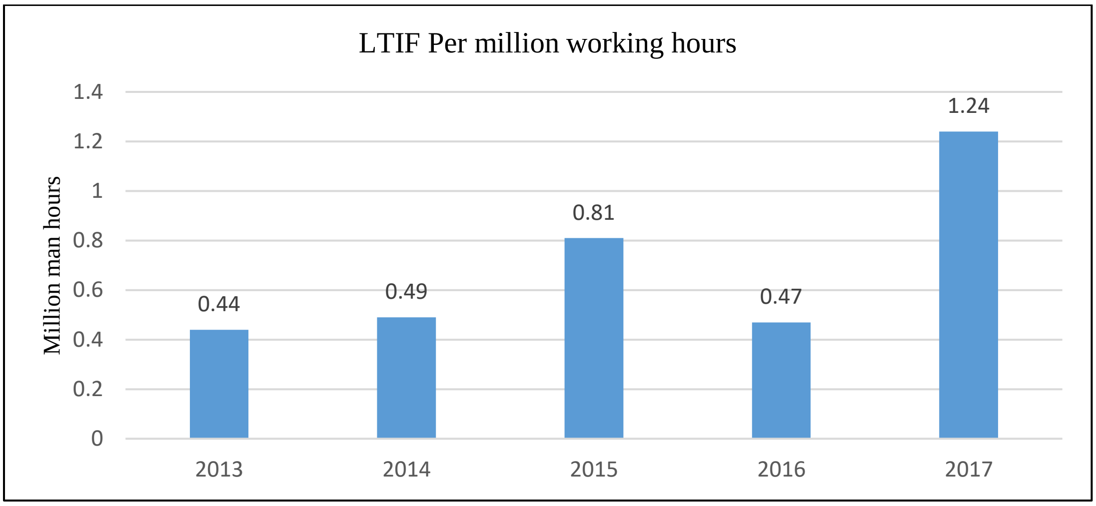


Figure 6-1 LTIF

6.3.2. Total Recordable Cases Frequency (TRCF)

TRCF is the sum of all work-related fatality, lost time injuries (LTIs), restricted work cases/injuries (RWCs) and medical treatment cases/injuries (MTCs) multiply by million hours then divided by man-hours.

$$TRCF = \frac{(\text{LTI}+\text{RWC}+\text{MTC}) * 1{,}000{,}000\text{hrs}}{\text{man}-\text{hours}} \qquad \text{(Eq 6.2)}$$

The company has recorded the TRCF for the past five years, and they have failed to achieve a rate close to zero. The fluctuation of the trend as shown in Figure 6-2 below is not promising despite the fact that the senior managers at the company are investing in the improvement of the safety culture which does not pay off. The number of LTI, RWC and MTC needs to go to the minimum. A similar study was conducted by Arslan (2018), a high level of safety culture can be detected from the TRCF and the LTIF rate. His result gave the author an indication on how to estimate if any shipping company is having a high level of safety culture or not. TRCF rate for a confidential shipping company was fluctuating between 1.5 and 0.17 Million-man Hours. Moreover, SHELL (2019) has published the TRCF rate for its fleet for the period from

2010 to 2019, the maximum rate was recorded in 2012, and it was1.3 Million-man Hours. Afterwards, the rate was decreasing to reach 0.8 Million-man Hours. By comparing those result with TRCF rate for the shipping company, an indication of the huge amount of efforts that need to be carried out to enhance the safety is noticeable.

Unfortunately, the company data, which was utilised in this study, reflect deficiencies in the overall safety culture in general, including the deficiency in applying and utilising the NMR system. It is required to investigate the high rate of the TRCF and find a solution. The solution needs to focus on the injuries that happing to the seafarers and its root causes. Eliminating the root causes is the primary solution to have safer fleets and higher safety for the whole organisation. The figure below shows the trend of TRCF. The acceptable TRCF rate for a decent shipping company needs to be near to zero.

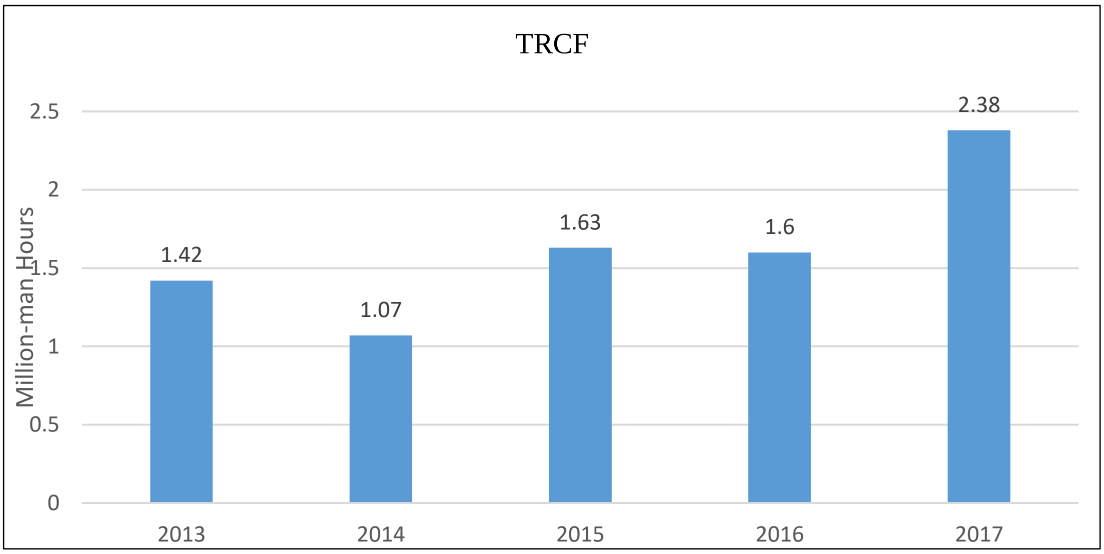


Figure 6-2 TRCF

6.3.3. Number of first aids cases (FAC)

Minor work-related injuries that require simple first-aid treatment come under this category. OCIMF (1997) has described FAC "*as any one-time treatment and subsequent observation or* *minor injuries such as bruises, scratches, cuts, burns, splinters, etc. The first aid may or may not be administered by a physician or registered professional".* The increase of the FAC is an indication of the none-compliance with safety procedure by seafarers and a low level of safety culture. By looking into Figure 6-3 below and considering the number of the FAC cases in 2016, which was 42 cases, on average, 3.5 FAC cases occurred per month. This number is relatively high comparing to the first two years. The reduction of FAC in the last year 2017 may be due to the increase in the number of safety meeting and the number of NMR, as it will be shown in the following sections.

It is clearly shown that the FAC result of this shipping company is far behind in relation to the other companies' FAC results as Arslan (2018) has obtained in his study. Therefore, Arslan has collected FAC cases numbers for nine years, the last five years in which he has noticed a steady reduction on the number of the FAC cases, which are stated as twenty as a maximum and eight as the minimum. However, the cooperated shipping company in this research has failed to maintain a steady reduction over the years. On the contrary, the shipping company has recorded the maximum number of FAC in 2016. This gives an indication that the shipping company is required to implement a proactive measure to develop a resilient safety system to reduce the overall number of FAC in the future.

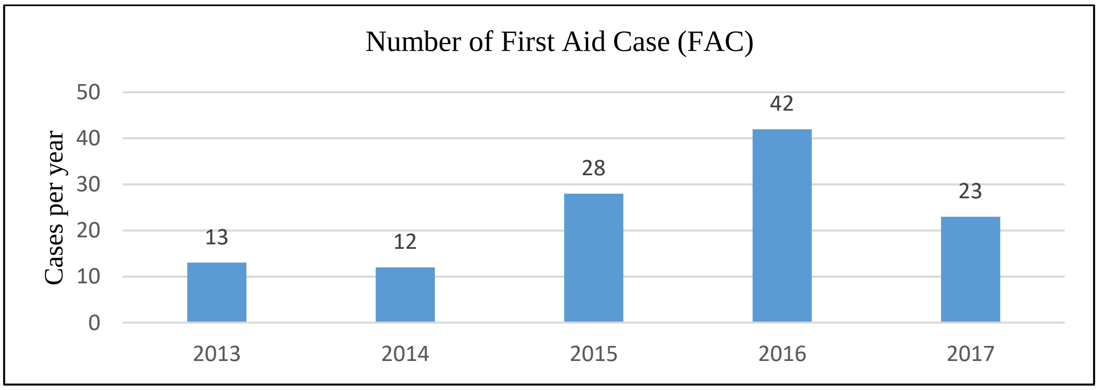


Figure 6-3 Number of FAC

6.3.4. Number of Navigational Accidents

This category relates to the event that includes steering failure, propulsion failure, navigational equipment failure, collision, grounding, or any other failure related to navigational practice. The trend for this category was almost steady during the five years, except for the second year, as shown in Figure 6-4 below. The rate of the navigational accidents recorded in the second year was more than double the rate recorded in the last three years. By considering the total number of ships at the company, which is 90 ships, then the rate of the navigational accidents in 2014 is 0.088, and in 2015, 2016 and 2017 the rate was constant at 0.033. A more detailed investigation was carried out to identify the types of accidents that occurred and which types of ship were involved during the past five years. Oil tankers and Bulk carriers were involved in a collision, Allison, touch bottom, Steering failure and Tug contact. The Multi purposes vessels, which carry RORO goods and containers were free from any accident during the five years. This means the safety culture and the maintenance procedure is higher in the Multi purposes fleet. The other fleets need to adopt the high-quality safety culture of the Multi purposes fleet to mitigate the accidents as much as they can until they reach zero accident rate per year. It is advisable that the shipping company should standardise the qualifications and the capabilities of the fleets' managers to match the practice of the Multi purposes fleet. Subsequently, the good practice will impact positively on the seafarers as well. The author has tried to identify the type of accidents in relation to the ship type. Unfortunately, the shipping company did not provide those details for their own reasons.

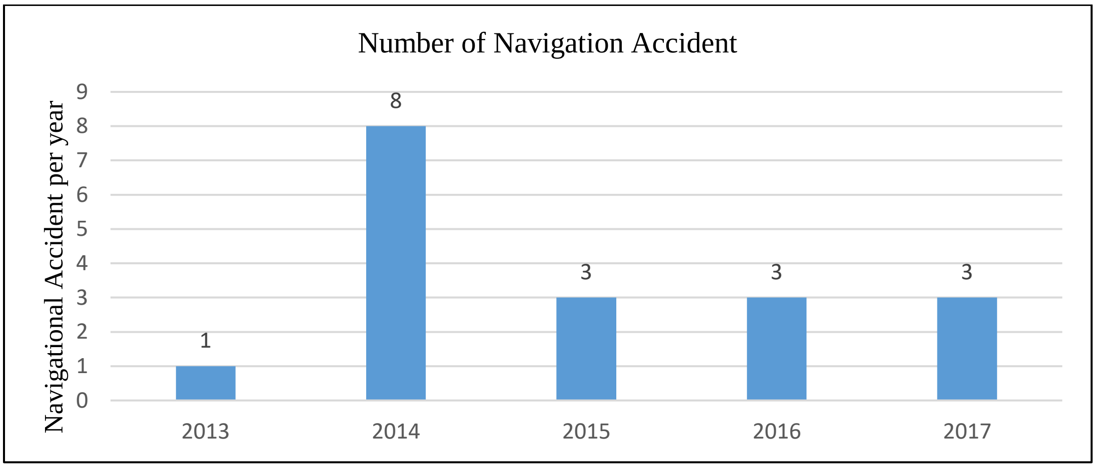


Figure 6-4 Number of navigational accidents

6.3.5. Number of Incidents

One of the KPIs that the company used to record is the number of incidents per year. The ideal situation is to find a zero-incident rate in each year. However, we are not living in the ideal world yet. The company has noticed an increase in the number of incidents in the first three years, as shown in Figure 6-5 below. Then the peak dropped again. Even with the drop, the number of incidents in each year still considered a high number compared with the number of incidents per ship per year in the UK as mentioned in the MAIB (2018) whereas, MAIB recorded 1.86 incidents per ship per year in 2015, and the shipping company has recorded 2.066 incidents per ship per year in the same year.

Another deficiency with accidents is that the shipping company did not categorise and classify the incidents. Thus, the company failed to identify which kind of incidents are occurring and on what types of ships. Consequently, over the years, the company will find it difficult to contain those incidents and to track its root causes to eliminate them. Thus, it is highly essential for the shipping company to record those incidents along with its conditions and categorise them. The categorisation is according to the types of ships that were involved in incidents and underlying causes of the incident, whether it is a human error, manufacturing errors or improper design and installations. Moreover, classifying the incidents according to its potential safety consequences as mentioned by Wang (2006b) is essential as the incidents with high-risk safety potential should be given a priority in the analysis. On the other hand, the potential low-risk safety to be rated as low priority. Subsequently, the shipping company will be able to capture which fleet has the most incident rate and has been rated as a high potential risk and what kind of incident has the most frequency rate. By following this method of recording the incidents, the shipping company will improve the weak area by enhancing the resilience among the ships with a high rate of incidents, along with its management.

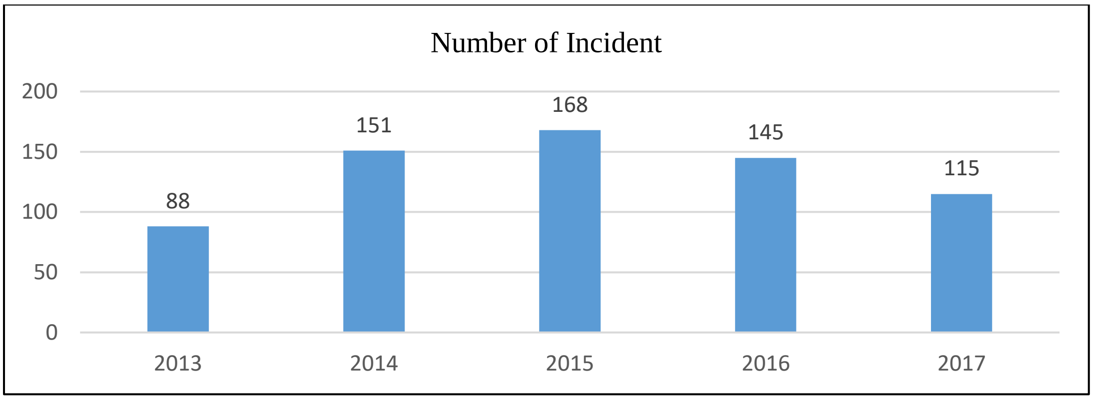


Figure 6-5 Number of incidents

6.3.6. Number of Near Miss Report (NMR)

An event or chain of events that could potentially lead to an accident, injury, damage to the property or the environment or even fatality under specific circumstances come under this category. The company has been aware of the importance of this kind of reports, and they have encouraged all the seafarers within the company through the safety meetings, and other means of motivations such as award prize for best NMR to report as many safety-related issues as possible. In Figure 6-6 below we can see the increase of the NMR from year to year. Bearing in mind that only nine vessels were added to the company's fleet in 2014, the effort by the company explains the significant jump in the number of Near Miss reports from 2013 to 2014, and the positive response by the seafarers toward the encouragement. After that, the fleet number has remained the same, 90 ships, and the increase in NMR has still continued. This is a valuable indication that the crew have been aware of the importance of the NMR and trying to achieve the company's goal, which is four reports per ship per month resulting in 4416 reports per year. The company succeeded to collect this number in 2017. Keeping this number, the same in the next year's NMR means staying on the same track. However, the quality of the report is more important than the quantity. This comes down to how the marine superintendents analyse the reports and classify the feasibility of each case. Unfortunately, the company does not have such a system to identify high-quality reports from low quality.

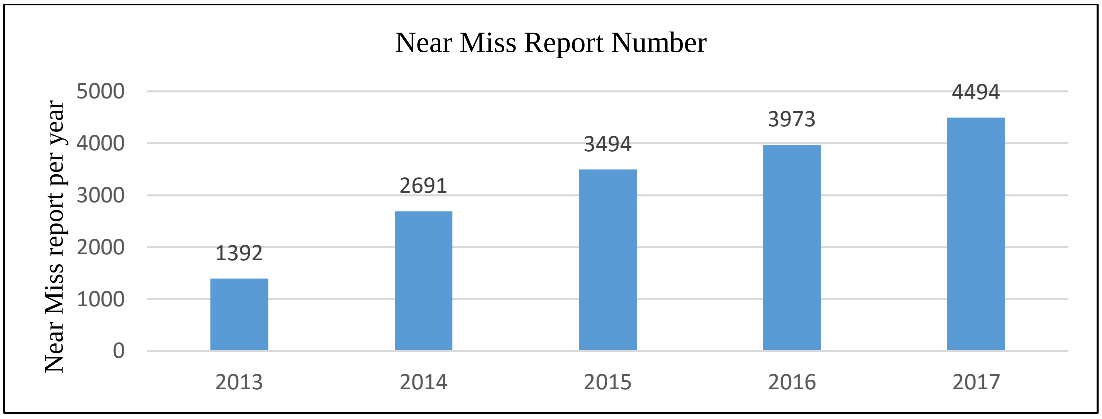


Figure 6-6 Number of NMR

After knowing the number of the Navigational Accident, Incident and the Near Miss in each year from 2013 to 2017, then the ratio between them for each year can be calculated. The ratio will be compared with the ratio of the Accident to the Incident and to the Near Miss that was given by (Storgård *et al.*, 2012), which is 1:29:300 respectively. the shipping company has successfully achieved a better ratio than the Storgård's claim, except in 2014. The ratio of the Navigational Accident to the Incident to the Near Miss at the shipping company is as follow; 2013 (1:88:1392), 2014 (1:19:375), 2015 (1:56:1164), 2016 (1:48:1324) and in 2017

(1:38:1498). Thus, the shipping company has improved her safety performance significantly after 2014 by encouraging the seafarers to report Near Misses as much as they can.

What if the NMR system was anonymous and ensure the implementation of the just culture by enhancing the trust between the employees and the managers at the shore-based office? Then, the author would expect more critical, real and not repeated cases to be reported to the shore-based office. Subsequently, each Navigational accident will be requiring more than 1498 Near Miss to occur, as this number of Near Misses is the highest number recorded during the five years of the KPIs. Moreover, the seafarers will find a perfect platform to take more accurate lessons learned via the new NMR system.

Figure *6-7* below shows the percentage of NMRs that include unsafe conditions and unsafe acts. The main purpose of the NMR System is to highlight the unsafe act in the first place and take corrective actions. According to the 189 randomly taken samples that were collected from the company for the period from 2016 to 2019, the percentage of the unsafe act reports was 61%, which is more than the unsafe condition, and considered to be a positive indication, as the Near Miss reporting aims to capture the unsafe acts which formed in Near Misses. However, after examining the 115 unsafe act reports, it was found out that some of the hazardous acts were identified as repeated cases, as shown in Figure 6-8 below. For instance, the occurrences of not using the proper PPE was 22% among the collected token sample of the NMR.

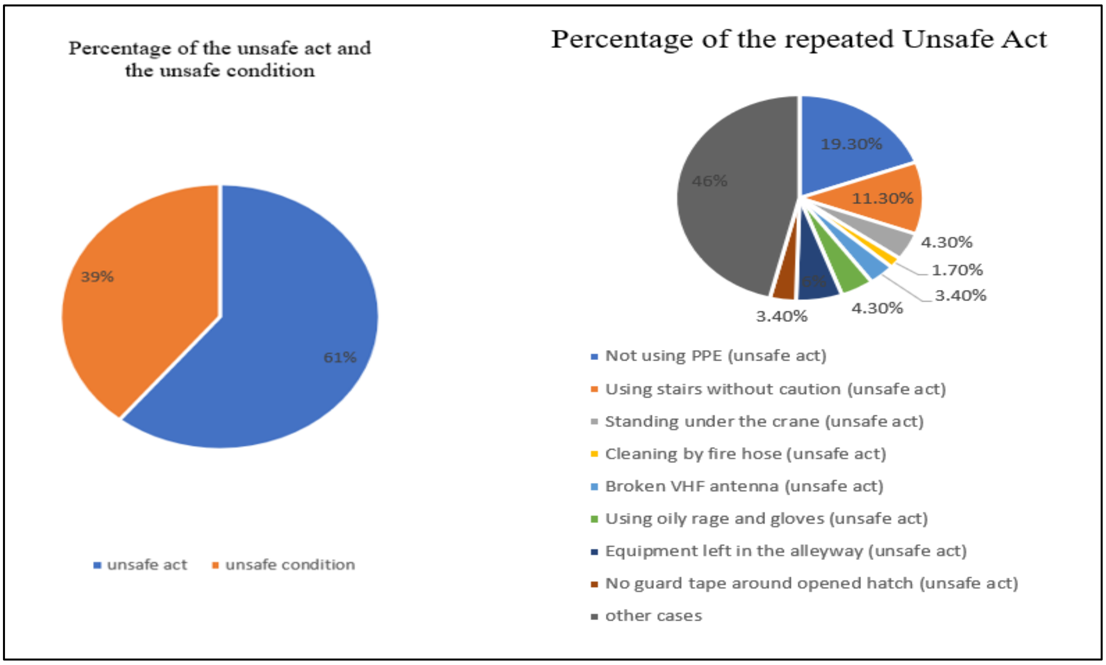


Figure 6-7 Percentage of the repeated Unsafe Act, Unsafe condition and Repeated cases

The below Table *6-1* below shows the repeated cases. This leads to the one fact; neither the seafarers learn from the Near Misses nor take advantage of the distributed safety bulletins. The main aim of the NMR is not achieved in the company, whereas the reporting system was applied to mitigate the frequency of the same occurrences. Moreover, NMR is aimed to give the seafarers a learning opportunity not to repeat the same occurrences by understanding its consequences and its root causes.

In a nutshell, NMR system is to report an unsafe act that needs corrective action and give learned lessons to the seafarers in the future to avoid similar action. Unfortunately, this aim has not achieved.

Table 6-1 Breakdown of the unsafe act reports

Breakdown of the repeated unsafe act reports									
Total number of the unsafe act	Not using PPE (unsafe act)	Using stairs without caution (unsafe act)	Standing under the crane (unsafe act)	Cleaning by fire hose (unsafe act)	Broken VHF antenna (unsafe act)	Using oily rage and gloves (unsafe act)	Equipment left in the alleyway (unsafe act)	No guard tape around opened hatch	Other cases
115	22	13	5	2	4	5	7	4	53

It is remarkable that crew members have kept ignoring the correct practice of using the PPE. Seafarers are ignoring their own safety; which means their safety culture level is below the expected level. They are expected to take lessons learned from the safety newsletters and bulletins that meant to educate crew members on safety-related issues. The management part of educating and increasing the awareness for the seafarers lies in introducing the importance of the proper usage of the PPE. This part is the responsibility of the Marine superintendents during their visits to the ships. However, these efforts have not paid off, as the case of ignoring using PPE is still occurring at high frequency. Table *6-2* below provides the meanings for each NMR case.

Table 6-2 Meaning of the repeated Near Miss cases

Not using PPE	It includes all the cases that describe the wrong use or not using the PPE.
Using stairs without caution	It includes all the cases that describe the using of the stairs without holding the rails or not asking for help while carrying heavy equipment.

Standing under the crane	It includes all the cases where some of the crew were standing under crane while in the operational condition.
Cleaning by a fire hose	It includes all the cases when the crew use the fire hose for cleaning purposes.
Broken VHF antenna	It includes all the cases when the crew use a VHF with a broken antenna near to cargo tank, enclosed spaces or even inside the accommodation.
Using oily rage and gloves	It includes all the cases when the crew conduct some task that could initiate a fire using an oily rage or gloves.
Equipment left in the alleyway	It includes all the cases when the crew left some of the equipment in the alleyway.
No guard tape around opened the hatch	It includes all the cases when the crew open a hatch or find a broken step in the stairs or ladders and not using the guard tape.

6.3.7. Percentage of feedback towards the (NMR)

Figure 6-8 below demonstrates the percentage of the feedback given by the shore-based staff to the crew with regards to the NMR. The result shows that 100% of NMR had received feedback during the five years. Yet, during the interview with the MS, the marine Superintendents have said the generated feedback to the ship's personnel is not direct feedback to their Near Miss reports. However, the company is distributing safety newsletters that include all the valuable Near Miss and best Near Miss of the month. The newsletters are also including some recommendations for better corrective actions and the lessons learned. Therefore, the only meaning for this category is the feedback that was distributed throughout the crew using the safety bulletins and the newspaper. The feedback written in these publications contains no details, and therefore, the reporter will not discern from those articles any matter concerning his wrong or good reporting practice. in this way better to provide direct feedback to the reporter himself via the Near Miss reporting dashboard that is used for reporting. Therefore, the reporter would know that the management pays attention and values his feedback, including the feasibility of his corrective actions. In the end, before marking the report as a closed case, the recommendation should be available to the reporter on how he might enhance his reporting practice for a better outcome. Unfortunately, none of the reporting systems that were introduced in the critical review is following the method of providing direct feedback to the reporter as all the systems that were investigated are not individual systems. However, the new reporting framework, which was proposed during the interview with the key personnel was including the new practice of directing feedback to the reporters. In principle, the idea was accepted by the participants in the interviews and seemed to be feasible. The direct feedback to the reporter will play a significant role in educating the seafarers about their reporting mistakes. Subsequently, the seafarers will gain better understating and higher safety performance.

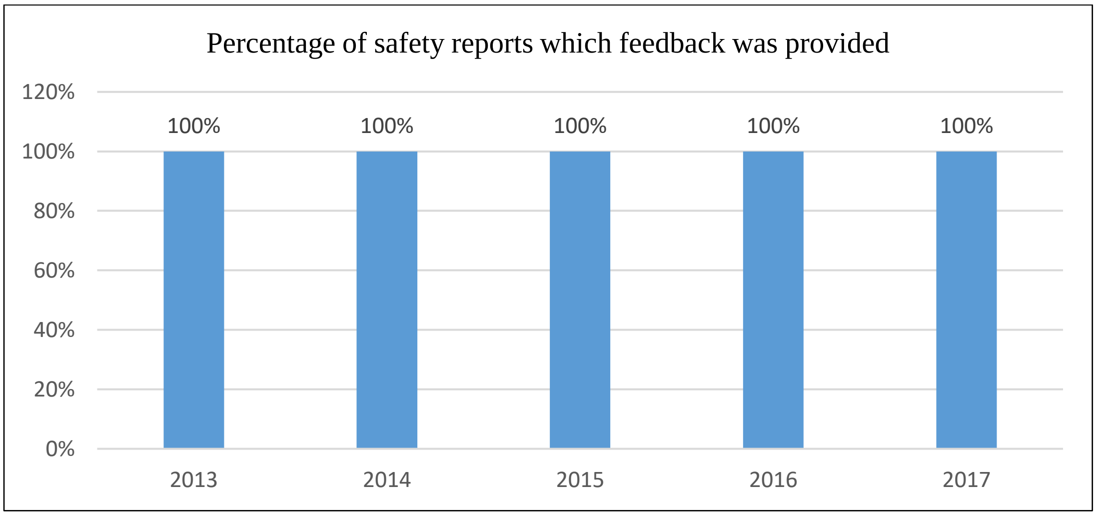


Figure 6-8 Percentage of feedback toward NMR

6.3.8. Number of Port State Control inspection

Port State Control inspection is performed by a member of the port state control to check the validity of the ship's certificates and documents, and to make sure that the ship is complying with all the regulations that come under the IMO such as the SOLAS, MARPOL, STCW, overall condition of the ship, its equipment and the crew qualifications (IMO, 2019c). Figure 6-9 shows the number of inspections by port state control increased for the first four years; then slightly decreased in 2017. According to Rodríguez and Piniella (2012), high-risk ships have been inspected by PSC every 5-6 months from the last inspection (twice a year). Standard risk ships are required inspection by the PSC every 10-12 months from the last inspection. Low-risk ships are required inspection by PSC every 24-36 months from the previous inspection. Knowing that the shipping company has 90 ships and recorded 175 inspections in 2016, this gives an indication that most of the ships were inspected twice in 2016. therefore, more than half of the company's fleet is treated as high-risk ships. This is a negative indication for the company as it may lose its reputation, and some of the vessels might be detained by the port state control. This is a valid concern to address as most of the ports that the company vessels are calling are highly important ports, and their safety standards are relatively high.

For this reason, the company started to record the number of PSC inspections with deficiencies, and the number of deficiencies found by PSC in the last two years as it will be shown in the next two sections. The data presented indicate 35 out of 175 inspections resulted in non-compliance with the conventions and regulations in 2016. Furthermore, the number of safety issue findings from the 35 inspections is 78. Unfortunately, the types of safety issue findings were not provided to the author by the shipping company for their own reasons. The database of the Paris MOU and Tokyo MOU have been accessed to capture the type of deficiencies. However, no detailed information was available to the public. The collected data from the company does not mention how many ships were marked with deficiencies by the

PSC, and the types of the deficiencies. Thus, the company is required to share this kind of information to allow the author to analyse them more effectively so that those deficiencies can be addressed in a pro-active manner.

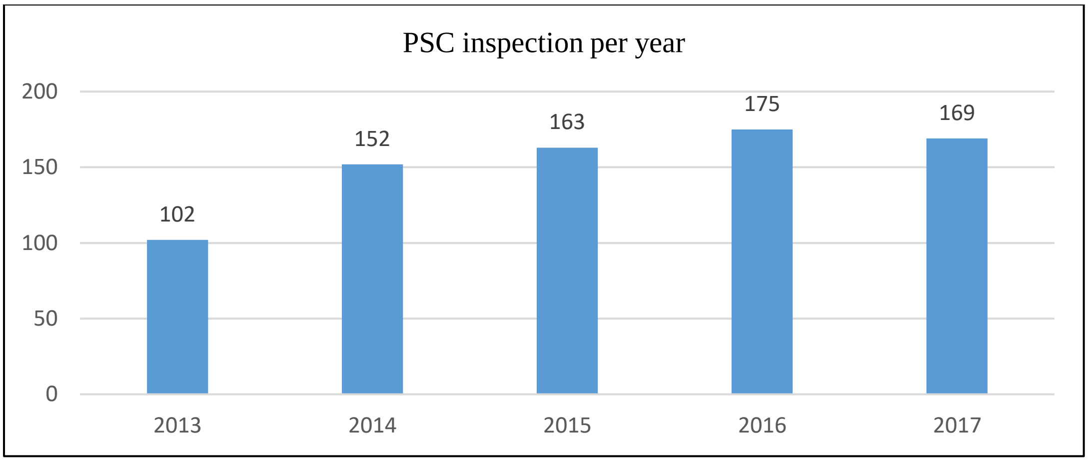


Figure 6-9 Number of PSC inspection

6.3.9. Total number of findings during Port State Control inspection

This category includes the number of port state control inspections that have findings (deficiencies) as far as regulatory compliance is concerned; such as non-compliance, discrepancy or deviation from the requirement of the relevant instruments/conventions on a vessel identified by port state control. This relatively high number of findings during the inspections by the PSC was expected, as the shipping company has recorded three Navigational Accident and high number of Incident in 2016 and 2017. Those unfortunate occurrences have happened as a result of non-compliance or deviation from the requirements.

The company started to record these figures in 2016 after they found the number of PSC inspection is higher than the expected numbers, as shown in Figure 6-10. The company is required to keep monitoring the compliance of the ships with the conventions and the requirement of the safe instrument to minimise the number of the deficiencies, then the number of PSC inspection with deficiencies will be less, consequently resulting in less PSC inspections in the medium term. The figure below shows the trend for the last two years about the total number of deficiencies during the PSC inspection. It is noticeable that after stressing the number of deficiencies founded by the PSC in 2016, the number has decreased in the following year. This is a good indication that the company started to invest in improving the safety level. However, the reduction is not drastic, and more effort is required to bring the deficiencies further down.

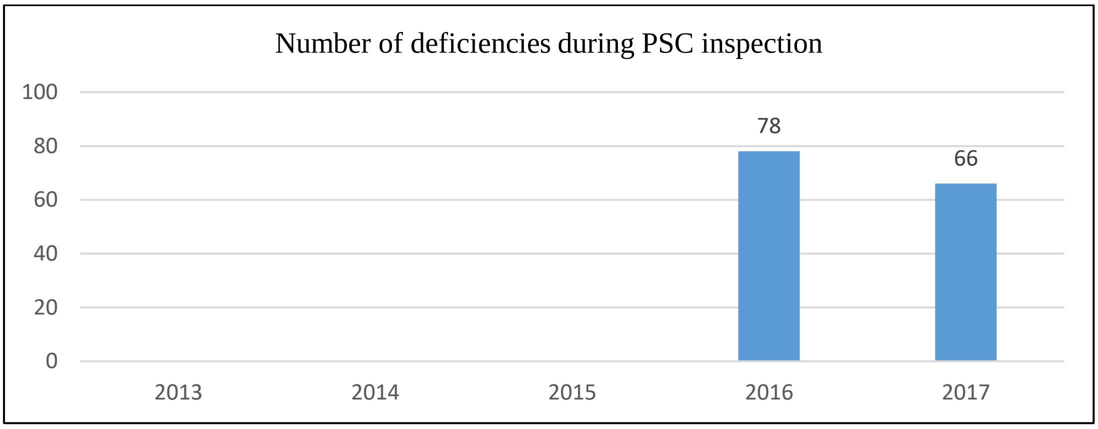


Figure 6-10 Total number of finding by the PSC

6.3.10. Number of PSC inspection with findings

This category includes the number of inspections by the PSC that resulted in finding some safety-related issues and non-compliance with the regulations and the conventions. As we see in

Figure 6-11 below, the number of inspections with finding in 2016 was 35 out of 175 inspections. Then this number dropped to 30 findings out of 169 inspections. The table 6-1 also shows further analysis of the inspections and the number of deficiencies to measure the

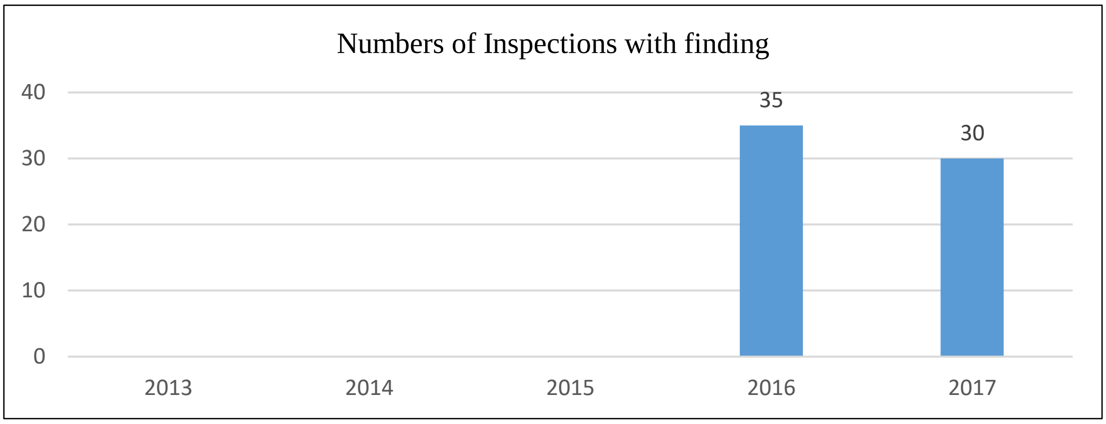


Figure 6-11 Number of inspections with findings

actual improvement.

Table 6-3 PSC significant ratios

year	Total number of PSC inspection	Total number of inspections with finding	Total number of finding	The ratio of the number of inspections with findings to the number of inspections	The ratio of the number of findings to the number of inspections with findings

2016	175	35	78	35/175 = 0.2	78/35 = 2.28
2017	169	30	66	30/169 = 0.18	66/30 = 2.2

Table *6-3* above shows the ratio of the number of inspections with findings to the number of inspections, the ratio of the number of findings to the number of inspections and the ratio of the number of findings to the number of inspections with findings. Unfortunately, the company has failed to improve its performance regarding the compliance with the conventions and the regulations according to the number of findings by the PSC Inspections. Therefore, it can be seen that the number of inspections, inspection with findings and the total number of finding and the ratio between one to another is almost steady in the two years 2016 and 2017. The result in the table can also be interpreted as follows:

- 20% of the total number of inspections by the PSC has resulted in finding in 2016, and 18% in 2017
- In average, 2.28 findings have resulted in each inspection with finding in 2016 and 2.2 findings in 2017.

The company is required to put in extra effort to solve this issue to keep her reputation at par with other world-wide oil tankers companies. The increase of the NMR numbers throughout the five years is meant to increase safety level and consequently, the reduction in the number of PSC inspection and findings.

Unfortunately, this is not the case in this company. This gives an indication that the crew members are reporting Near Misses just to fulfil the company's requirement of keeping the minimum number of reports without paying any attention to the quality and the nature of the reports and subsequent actions (if taken). Instead of that, the seafarers possible are reporting not genuine Near Miss cases. This also indicates that they do not understand the idea behind reporting Near Misses.

The logic behind the NMR is to identify more unsafe acts affecting the safety, take corrective action, learn from NMRs to improve the company's performance to prevent deficiencies and incidents/accidents effectively. Then, the most important thing is to increase the level of safety culture and resilience, which is supposed to reduce the number of PSC inspections and findings.

6.3.11. Number of non-conformities finding during Internal Audit (ISM)

Firstly, the definition of non-conformity needs to be addressed. It means an observed situation where objective evidence indicates the non-fulfilment of a specified requirement of the ISM code. By understanding the meaning, then this category includes all non-conformities identified by an internal audit, which is arranged by the company. The Safety Inspection is designed to inspect the application of international maritime safety and the environmental protection regulations by the vessels' crew. In addition to that, as per the ISM code, the internal audit needs to be carried out one month in advance before the anniversary for each ship from the date of its launching (Novaveritas, 2019). In some cases, due to the ship operation and location, the audit might be delayed up to three months. Figure 6-12 below shows the total number of findings during internal audits each year. As it is noticeable the number is within the acceptable number whereas, on average the company is expected 90 visits a year. This gives almost one finding per visit on average if we consider that some ships had a delayed internal audit in 2016 to the next three months, which resulted in being in 2017 due to the scheduling issues. Thus, the number of finding is considered as an acceptable number. This gives an indication that the Internal Audit is not as strict as the PSC inspections. According to the author's experience as a seafarer, the crew members of any ship usually prepare for their safety audits, all the safety checklists and documentation before the Internal Audit. Therefore, the auditor finds all the procedures and the ISM requirements are in compliance without deficiencies. This is the reason behind the acceptable number of findings.

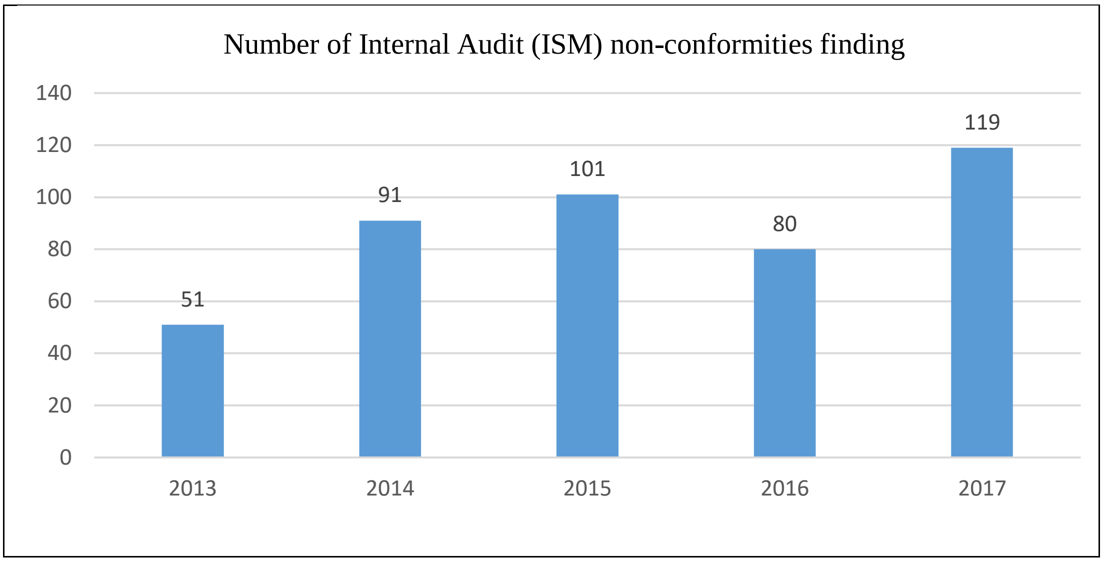


Figure 6-12 Number of internal audit findings

6.3.12. Number of non-conformities findings during External Audit (ISM)

The external audit is an arranged visit from the flag state to the company to go through the company's procedures and safety manuals. They also may conduct a drill on-board one of the company's vessel to evaluate the seafarers' response toward the simulated emergency. This category includes all non-conformities observed during the external audit. Figure *6*-13 below shows the trend during the five years. It is observed that there was an increase in the first two years. Then a tremendous drop for the following three years. This improvement must have happened as a result of the successful internal audits effort as the seafarers learned how to deal with this kind of audits by keeping every single detail about the safety issues recorded in an appropriate logbook. Thus, the external audit found that all the records are organised, and the

Figure 6-13 Number of finding during the external audit level of safety has increased. As a result, fewer findings were found during the external audit. Moreover, the company possibly used learned lessons from the years 2013 and 2014 and were more prepared for external audits. This kind of improvement is expected from a company that keeps recording its KPIs seeking of safety improvement.

Linking the number of finding by the internal audit, external audit and PSC we can understand that the PSC inspection is extraordinary by implementing a stricter safety regime to make sure the ISM is applied correctly on each ship. Unfortunately. PSC finding is way more thorough than the audits, which mean there is a failure in applying the ISM correctly by the seafarers. Moreover, the external auditor who is conducting the audit is possibly not as experienced or thorough as the inspector from the PSC. Thus, the classification society which conducts the External Audit must deal with the Auditing strictly and justly, as the more finding will help in enhancing the shipping company safety performance and keep the reputation of the classification society.

By investigating the three different types of inspections along with their findings, we can see the difference in the number of findings from each type of inspection. The variation is significant, and this is the reason why this topic required deserved attention. The external audit findings are almost zero in the last three years. The seafarers and the company know the timing and schedule of the external audit, and the audit is done by a classification society that was chosen by the company itself. This gives us an indication that the seafarers are very prepared for this audit by showing the auditor their best practice and implementation to the regulations and conventions. However, during the internal audit, it is the company's and the masters' benefits to highlight some of the safety-related issues. Thus, in the next audit, those safety-related issues will be improved and passed issues.

Regarding the third type of inspection, which is by the PSC, it supposed to be fair and does not rely on any kind of compliments. The number of safety-related issues under this kind of inspection does not match the number of finding under the Internal or the External audit. Moreover, the number of the finding by the PSC started to be recorded in the last two years only after according to the highest number of inspections by the PSC as it mentioned in Figure 6-9. The resulted outcome from investigating those numbers of findings. We can see that the company does not implement or improve the safety culture of its seafarers as one would like to see. They are trying to apply and comply with the safety procedure temporarily whenever they felt themselves under the spot of some sort of inspection. Such a deviation in findings between the external audits and the PSC inspections reflect that there is a significant room to improve in terms of how ISM is implemented and more importantly, the maturity of safety culture.

If they were implementing a proper safety culture in a mature way, then, the seafarers will be potentially complying with the safety regulation and the conventions without breach. Thus, the trend of the number of the finding by the PSC and the two types of the audit will be decreasing in parallel with the increase of the number of NMR.

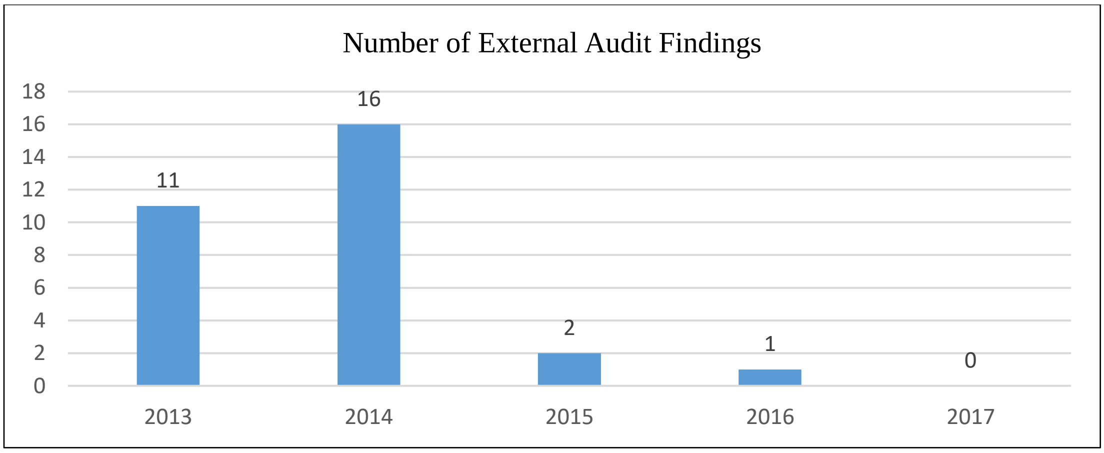


Figure 6-13 Number of External Audits Finding

6.3.13. Number of safety inspection by the Marine superintendent

This category includes the total number of safety inspection performed by the marine superintendent. The company's requirement for the number of the marine superintendent is a visit every time the ship berths at her home port (port of the registration of the ship), and not less than two visits per year. Therefore, the company is required to record at least 180 visits each year. However, the total number of visits in 2013, 2014 and 2015 was less than 180 visits. Unfortunately, the total number of the company's ship at that period is not accessible.

It is observed that the number is increasing during the five years. Figure 6-14 below shows the exact number of inspections each year. The jump from year one to year two is due to the increase in the vessel numbers within the company. In general, the trend is moving up through the five years period. The number of the visit has increased as a result of the increase in the number of NMR, FAC and the occurrences of navigational accidents. Thus, the company has succeeded in maintaining the minimum number of visits in 2016 and 2017. The more visits conducted by the marine superintendent, the more issues found and solved before the PSC inspection. Subsequently leads to fewer safety issues found by the PSC. Moreover, the external audit process will be affected positively, and the number of findings is going to be less. The company is required to pay more attention and scheduling more visits to the ships by the marine superintendents, as it will encourage the seafarers to indulge with the ISM code requirement and motivate them to report more Near Misses. The result will reflect on the enhancement of the safety culture and increasing the resilience gradually for the shipping company.

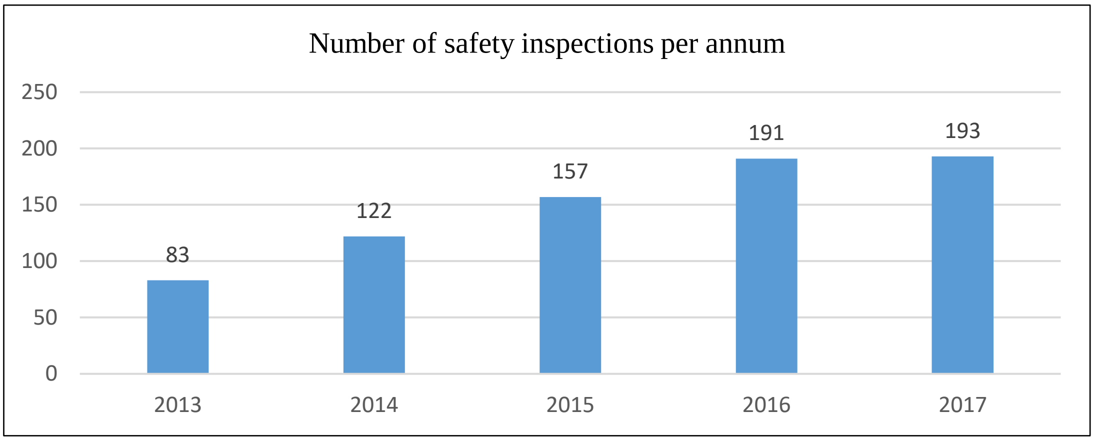


Figure 6-14 Number of safety inspection by MS

6.3.14. Number of issues identified during Marine Superintendents' visits

The graph below is demonstrating the total number of safety issues that were found during the marine superintendents' visits. According to Figure 6-15 below, the total number of visits was increasing from year to year. Consequently, the number of issues found would increase, as well. Except for the year 2015, the safety issues found was less than the year before. This could be a result of the high number of findings during the internal audit. Thus, all safety-related issue was addressed in the year 2015 before the visit by the marine superintendent.

Regarding the last two years, the number of findings during Marine Superintendents' visits has increased drastically. The increase is logical, as the number of the PSC inspection was increased as well. At that point, the marine superintendents decided to increase their inspection criteria to make it stricter. Thus, more findings will be addressed and solved. Subsequently, the PSC number of findings will decrease gradually. And this is what happened in the year 2017. The number of findings by the PSC was less in 2017 than the findings in 2016 as a result of the effort done by the marine superintendents' visits.

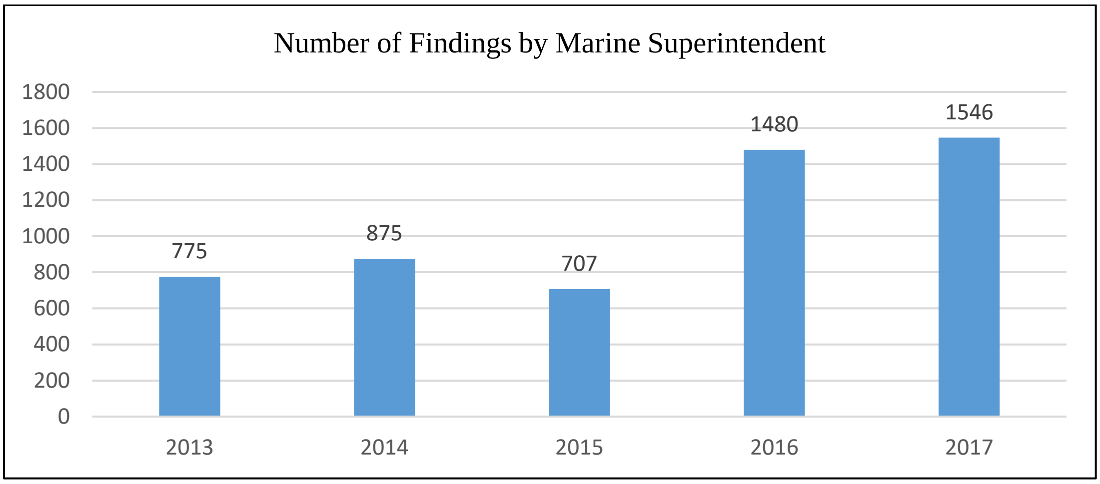


Figure 6-15 Number of finding during Marine Superintendents' visits

6.3.15. Number of the safety committee meetings

This category includes the total number of safety meetings that are held on-board the company vessels per year. By looking at some of the previous figures like the Figure 6-3 and Figure 6-6 at the beginning of this chapter, it is logical to expect an increase in the total number of the safety meetings. Safety meetings are designed to discuss the Near Misses and any other safety-related issues occurred on-board the ship. However, the ratio of the increase is not steady, and this is normal. As the number of vessels increased in 2014, the number of NMRs and the FACs are not constant either. However, as per the company's HSE manual, the safety meeting is required to be conducted once a month, with a primary aim of identifying, minimising and controlling the hazards created during daily routine work on-board ships. By considering the total number of ships, which stands currently at 90. Then the number of safety meetings should be 1080 per year. Unfortunately, the company did not meet this requirement, as identified in Figure 6-16 below. The Masters, Chief Officer and Chief Engineer must put extra attention to include the safety meetings on their monthly agenda. The more commitment by the master and chief engineer to have safety meetings will impact positively on the rest of the crew with regards to safety. Thus, the company is required to encourage more safety meetings to be conducted to eliminate the possibility of latent conditions, which might lead to active failure.

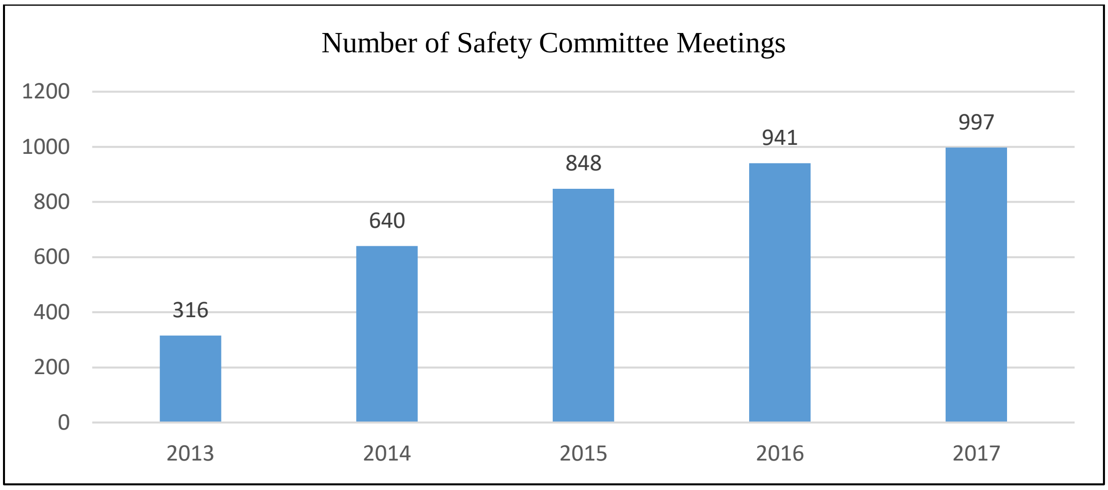


Figure 6-16 Number of on-board safety meeting

6.3.16. Number of safety bulletins and newspaper distributed

The company was publishing safety bulletins only between 2013 and 2016. Then they started to introduce safety newsletter in quarterly bases in 2017, in addition to the safety bulletins. However, safety bulletins were not regulated in term of the minimum number per year as it is noticeable in the graph below. By looking into the number of the bulletins in Figure 6-17 below it is noticeable there is no pattern to maintain odd or even number of the safety bulletins, whereas, the number of safety bulletins is an odd number in years 2014, 2015 and 2016, an average of two publications a month. Regarding the years 2013 and 2017, the number of safety bulletins was an even number. Whereas, the company had distributed two publications a month in 2013 and on average, 2.67 publications a month in 2017. The figure is also indicating that the shipping company has just started to publish a newsletter on quarterly bases in 2017, which match the criteria of CHIRP publications.

The unregulated number of safety bulletins would give the seafarers an indication of the low importance of that kind of safety publications. Therefore, no attention would be given by the seafarers upon receiving the bulletins. The company could keep publishing the same publications to educate the crew and improve its safety culture but in a regulated frequency. Thus, the crewmembers will be expecting a new edition each month or so. Moreover, during the on-board safety meeting, they might discuss the highlighted contents in the latest version, rather than leaving the bulletins on the desk at the ship's office.

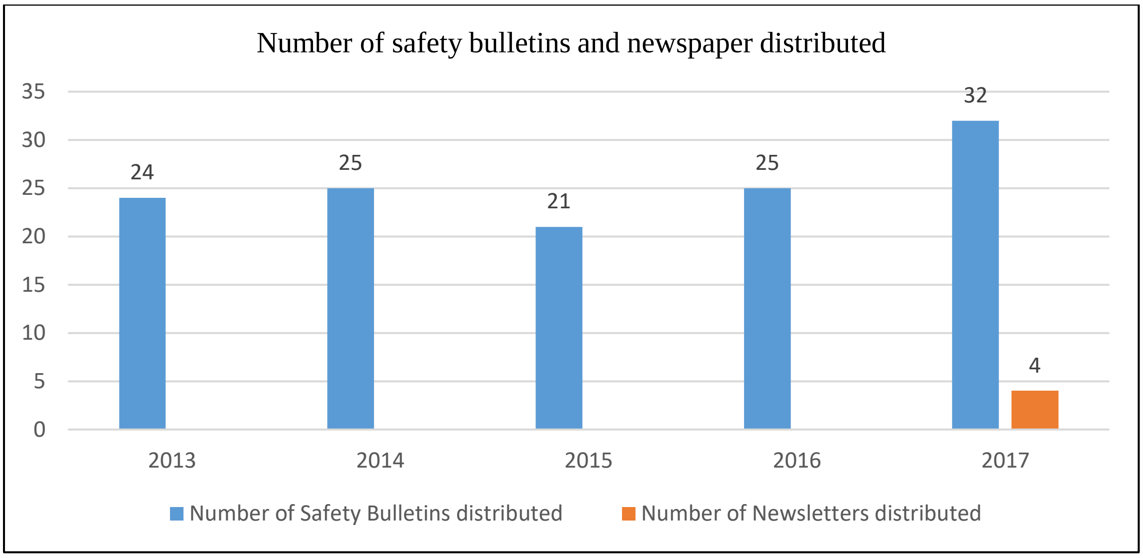


Figure 6-17 Number of safety bulletins and newsletters

6.3.17. number of days without an accident

The number of days without an accident was recorded by the company for each individual ship. Unfortunately, most of the ships were grouped under the range of days from 0 to 365 days as Figure *6-18* below shows. Then the trend was decreasing to be five ships under the range of up to 4 years and above. A company with a high level of safety culture and a well-known reputation in the shipping industry must have an opposite figure, whereas, most of the ships to be under the group of up to 4 years and above. A similar study has been conducted by Arslan (2018) show the accident-free days for a confidential shipping company per year, as the correct way of recording the accident-free days is to calculate how many days per year is free form accidents. Unfortunately, the shipping company was recording their accident-free days differently. Thus, the comparison between the shipping company accident-free days with another study is not feasible Arslan's results indicate a high level of safety performance among the shipping company, as they managed to record an average number of days without accident 350 days each year in the last three years of the collected data.

The five ships that succeeded to reach four years and above without accidents, and the 49 ships that grouped under the group 9 (up to 1 year) are from different fleet types, under different fleets' managements and operated by different crews from various nationalities. This is an indication on widely varying competency and the efficacy in the company to comply with the safety regulations and the ISM code by the seafarers themselves and the kind of education the masters obtained regardless of the fleet managers' vision. Thus, the personal efforts of any ship's crew and master is the main reason behind maintaining a high number of days without an accident, not a standardised company's procedures. Therefore, the fleet managers must study and evaluate the crew's safety performance and behaviour which work on-board ships with a high number of accident-free days to generalise their safety practice to other ships. By then, the company's fleets safety culture and resilience will rise to a new level.

The author of this project was aiming to compare the shipping company's result with regard to the accident-free days with another competitive shipping company. Unluckily, there was no resource available to compare with. After searching in the Shipping KPI Standard by (BIMCO, 2018), the author has noticed that the accident-free days were not listed as one of the suggested KPIs. This could be the reason behind not recording the accident-free days by other shipping companies.

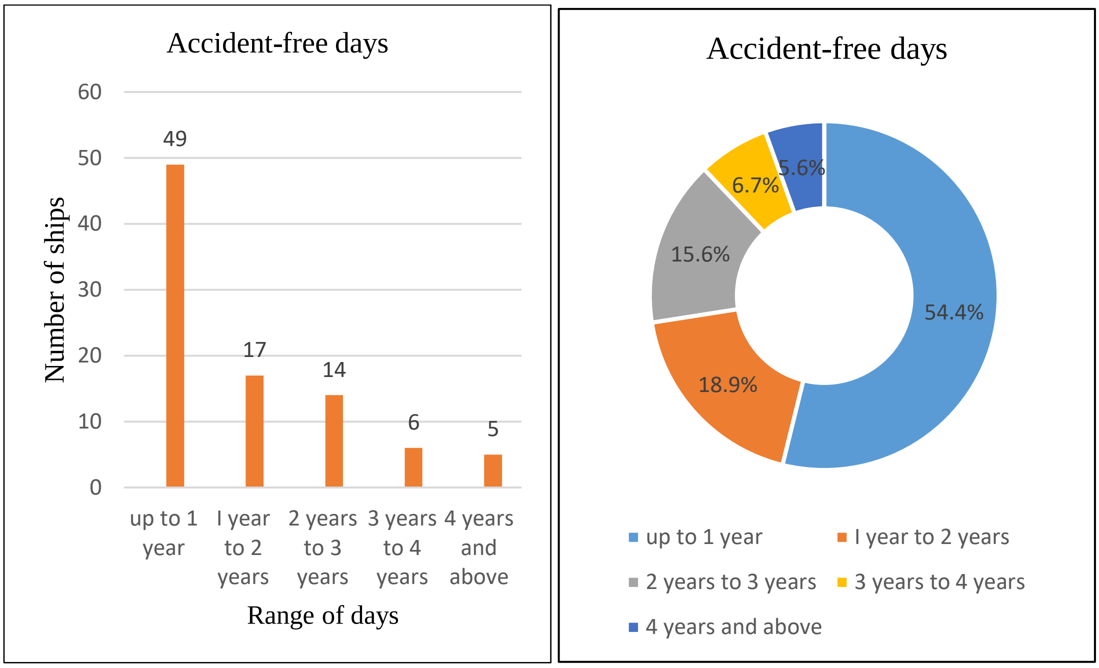


Figure 6-18 Accident free days

6.4. KPIs correlation

Correlation for KPIs aims to identify positive and negative relations between the company's KPIs. It is important to improve the areas that affect the other areas positively as it will improve the company's safety performance towards achieving the highest safety culture and resilience.

This section demonstrates the correlation process for the KPI data using the SPSS software. The spearman's r test was utilised to run the correlation for each KPI with other KPIs as the collected KPI data was non-parametric. It is expected that the results from this correlation test will give a statistical indication of the importance of improving the existing Near Miss reporting system within the company.

The tables below include the correlation coefficient which fluctuates between -1 and 1 as the closest to -1 represents a strong negative correlation between the two KPIs. And the closest to 1 represents a strong positive correlation between the two KPIs. The tables also include the significance level of the correlation. In some cases, if the data sample size is not enough, the correlation coefficient will show a strong positive or negative relationship. But the significance level will show no significance in that particular result. The reason is the sample is considerably small and cannot be correlated with other KPIs without a bigger sample size. Therefore, the PSC inspection deficiencies and PSC inspection findings will be disregarded due to the insufficient sample size.

6.4.1. Significant correlation matrix for the company's KPIs

The tables below show the considerable correlation matrix between the shipping company's KPIs and include the matrix that has a significant result and result at the borderline between the significance and non-significance. The reason behind the inclusion of the results at borderline before the significance level is, they will give an indication of a significant result in the future if the trend has changed slightly. The correlation tables are marked by a colour code. The green code is representing the positively significant result, and the red colour is representing the negatively significant result. The result at the boundaries and non-significant will be marked by yellow colour code for the positive result and amber colour code for the negative results. The complete correlation table for the whole KPIs will be presented in Appendix I. The key KPIs that were correlated with other KPIs are:

1. Lost Time Injury Frequency (LTIF).
2. Total Recordable Cases Frequency (TRCF).
3. Number of Near Miss Report (NMR).
4. Number of Port State Control inspection.
5. Number of Internal Audit (ISM) non-conformities.
6. Number of External Audit (ISM) non-conformities findings.

7. Number of safety inspection per annum by the marine superintendent.

8. Number of safety meeting.

The next section is demonstrating and discussing each of the KPIs and their correlation results.

6.4.1.1. LTIF and TRCF correlation result

A positive correlation was identified during the test between the LTIF and the TRCF, as shown in Table 6-4 and Table 6-5 below. This result is a logical one and expected, as both LTIF and TRCF are dependants on the fatality or the injury rate that caused by accidents or incidents. A positive correlation between the LTIF and the TRCF was also identified among the fleet of Shell Shipping company SHELL (2019) and the fleet under the management of the Wilhelmsen (Wilhelmsen, 2017). Thus, the shipping company is required to invest more in reducing accident and incident rate by enhancing the shipping safety and resilience to cope with any irregular circumstances. Subsequently, the leading factors of the TRCF and LTIF will be reduced, which will result positively on the rate of the TRCF and LTIF.

LTIF was also found another positive correlation with the number of the findings by the Internal auditors as shown in Table 6-4. The correlation is at the borderline before the significance level, which means the reduction of the number of the Internal Auditors findings could lead to the reduction of the LTIF rate. Thus, the shipping company is required to pay extra attention to the Findings by the Internal Auditors and investigate them along with its root causes to solve those findings. Subsequently, those finding will not occur again, and the rate of the LTIF is expected to be reduced by then.

TRCF has been found to be almost negatively correlated with the number of findings during the External Audit, as shown in Table 6-5. By looking at Figure 6-2, it will be noticed that the number of the findings is very low in the last three years, which indicates a poor inspection by the External Auditor. The number of findings does not match the number of findings during the PSC Inspection and the Internal Audit. Therefore, if the External Auditor had performed a better inspection and recorded more findings, then the shipping company will investigate them and solve its root causes before they are detected by PSC. Subsequently, the TRCF rate will decrease. It is advisable that the shipping company choose and instruct a Classification Society carefully which inspects properly and justly to address the contradiction between PSC findings and external auditor findings, as those findings help the shipping company to enhance its safety performance by capturing more deficiencies and solving them.

Table 6-4 LTIF correlation results

KPI 1	KPI 2	Correlation	Correlation coefficient	Sig level
LTIF	TRCF	Positive	0.889*	0.043
	Internal Audit Findings	Positive	0.837***	0.077

***. Correlation is significant at the 0.05 level (2-tailed).**
****. Correlation is significant at the 0.01 level (2-tailed).**
*****. Correlation at the borderline at the (0.06-0.09) 2-tailed.**

Table 6-5 TRCF correlation results

KPI 1	KPI 2	Correlation	Correlation coefficient	Sig level
TRCF	LTIF	Positive	0.889*	0.043
	External Audit findings	Negative	-0.807	0.099

***. Correlation is significant at the 0.05 level (2-tailed).**
****. Correlation is significant at the 0.01 level (2-tailed).**
*****. Correlation at the borderline at the (0.06-0.09) 2-tailed.**

6.4.1.2. Number of NMR correlation result

Number of NMR has positive correlations with the number of PSC Inspection, Number of findings during the Internal Audit, number of safety inspection by MS and the number of on-board safety meetings, as Table *6-6* below shows.

Table *6-6* indicates that the number of NMR has a positive correlation with the number of Safety Inspection conducted by PSC, which is contradictory to the expectations. This means that the number of PSC inspections has been still increasing despite all the efforts the company has put in regarding the number of Near Miss reports and the safety. If the trend keeps continuing in this way, then the company's reputation among the ports will be affected negatively. There is an indirect relation between the PSC inspections and the NMR, as the PSC inspectors report their observations/findings during their visits. If the marine superintendent visits and the on-board safety meetings were conducted at higher standards, the safety issues would be addressed at that level. Naturally, by the time, when the PSC inspections take place (PSC inspections are random and unannounced), all safety points would be complying with the international requirements. Subsequently, the trend of the number of the PSC findings should decrease as their inspections are meant to investigate whether the ships, along with its equipment, are complying with the international requirements or not. This will lead to less PSC inspections as the PSC inspection reports are shared between countries through Port State MOUs such as Paris MOU and Tokyo MOU etc.

According to the PSC practice, some ships are categorised as high-risk vessels (Blacklist), and some ships are categorised low-risk vessels (white list) according to their conditions and depending on the number of the inspection by the PSC to that ship. This clearly indicates the importance of the inspections by the marine superintendents as well as by the external auditors.

The number of the NMR must reflect positively on the safety performance of the ships' crew and fewer findings by the PSC inspectors. Subsequently, a smaller number of PSC inspection was expected as a result of the increasing number of NMR. The non-logical correlation indicates the non-fulfilment of the seafarers' duties with the main goal of conducting the NMR, internal audits and subsequent correction regime. This means, the quality of the reports and its contents is not effective and not delivering lessons learned to the seafarers as effectively as it is expected. The shipping company and the seafarers must pay more attention to the reported cases, as it was noticeable that more than the half of the reports were repeated cases and not critical ones as mentioned in Figure 6-8 Percentage of feedback toward NMR. The reason behind this phenomenon is the lack of trust between the seafarers and the managers at the shore-based office, as mentioned in chapter 5 under section 5.3.5.2.

Number of the NMRs is also positively correlated with the number of the findings during the Internal Audits, the number of safety inspections by marine superintendents and the on-board safety meetings as Table *6-6* represents. In normal circumstances, an increased number of NMRs indicate that safety culture is getting better on-board the ships as the seafarers understand the value of Near Miss reports. In return, it is also expected that the company increases superintendents' visits and on-board safety meeting to identify the root causes and to address them immediately. This, in normal circumstances, should result in reduced PSC inspections and findings and the Internal Audits findings, which would indicate that the company has been taking the right actions towards safer operations and higher safety culture. However, while the company's efforts are the right actions, the outcome is not the desired one. Therefore, the seafarers should report more critical Near Misses cases, and take advantage of its lessons learned. Subsequently, the number of findings by the Internal Auditors and the PSC inspectors will be reduced.

The main aim of the Safety Meeting is to discuss the most critical cases reported by the NMRs. It is logical to observe an increase in the number of the Safety Meeting as well with the increase of the number of NMR. Another purpose of the on-board safety meeting is to discuss the issues found during the superintendents' and PSC inspections, as the vessels' crew need to understand their violation of regulations or their lack of competency. If this process is executed correctly, then the PSC and the superintendents will not find many safety-related violations. The company needs to be stricter in applying the safety meeting as it meant to be.

In the Ideal situation, the increase in the number of the real and critical Near Miss reports will lead to a better learning opportunity to the seafarers to avoid their mistakes in the future.

Subsequently, fewer findings during the inspection by the PSC and the Internal Auditors. As it was mentioned earlier, the fewer findings by the Internal Auditors could result in less LTIF rate, which means fewer accidents and incidents among the shipping company. Here is the importance of the reporting as much as critical Near Miss cases that can play a significant role in enhancing the shipping safety through managing the unsafe acts resulted from the seafarers.

Table 6-6 NMR correlation result with other KPIs

KPI 1	KPI 2	Correlation	Correlation coefficient	Sig level
NMR	PSC Inspection	Positive	0.938*	0.019
	Safety Inspection by (MS)	Positive	0.985**	0.002
	Onboard Safety Meeting	Positive	0.994**	0.001
	Internal Audits Findings	Positive	0.838***	0.076

***. Correlation is significant at the 0.05 level (2-tailed).**
****. Correlation is significant at the 0.01 level (2-tailed).**
*****. Correlation at the borderline at the (0.06-0.09) 2-tailed.**

6.4.1.3. Number of Port State Control Inspection Correlation result

The number of the PSC Inspections has correlated positively with all of the Number of the Near Miss reports as mentioned above under section 6.4.7.2, the number of the safety inspection by the Marine Superintendents and the number of safety meeting on-board as shown in *Table 6-7*.

The synchronous increase between the number of inspections by the PSC with the number of NMR is neither logical nor expected by the author. The logical correlation between the number of PSC inspection and the number of the reported Near Miss is to be negative correlation. This gives the more Near Miss cases reported to the shore-based office, the more violation and unsafe occurrence to be solved and addressed. Subsequently, no critical issues will be found by the PSC, which will lead to a smaller number of inspections by the PSC. Thus, the positive correlation between the number of PSC inspection with the number of NMR indicate the ineffectiveness of the current Near Miss reporting system at the shipping company.

On the other hand, the number of inspections by the Marine superintendents and the number of on-board safety meetings is positively correlated with the number of the PSC inspection, which is not logical. As, the MS and the ships' masters had to increase their efforts to capture all the violations by increasing the number of the safety meeting and inspections by the MS coinciding with the increase of the number of NMR to cover and solve all the issues. Therefore, the PSC inspection number should have been decreased as a result of the relatively big number of inspections by MS and on-board safety meeting.

After capturing the deficiencies by the MS and the ships' masters, the shipping company will be able to investigate them and improve the ships certifications and the seafarers' behaviour accordingly. For a shipping company with high deficiencies during PSC inspections may have its ships detained and, in some cases, they may be prevented from entering the ports. Therefore, the best action was taken by the company by increasing the number of inspections by the MS and the on-board safety meeting. However, this effort has not paid off during the five years, as the number of the PSC inspection is still high according to the PSC inspection criteria. This is an indication that the seafarers and the ships' masters are not learning from their mistakes, and their competency has not improved during the five years. Thus, the shipping company is required to invest in improving the seafarer's competency by enforcing more educational courses.

Table 6-7 PSC inspection correlation result

KPI 1	KPI 2	Correlation	Correlation coefficient	Sig level
PSC Inspection	NMR	Positive	0.985**	0.002
	Safety Inspection by (MS)	Positive	0.925*	0.024
	On-board Safety Meeting	Positive	0.965**	0.008

***. Correlation is significant at the 0.05 level (2-tailed).**
****. Correlation is significant at the 0.01 level (2-tailed).**
*****. Correlation at the borderline at the (0.06-0.09) 2-tailed.**

6.4.1.4. Safety Inspection by marine superintendent correlation result

The safety inspection by the MS was correlated positively during the five years with the number of the NMR as mentioned under section 6.4.7.2. Besides, the Number of the PSC inspection, as mentioned under section 6.4.7.3. The on-board safety meeting was also positively correlated with the safety inspection by the MS, as shown in Table *6-8*. The matching trend between the safety inspection by the MS and the on-board safety meeting is reasonable. As the number of the MS visits and their finding are increasing, the ship's masters are increasing the safety meeting to discuss those findings with the seafarers. Thus, the increase of the safety meeting is the right action by the ships' masters. However, this effort did not pay off, as the number of the findings during the MS was increasing along the five years. This gives an indication that the seafarers' level of safety culture is required to be enhanced. By the time when the number of the findings by the MS, internal Auditors and PSC decreased, then the shipping company will experience a new level of safety culture.

Table 6-8 Safety Inspection correlation result

KPI 1	KPI 2	Correlation	Correlation coefficient	Sig level
Safety Inspection by (MS)	NMR	Positive	0.938*	0.019
	PSC Inspection	Positive	0.925*	0.024
	On-board Safety Meeting	Positive	0.983**	0.003
	External Audit Findings	Negative	-0.827***	0.084

***. Correlation is significant at the 0.05 level (2-tailed).**
****. Correlation is significant at the 0.01 level (2-tailed).**
*****. Correlation at the borderline at the (0.06-0.09) 2-tailed.**

A potential negative correlation between the number of safety inspections by the marine superintendents and the number of the findings by the external auditors was recorded during the correlation test, as seen in Table *6-8*. The interpretation of this potential correlation indicates the possibility of the reduction of the number of the findings by the external Auditors in the future if the MS inspections are effective. Thus, the MS is required to inspect the ships rigorously and capture as much as findings. Those findings will be investigated, and the unsafe actions/conditions will be mitigated. When the time of the external audit comes, the number of the finding could be reduced as a result of the MS efforts. However, to capture this phenomenon, KPIs should be collected for another three years minimum to validate this prediction.

6.4.1.5. On-board safety meeting correlation result

The number of the on-board safety meetings was correlated positively with the number of the NMR, the number of the PSC inspection and safety inspection by MS. Full description regarding those correlations is listed in the above sections. The number of on-board safety meetings was also recorded a potential positive correlation with the number of the external

Audit findings as shown in Table *6-9*. This potential correlation is not logical, as the number of the findings by the External Auditors is expected to be reduced with the increase in the number of an on-board safety meeting. Thus, this is an indication of the wrong direction that the shipping company is taking in terms of the safety culture, as the safety meetings that are conducted regularly on-board the ships are not increasing the safety awareness for the seafarers. Therefore, the shipping company is required to raise the level of the safety culture for the seafarers. This can be achieved by increasing the recruiting criteria and enforce an awareness, and other relevant training to improve the safety culture. Conducting a safety climate survey without subsequent actions to improve deficiencies will lead to no improvement. The maritime industry is one of the sectors that require resilient seafarers who can cope with all different circumstances with full capability of safety.

Table 6-9 On-board Safety meeting correlation result

KPI 1	KPI 2	Correlation	Correlation coefficient	Sig level
On-board Safety Meeting	NMR	Positive	0.994**	0.001
	PSC Inspection	Positive	0.965**	0.008
	Safety Inspection by (MS)	Positive	0.983**	0.003
	Internal Audit Findings	Positive	0.823***	0.087

***. Correlation is significant at the 0.05 level (2-tailed).**
****. Correlation is significant at the 0.01 level (2-tailed).**
*****. Correlation at the borderline at the (0.06-0.09) 2-tailed.**

6.4.2. Key findings from the Correlation study

The statistical correlation results provide an indication of the significant KPIs that affect other variables. However, the indication itself is not enough to prove the relationship between the variables. It needs to support those results by introducing additional evidence and theories. Studying other shipping companies' KPIs can be used as an evaluating criterion for this shipping company as well. However, the resources are very limited regarding the KPIs data for shipping companies. Despite this fact, the result shows a significant insight into six of the KPIs, and some others KPIs which were correlated but not significantly, as listed below

- Number of the Near Miss reports.
- Number of PSC inspections.
- Number of the findings by the Internal Audits.
- Number of the findings by the External Audits.
- Number of on-board safety Inspections by MS.
- Number of on-board Safety Meetings.
- LTIF.
- TRCF.

The company's understanding of the importance of NMR is visible through the result, the trend of the number of Near Miss reporting in the descriptive analysis over the five years has been increasing. This was captured during face-to-face interviews as well, as the Marine superintendents have mentioned the importance of capturing the Near Miss reports. Figure 6-3 clearly shows, NMRs have increased continuously over the last five years, reaching almost 4 Near Miss reports per ship per month which is the criterion set by the company. While the company was failing to meet the company's Health, Safety and Environment Manual (HSE) in term of the minimum number of the NMRs during the first four years, in the final year, the number of NMR increased to meet the company requirement. Along the Safety Culture Maturity journey, an increase in the number of NMRs at the beginning of the journey is an extremely positive sign as:

- The increase in the number of NMR indicates that the company is overcoming the blame culture, which is a very strong negative feature in the shipping industry. However, after studying the quality of the Near Miss reports that was collected from the shipping company, a considerable number of reports were repeated cases or unsafe conditions discovered during daily routine inspections (not to be considered as a Near Miss) as it was mentioned earlier in section 6.3.6.

- The increased number of the NMR could reduce the percentage of the incident and accident happened due to human error. Therefore, the LTIF and TRCF rate will decrease as well. However, the shipping company failed to record a reduction in the rate of the LTIF and the TRCF. Which means, the increase in the number of the Near Miss reports did not pay off.
- Effective application of Near Miss reporting can play a significant role in enhancing the safety culture among the company's seafarers by capturing their violations and taking preventive actions by the key personnel at the shore-based office. However, the safety culture level is still required further improvement, as the number of the findings by the PSC and the Internal Auditors is high.

However, despite the increase in the number of NMRs, the outcome of the analyses indicates some possible issues:

- The crew may not be reporting the actual issues on-board due to the blame culture but maybe reporting mostly trivial issues (to meet company's requirement of a minimum number of Near Miss Reports) that may not even be qualified as a Near Miss.
- Near Misses are not anonymous, and this may discourage crew from reporting real issues to avoid punishment. Anonymous NMR system will remove the blame culture gradually. Therefore, the seafarers will report more critical Near Miss cases.
- The crew do not receive the feedback on their Near Miss Reports, and this is seen as 'management do not value seafarers' opinion/input'. Despite the monthly 'the best Near Miss report award' run by the company, individual feedback is the best motivation.

- Marine Superintendent or the Internal auditors may not be as effective, and the quality and thoroughness of these visits should be enhanced.

Applying the newly designed and proposed framework for reporting Near Misses will facilitate the elimination of the blame culture phenomenon. Consequently, more safety violation will be addressed through the NMR, which will lead to more learning opportunity for the crewmember. Then the overall safety culture will be improved.

The second observed result from the KPI study is the number of the PSC Inspection and the Safety Inspection done by the MS. The trend for both the numbers of PSC Inspections and the Safety Inspections by the MS has been increasing over the last five years from 2013 to 2017. The more inspection to be conducted by the MS on-board the ships, the more violations found. This is the reason behind starting to record the number of PSC with deficiencies and the number of PSC findings in the last two years. Table *6-3* PSC significant ratios indicates an inacceptable ratio of the number of the findings and number of the inspection with finding with the number of the PSC inspection in 2016 and 2017 and. The shipping company should investigate the findings and identify the violations to eliminate them before the next PSC.

The last key finding is linked to the increase in the number of NMR and the on-board safety inspection. It is noticeable that the number of safety meetings has jumped up from the first year to the second year. Then it maintained a slightly increasing trend. However, according to the company's HSE manual, the safety committee meetings should be conducted according to the following company guidelines:

- Monthly (in a normal situation)
- In case of an incident or accident.
- On the company's demand.

This means the company is expecting at least 1104 safety committee meetings are conducted per year, taking into consideration that the company contains a fleet of 90 vessels in total. Unfortunately, the company failed to meet its own HSE manual requirements. This deficiency with the safety meeting requirements could be due to many factors. The possible factor is the intense busy schedule for seafarers and bad time management among the management level within a vessel, especially for the key people, who must be present at the meeting Such as;

- The chairman (the master)
- The safety officer (the chief officer)
- Permanent member (the chief engineer)
- Officer representative (one of the engineer officer)
- Three crew representatives (one from deck department, one from the engine department one from the catering department)

It was expected to find a significant correlation between the number of FAC and the number of navigational accidents with other KPIs. As those two indicators have recorded the number of cases that need to be linked with other KPIs to give an indication of this high number, the author suggests the shipping company should record those KPIs for each individual fleet to give a more reliable and accurate result for each fleet. Another expectation was related to the accident-free days. It was not possible to correlate Accident-Free Days with the rest of the KPIs, as it is not recorded on a yearly basis (or data was not processed on a yearly basis) as the others KPIs. If the correlation was conducted, significant insight into the relations between more KPIs might be available.

6.5. Dimensions of Reporting culture questionnaire VS KPIs correlations

The questionnaire which was distributed to the company's seafarers to assist the reporting culture and the communication skills among the crew consists of five main domains. The overall score, which was computed via the SPSS, was utilised to run the Spearman Rho's correlation test with the KPIs. As aforementioned, the result of the correlation gives an opportunity to identify witch KPI may affect the questionnaire's domains positively or negatively. However, the correlation by itself does not allow the researcher to capture the full picture, unless evidence was provided to prove the hypothesis. Three of the questionnaires' dimensions were correlated with two of the KPIs positively. The sections of the questionnaire are as follows:

1. Competency and confidence in communication and reporting.
2. Shore-based personnel's response towards safety issues.
3. Non-Native Speakers using the English Language.
4. Enhancement programme for Crew members
5. Near Miss reporting culture.

6.5.1. Shore-based personnel's response toward safety issues correlation with KPIs

The response of the shore-based staff with regards to the safety issue gives a significant positive correlation with the number of Near Miss reports, the number of PSC inspections, the number of safety findings during the Internal Audits and the number of on-board safety meetings as shown in Table *6-10* below. The harmonised increase between the responsiveness of the shore-based staff and the number of Near Miss reports is logical and expected. Thus, the shore-based staff started to respond to the seafarers' increased Near Miss reports. This phenomenon is creating a healthy working environment and mutual trust between the seafarers and the shore-based staff. However, the blame culture still exists, as mentioned earlier in chapter 5 under section 5.3.5.2. Therefore, the response of shore-based staff could be more beneficial if blame culture was eliminated from the company completely. This clearly indicates how important the anonymous reporting system is for Near Misses. It will play a significant role in enhancing the just culture by eliminating the blame culture and increase the mutual trust between the seafarers and the shore-based staff.

Another positive correlation is identified between the shore-based staff's response and the number of inspections by the PSC and the number of the Internal Auditors' findings as shown in Table *6-10*. This correlation is logical. The increase in the response of the shore-based staff has resulted from the bigger number of safety issues founded by the PSC and the internal auditors. However, the increased trend of the shore-based managers' responses did not pay off, as the number of finding during the PSC and internal auditors inspections is still increasing Applying an anonymous Near Miss reporting system will transform the response of the shore-based staff into a more rewarding response. Hence, the number of PSC inspections and the findings by the Internal Auditors will be less noticeable.

The last positive correlation is between the response of shore-based staff and the number of on-board safety meetings. The increase in the number of safety meetings is justified, as the company is trying to reach the minimum requirement of the number of on-board safety meetings to be 1080 meeting per year. Unfortunately, the company failed to record this number of meetings. Thus, the shipping company is driven by two factors to increase the number of on-board safety meetings. The first one is to achieve the requirements. The second one is to cope with the response from the shore-based staff. Therefore, whenever the company communicated with the ships to enquire about the safety or provide feedback about safety issues, the master needs to organise a meeting with the crew to discuss those issues. The result is the increased number of on-board safety meetings.

Table 6-10 Shore base staff response toward safety issues correlation result with KPIs

Dimension	KPI	Correlation	Correlation coefficient	Sig level
Shore base staff response toward safety issues	NMR	Positive	0.900*	0.037
	PSC Inspection	Positive	0.895*	0.040
	Internal Auditors findings	Positive	0.947*	0.014
	On-board safety meeting	Positive	0.890*	0.43
***. Correlation is significant at the 0.05 level (2-tailed). **. Correlation is significant at the 0.01 level (2-tailed). ***. Correlation at the borderline at the (0.06-0.09) 2-tailed.**				

6.5.2. English enhancement programme for Crew members correlation with KPIs

The domain of the English enhancement program is positively correlated but not significantly with the number of Near Miss reports and the number of on-board safety meetings. Besides, the significant positive correlation with the number of the PSC inspections was identified as shown in Table 6-11. The enhancement for the English language for the seafarers could result in more Near Miss reports in the next few years if the trend keeps increasing. This is a logical result, as the more confidence the crew has in their level of English, the more Near Miss reports will be generated. This is an indication of the importance of enhancing the seafarers' level of English. The shipping company should invest in the seafarers' enhancement courses as it will reflect positively on the level of the safety culture. As the Near Miss reports and cases will be more, it will allow the company to identify more safety issues and take the appropriate preventive actions.

The number of PSC inspections was positively correlated with the enhancement program for the seafarers. This is not logical. As the enhancement program leads to better safety performance on-board the company's vessels. Subsequently. The number of PSC inspection must be reduced. Thus, the enhancement program is not enough by itself. The shipping company is required to improve the seafarer's safety culture level as well. This can be achieved by implementing an anonymous reporting system for Near Misses capturing every critical unsafe act that is happening on-board the ships. Gradually, the seafarers will overcome the blame culture and improve their safety culture level. The result will be a smaller number of PSC inspection.

The English enhancement program could also play a role in increasing the number of an on-board safety meeting. This could happen when the seafarers started to interact and dialogue about the safety concerns with the safety meeting chairs. Therefore, the safety meeting chairs will be more motivated to conduct more on-board safety meetings, as the master and the Chief Engineer desire to capture the point of view of the seafarers. Thus, the safety-related issues will be understood by everybody at the same level among the senior officers, junior officers and the ratings.

Table 6-11 English enhancement program for crewmember's correlation result with KPIs

Dimension	KPI	Correlation	Correlation coefficient	Sig level
English enhancement program for Crewmembers	NMR	Positive	0.837***	0.077
	PSC Inspection	Positive	0.957*	0.011
	On-board safety meeting	Positive	0.872***	0.054

***. Correlation is significant at the 0.05 level (2-tailed).**
****. Correlation is significant at the 0.01 level (2-tailed).**
*****. Correlation at the borderline at the (0.06-0.09) 2-tailed.**

6.5.3. Near Miss reporting culture correlation with KPIs

The Near Miss reporting culture is positively correlated with the number of PSC inspections and the number of the findings by the Internal Auditors, as shown in Table *6-12*. This is not logical. When the level of the reporting culture increase, the number of PSC inspections and the Internal Auditors' findings should decrease. Thus, the result indicates the insufficient level of reporting culture achieved at the shipping company. Therefore, the shipping company is required to take a bold step to improve its reporting system for the Near Misses to make sure that genuine Near Misses or unsafe conditions are reported. The new reporting system for Near Misses will increase the level of the reporting culture in the shipping company and this will be demonstrated in the next chapter.

Table 6-12 Near Miss reporting correlation result with KPIs

Dimension	KPI	Correlation	Correlation coefficient	Sig level
Near Miss reporting culture	PSC Inspection	Positive	0.876***	0.051
	Internal Auditors findings	Positive	0.899*	0.038

***. Correlation is significant at the 0.05 level (2-tailed).**
****. Correlation is significant at the 0.01 level (2-tailed).**
*****. Correlation at the borderline at the (0.06-0.09) 2-tailed.**

6.6. significant findings and recommendation for the company

- The correlation analysis has proven the importance of applying an effective NMR system. The effective and anonymous NMR system leads to more issues to be solved and may be prevented by the shore-based staff, and more lessons will be learned by the seafarers. Therefore, less findings and inspections by the PSC will be recorded. Thus, it is highly recommended that the shipping company adopt the newly designed reporting system for Near Misses as it will enhance managing the human errors and increase the resilience.

- RORO container fleet at the company is free from Navigational accidents. Therefore, oil tanker and chemical tanker fleets are required to adopt the successful practice from the container fleet to achieve a higher safety culture level.
- Seafarers are willing to apply any instructions given by the higher management level. Thus, seafarers have successfully achieved the target of the minimum number of NMRs. However, the managers are required to be more resilient and track the quality of NMRs rather than focusing on the quantity only. Many of NMR is repeated, and no lessons learned were demonstrated.
- The company has established recording a very beneficial KPIs such as; incidents and navigational accidents, which is a good initiative. However, the number by itself without breaking down for the incident is not informative/beneficial. There must be records regarding which fleet has the incidents, the type of incidents and the root causes. This kind of information will be utilised to enhance the analysis process at the company for the incidents and will impact positively on the incident reduction rate. It is very likely that the shipping company is holding that information and not allowed to share them as they are classified and confidential.
- Looking at the figures under the number of inspections by the PSC, it gives an impression that most of the ships at the company are treated as high-risk ships. This indication is not acceptable in this company with its reputation. The company was asked to share those data. Unfortunately, they did not share it with the author due to the confidentiality of the data. Moreover, the number of detentions due to the number of PSC findings was not provided. However, according to TokyoMOU (2020), only one detention has been recorded in 2018 as there was a missing safety certification on-board one of the Chemical tankers.
- By looking at the percentage of the reported cases considered by the author based on the nature of the hazard as an Unsafe Acts and the Unsafe Conditions, we can see that

the percentage of both categories is not equal. This is against the primary goal of reporting Near Misses, whereas, NMR is designed to capture Unsafe Act and human error and Unsafe Condition. Seafarers need to be educated to distinguish between the Unsafe Act and the Unsafe Condition, then report both of them. Distinguishing between them is important as it makes the reporter aware of the appropriate corrective action.

- Master and Chief engineer are required to conduct more on-board safety meetings to fulfil the HSE manual requirements. The more on-board safety meetings mean more commitment toward safety by the high managerial level on-board any ship, and this will positively impact the rest of the seafarers' safety performance. According to the positive correlation between the number of the on-board safety meetings and the number of the Near Miss reports, more safety meeting leads to more Near Miss reports, which will allow the shipping company to identify more safety performance gaps. Subsequently, educating the seafarers on how to overcome those gaps by all possible means, such as; disrupting safety newsletters and discussing those issues during the MS visits.
- The feedback towards the NMR would be more beneficial if it was submitted to each individual user via the NMR dashboard.
- Specifying a specific date of publishing the safety bulletins and including its contents in the on-board safety meeting would encourage the seafarers to get the benefits of the safety bulletins.
- LTIF and TRCF rate is highly unsatisfactory comparing to other LTIF and TRCF rate at other companies, as shown in the study conducted by (Arslan, 2018). The company is required to invest more to enhance these critical safety performance indicators by eliminating all the root causes that lead to the increase of LTIF and TRCF.

The accident records would be very beneficial if it was recorded on a yearly basis to match the same criteria as the other KPIs. Subsequently, it will be possible to correlate with the other KPIs and will be resulted in more useful insight information that can be utilised toward improving safety. The way of recording the accident-free days at the shipping company cannot be utilised. The author was not able to capture the trend of the accident-free days, as it is not possible to know how many days per year have the company stayed free of accidents. Subsequently, accident-free days were not comparable with other similar data.

However, according to Figure 6-4 Number of navigational accidents, the author has captured the efficacy of the RORO (multi-purposes) fleet in maintaining a good safety performance. Thus, it's advisable that the shipping company generalise the working standards of the RORO fleet manager and MS to the other fleets. Moreover, RORO ships' masters and seafarer's safety performance needs to observe for enough time to compare their safety performance and their implementation to the regulation with the other masters and seafarers. It is expectable to capture a significant differentiation.

6.7. Chapter summary and conclusion

Analyses of the Key Performance Indicators or in other words, the analyses of the leading indicators provide a general overview of the safety culture level within the company. Also, it gives an indication to the company in which areas need improvement. The acquired results from the analysis under this chapter show that the company has figured out the importance of the NMR and its outcome, as it can play a significant role in reducing the percentage of accidents occurring. Therefore, the number of NMRs was increased noticeably throughout the five years, and therefore, some other KPIs were also improved as a result of the increase in

NMRs. However, the number of NMRs is not the only indicator to prove that the company is moving on the right track. The quality of the NMR is also extremely important.

It can also be seen the trends of the number of PSC Inspections and the company's inspections are increasing as well. This reflects how much effort the shipping company should spend to increase the level of safety as is it is possible that the PSC may have enforced a number of detentions due to the number of the deficiencies that were recorded in the 2016 and 2017.

In a nutshell, the study provides detailed information regarding the safety of the company’s fleets by using the company safety-related KPIs. This resulted in capturing improvement in some indicators such as the increasing number of the Near Miss reports and the on-board safety meeting. However, the shipping company needs to make sure this improvement is in the quality not only in quantity and should be translated to other safety indicators. Finally, the company is required to expand the list of the KPIs to follow the standardised list by BIMCO. Subsequently, a broader vision of safety can be expressed by then.

7. New reporting form for Near Miss development and outcome

7.1. Chapter Overview

The new reporting form for Near Miss is inspired by and designed according to the so-called CHIRP standard and other well-known reporting systems for Near Miss. It is the official and voluntarily reporting platform in Europe for both the Aviation and the Maritime. The new reporting form aims to save the reporter time and acquire as much as necessary information regarding the unsafe act. So, the team at the shore-based office could analyse the case and keep recording the frequency and the root causes of the occurrences. It is also proposed to create the national data bank by the transportation ministry for the Near Misses in the near future. This will be utilised to develop and implement mitigating barriers to enhance safety and prevent the occurrence of accidents. Such a national database will assist shore-based staff in predicting potential accidents before occurring and taking preventive actions.

7.2. Introduction

According to the IMO (2008), '*Learning the lessons from Near Miss should help to improve safety Performance since Near Miss can share the same underlying causes as losses'.* Reporting hazardous occurrences in order to take lessons learned from other mistakes are widely known practice in most of the complex industries such as aviation, health, and nuclear power. It is proven that establishing such a reporting system has affected safety performance positively (Lappalainen *et al.*, 2011). The maritime industry is one of the complex sectors, and it is strictly required by the ISM code to adopt reporting culture for any unsafe act locally according to Storgård *et al.* (2012), and corrective actions must be taken to prevent similar incidents from occurring in the future. Reporting incident and investigating the root causes for the incident may contribute to safety enhancement in the maritime domain that may include modifying the organisational structure and routine crew training (Lappalainen *et al.*, 2011). In other words, powerful reporting is leading to better safety performance. Tapaninen, Storgard and Erdogan (2012) have mentioned in their studies that for each accident, there are 29 minor incidents and 300 Near Misses reported. This means one incident for each 10.34 Near Missies. The ratio of the incident to the Near Miss at the shipping company studied in this research is 1:38 in 2017 and 1:48 in 2016. Thus, the shipping company has recorded a better result than Tapaninen's argument. Now we can understand that the relationship between reporting and safety enhancement has a positive relationship. Each shipping company needs to make sure that their SMS is properly functioning by maintaining the reporting of incidents and Near Misses. According to the ISM code, the report does not need to be electronic as long as the maritime personnel are regularly reporting, according to Lappalainen *et al.* (2011). However, from the point of view of reducing paperwork as mentioned above, standardisation of reporting system is highly desirable in the maritime sector to achieve an active reporting culture.

7.3. Developing the new flowchart process for the new NMR system

The flowchart for the new NMR system has been created based on Near Miss systems around the world as listed in the critical review chapter. Since none of the available Near Miss system around the world is fulfilment the expected requirement as mentioned by (Thoroman, Goode, and Salmon, 2018) The flowchart begins with filling a soft copy of the reporting form by logging in to the individual account that every crewmember has at the time of the occurrence of the Near Miss. At this stage, the feasibility of the parameters of each Near Miss should be evaluated by the concerned department's head anonymously (the Chief Officer or the Chief Engineer). The parameters that required checking are the given rate, the potential consequences, the root causes, lessons learned, and the class of the Near Miss case. If all of the reported parameters are accurate, then the report will be sent for the next stage. An editing option is available for the head of the department to improve the quality of the reported parameters if they are required correction or intervening to make the case more feasible. In this case, the main reporter will be notified through the system about the correction that has been made by the head of the department. This notification is considered as a learning opportunity for the seafarers with regards to the good reporting practice, by reporting all of the parameters accurately. In addition to that, if the corrective actions taken at the time of the Near Miss was not effective enough, then the head of the department will communicate with all personnel within the department to intervene directly or indirectly to take a more effective corrective action.

Besides that, it is considered as a learning step for the crewmembers by amending the report. On the other hand, if the report is correctly filled, then it will go to the next stage, to the Marine superintendent, who is responsible for this ship. The Marine Superintendent will conduct the analysis of the report as a second filter. The evaluation includes the feasibility of the case, the rating of the case, the feasibility of the corrective action taken, providing feedback and finally the recommendation for the future reports, and to share lessons learned. All of that will be sent back to the reporter's account on the company's dashboard. The MS then will pass the reports to the fleet manager to decide the critical cases to be communicated to the other ships within the company, and to select the best report for the month. If the case was so critical and some of the company's Standard Operational Procedures (SOP) is required an update, then the DPA will conduct this step after conducting a meeting with the fleet managers.

In addition to that, statistical and root cause analyses of records will be carried out and saved in the company's database, and they will be sent to the national database that receives Near Miss reports from all shipping companies within the region. The national database which is planned to be launched in the near future will carry out one more analysis using all the database, and then share the learned lessons with all companies, who contributes to the common database.

In summary, the new reporting flowchart ensures a good practice for the NMR by educating the reporter on how to report NM properly while guiding the company how to process and provide feedback to the reporter effectively. This approach provides the seafarers with the encouragement and opportunity to take more effective corrective action by getting a recommendation from the Marine superintendent. Finally, the lessons learned will be shared among a broader range of people in the fleet/organisation to benefit all seafarers in the region. Figure 7-1 below shows the flowchart for the new Near Miss system, which was proposed to the shipping company. The Chief Officer (CO) or the Chief Engineer (CE), At the fist filtering loop stage will conduct the report validation to be proceeds to the next stage.

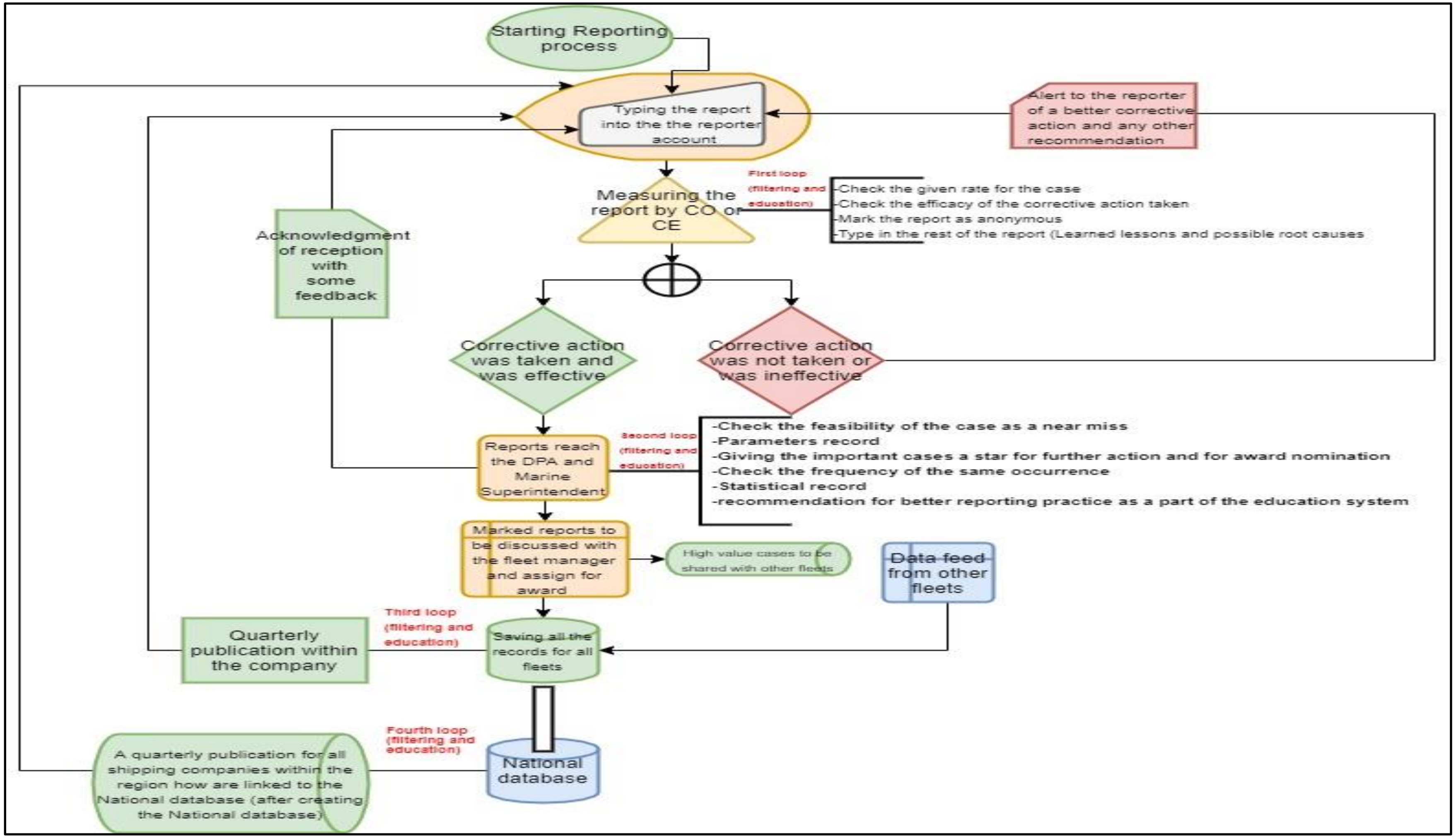


Figure 7-1 New NMR flowchart

Table 7-1 below shows a comparison of the significant parameters between all reporting systems that were listed in the critical review and the new reporting system that was proposed for the shipping company

Table 7-1 Parameter comparison for all Near Misses reporting systems

system / **parameter**	CHIRP-UK	REPCON-Australia	SECURITAS	INSJO-Sweden	NearMiss.dk-Denmark	ForeSea-Finland	EMCIP	MARS	The case study	New reporting platform
Governmentally	√	√	√							
Agency				√	√	√	√	√		
Nationally		√	√	√	√	√			√	√
Internationally	√						√	√		
Individually									√	√
Connected with a national database										√
Special reporting form	√	√		√		√		√	√	√
No blame Policy	√	√	√	√		√	√	√	√	√
Confidential	√	√	√	√		√	√	√	√	√
Accessible for all crew	√	√	√					√	√	√
Only DPA can report				√	√	√				
Paper reporting form (handwritten)				√	√	√			√	
Voyage phase		√				√		√		√
Position	√	√						√	√	√
Contact details	√					√		√	√	
Date	√	√						√	√	√
Time	√	√						√	√	√
Weather condition	√	√						√		√
Description of the unsafe act	√	√		√		√		√	√	√
Sharing recommendation on the website	√	√	√		√	√	√	√		
Newsletter disruption	√							√		√
Direct feedback to the reporter										√
Reports to be analysed by system operators	√	√	√			√	√	√	√	√

Reports to be analysed by a third party				√	√			√		√
Safety alert for urgent reports		√			√	√		√		√
Share the reports with regulatory authority										√
Open-end question in the form	√			√		√		√	√	√
Reports to be saved in the data bank	√			√		√	√	√		√
Total	**17**	**15**	**7**	**12**	**7**	**15**	**7**	**20**	**14**	**21**
				Planned to be one system						

7.4. The Proposed New Near Miss Reporting Form

NMR is an everyday routine for the crew members on-board any ship. Thus, it needs to be in a user-friendly electronic form, accessible, standardised and beneficial for the overall organisation. Otherwise, it would be wasting the seafarer's time. The existing system in the company is sufficient to a certain level. However, some gaps and deficiencies at the reporting stage, the analysis stage and the reporting form itself were identified during the analysis of the system and compared it with other systems listed in the critical review chapter.

7.5. The newly designed reporting form

The new reporting form was designed with consideration of the needs of the crew members and the staff on the shore-based office. The time saving and the kind of information that needs to be processed by the MS was considered in the first place while creating the new form. The first draft of the form received encouraging feedback from the Marine superintendents who participated in the interview. During the field trip, the interviewees provided very positive feedback about the structure and the content of the new form with some practical recommendations, which were implemented to enhance the report's effectiveness. Additional feedbacks were also taken from the crew members (the users) themselves during the testing mode. Some of the feedback included recommendations such as the company's logo and some other technical issues that could be fixed by the IT department, were not feasible to include by the researcher. Some other recommendations can be performed by the shore base staff such as the preventive measures not by a vessel's crew. Yet, some minor details, which were mentioned would make the reporting form even better. *Table 7-2* below summarises all the improvement applied to the proposed reporting form.

Table 7-2 Ideas to Improve the proposed Reporting form

Suggestions by the participant in the interview	Suggestions by the crew members
• The option that says in case of other ship was involved in the event. To be rewritten in the following form to include any third party was involved. (In case of other ship or a third party such as (pilot) involved in the case, give the name of the ship or the job title of the third party). • Under the option of operation type include: At sea, Ballasting, DE ballasting, Gas freeing, and measuring toxic gases. In general, all possible type of operation. • The potential consequences and the learned lessons should be filled by the Master during the validation process. Because it is too advanced for low rating crew to fill in that information due to their relatively narrow experience, additionally, if the low rating can write this section, this will be an indication of the high level of competency.	Under operation type, include more operation options: • STS • SPM • Bunkering • Pick up from service boat. • At sea
	Possible root causes to be in a drop-down list.
	Possible underlying root causes to be categorised the same as the potential consequences.
	File attachment capability.
	Possibility of choosing more than one option.

The new reporting form after the modifications consists of static information, which would be acquired automatically, such as the ship's name and the type, and the dynamic information, which needs to be entered by the reporter manually, such as the ship's location, cargo compartment statues, operation type etc. The last part of the reporting form is the description of the Near Miss case with some details. Figure *7-2* below shows how the form looks like exactly.

<table>
<tr><td>Ship's Name</td><td></td><td>Ship's Location</td><td>☐At sea ☐On berth ☐Anchor area
☐Dry dock ☐N/A</td><td>Operation Type</td><td colspan="2">☐Loading ☐Discharging ☐Loading and Discharging ☐Maintenance ☐Measuring toxic gases
☐Inerting ☐COW ☐Piloting ☐STS ☐SPM
☐Pollution control ☐Tank cleaning ☐Purging ☐Gas freeing</td></tr>
<tr><td>Ship's Type</td><td>☐Chemical tanker ☐Oil Tanker ☐RORO ship (multi purposes)
☐Dry bulk</td><td>Cargo compartments status</td><td>☐Fully loaded ☐partly loaded ☐Ship is on ballast condition</td><td>Date of the Near Miss</td><td>Click or tap to enter a date.</td><td>☐Unsafe Act
☐Unsafe Condition</td></tr>
<tr><td colspan="4">In case of another vessel was involved in the event, Give the name of the other vessel</td><td></td><td>Time of the Near Miss</td><td></td></tr>
<tr><td>Type of the Near Miss</td><td colspan="6">☐ Accident ☐ Incident ☐Near miss</td></tr>
<tr><td>Near Miss Rate (depending on how much it might cost*)</td><td colspan="6">☐Low ☐Medium ☐High ☐Very High</td></tr>
<tr><td>Underlaying Root causes for the Near Miss (tick more than one if applicable)</td><td colspan="6">☐Carelessness ☐Tools Deficiency ☐Equipment Failure ☐Failure to Comply with Procedure ☐Failure to use PPE ☐Housekeeping
☐Incorrect use of Equipment ☐Lack of maintenance ☐Lack of Competency ☐Failure to use LSA</td></tr>
<tr><td>Potential Consequences of the Near Miss (tick more than one if applicable)</td><td colspan="6">☐Damage to the Property ☐Damage to the Environment ☐Fire / Explosion ☐General Hazard to the Ship ☐Injury / Fatality
☐Navigational Hazard</td></tr>
<tr><td>Near Miss Description</td><td colspan="6"></td></tr>
<tr><td>Immediate Corrective Action</td><td colspan="6"></td></tr>
<tr><td>Class for the Near Miss</td><td colspan="6">☐ability, skills, knowledge of the people involved ☐personality (mental condition, emotional state) ☐physical condition (medical fitness, fatigue, use of alcohol or drugs) ☐activities prior to the accident/occurrence ☐assigned duties at the time of accident/occurrence ☐actual behaviour at time of accident/occurrence
☐attitude ☐division of tasks and responsibilities ☐composition of the crew (competence/nationality) ☐workload (both overload and underload)/complexity of tasks ☐work hours/rest hours ☐procedures and standing orders communication (internal and external)
☐on board management and supervision ☐organisation of on-board training and drills ☐teamwork ☐planning of work ☐level of automation ☐ergonomics of equipment and the working environment
☐adequacy of living conditions ☐adequacy of food ☐opportunities for recreations ☐vibrations, heat, noise ship motion ☐design ☐state of maintenance (not maintained, badly maintained)
☐equipment (availability, reliability) ☐cargo characteristics, including securing, handling and care ☐policy on recruitment ☐safety policy and philosophy ☐management commitment to safety ☐scheduling of leave periods
☐general management ☐assignment of duties ☐ship-shore communication ☐weather and sea conditions ☐Port and transit conditions (VTS, pilots etc.) ☐traffic density
☐ice conditions ☐regulations, survey and inspections</td></tr>
<tr><td>Lessons Learned from the Near Miss</td><td colspan="6"></td></tr>
</table>

*If the Unsafe act leads to potential damage of (250.000 US$ and more = Very High), (100.000 US$ and more = High), (10.000 US$ and more = medium) and (insignificant damage or estimated by less than 10.000 US$ = LOW).

Figure 7-2 Newly designed NMR form

7.6. Testing mode

The testing mode was accessible by all crew members on-board of all the company vessels via the Qualtrics website. All responses were anonymous and accessible by the researcher only. The Qualtrics link included the report itself to allow seafarers to report a real Near Miss case, plus the reporter's opinion about the new reporting form. Motivating the company to encourage the seafarers to use the new form was not an easy task, as the seafarers are busy with their daily routine work. After collecting the 93rd report in six months, the link was deactivated, and the analysis was conducted accordingly.

7.6.1. Descriptive result of the newly designed reporting form

This part of the chapter presents some of the static information with regards to the collected reports, circumstances of the unsafe acts/conditions and some details of the reporter such as the rank and to which department he belongs, etc. It also includes the opinion of the participant regarding the newly designed reporting form. The total number of participants is 93 seafarers. All the reports are 100% completed, and there is no missing data.

7.6.1.1. Ships' type

The total collected responses are 93 reports, which are enough, almost one report from each ship, as the fleet consists of 90 vessels in total.

Figure 7-3 below shows the total number of collected reports per ship type and the total number of vessels within the company fleet. As it is noticeable in the Figure below the Chemical tankers were not fully involved in the new reporting form for Near Miss. The main reason behind that was clearly written in one of the NMR by one of the crew on-board a Chemical tanker. *"Whatever* *the Good Near Miss from (NCC) the National Chemical Carrier fleet. The best Near Miss award goes to bullshit Near Miss from VLCC fleet. NCC is the most neglected fleet as the company's main business is VLCC. Consider this as a Near Miss! No Spares, no supplies, life is worst here. Just like any senior officer, I'm planning to leave the company for good"* he said. On the other hand, three Oil tankers, two RORO ships and one Dry Bulk carrier have reported twice.

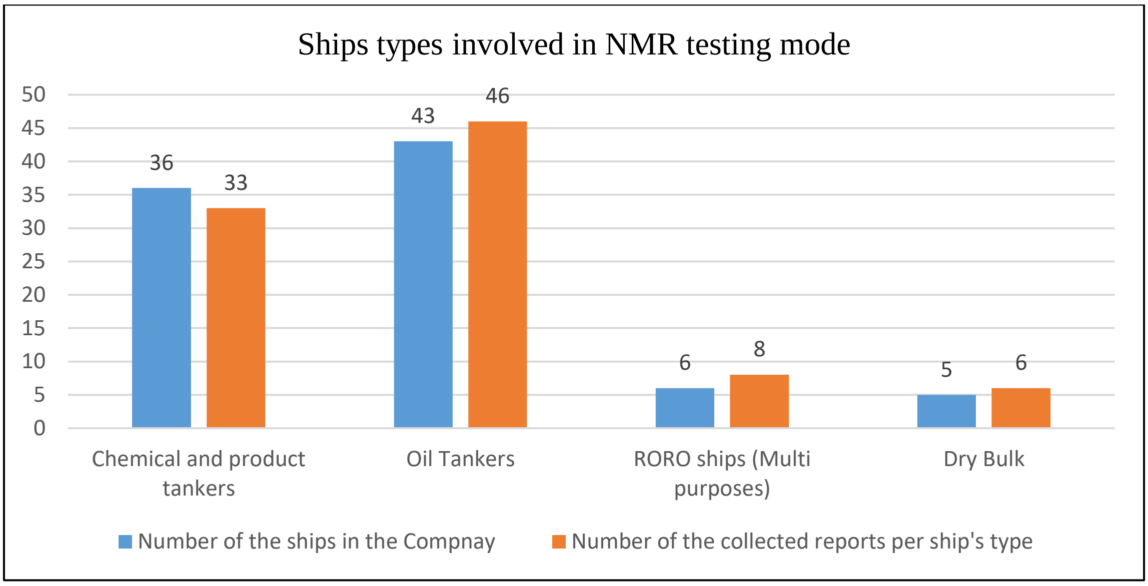


Figure 7-3 Number of ships at the company VS number of collected report per ship type

7.6.1.2. Ships' location

Ship's location at the time of the Near Miss was an option in the new reporting form as the analysis team at the company could trigger where most of the Near Miss is happening. Therefore, seafarers would take extra caution while sailing or operating in those areas. Figure 7-4 below shows the distribution of the ships' location during the unsafe act.

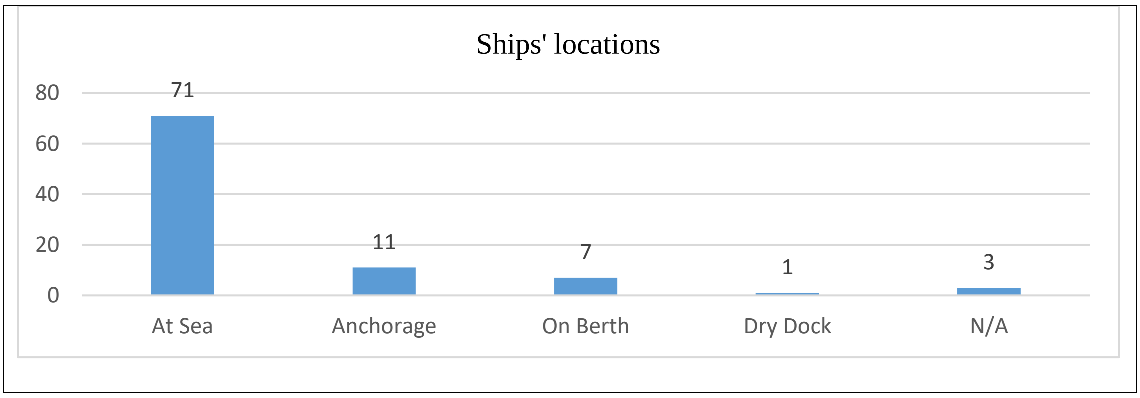


Figure 7-4 Ship's location

Most of the Near Misses had occurred while the ships were engaged in sailing at the open sea. Three of the reports were submitted while the ships were at unidentified locations. After considering the operation type for those ships, it turned out they were engaged with loading or discharging at a Single Point Mooring (SPM) or Ship to Ship (STS) transfer.

7.6.1.3. Cargo compartment status

Cargo compartment status is one of the options in the reporting form as this could affect the unsafe act/condition to be turned into an incident or even an accident. Also, depending on the cargo compartment status, the crew members can have a busy schedule or a little flexibility with the schedule on their daily routine tasks. If they have a more flexible timetable, then they can conduct more safety checks for Life Saving Appliances (LSA) during their daily tasks. This may result in more Near Misses cases to be reported. Figure 7-5 below shows the disruption of the cargo compartment status while reporting the Near Misses. Most of the cases occurred while the ships were fully loaded. This gives an indication that loaded ships lead to more tasks to be performed to take care of the cargo. For instance, Crude oil and some of the chemical products need extra caution with the inserting or while RORO ships require extra caution with the cargo lashing. This gives a broader room for Near Miss to happen.

It is noticeable from Figure 7-5 below; there is one case categorised as N/A. After looking into the ship's location, she was in the dry dock, and therefore she had no cargo at all.

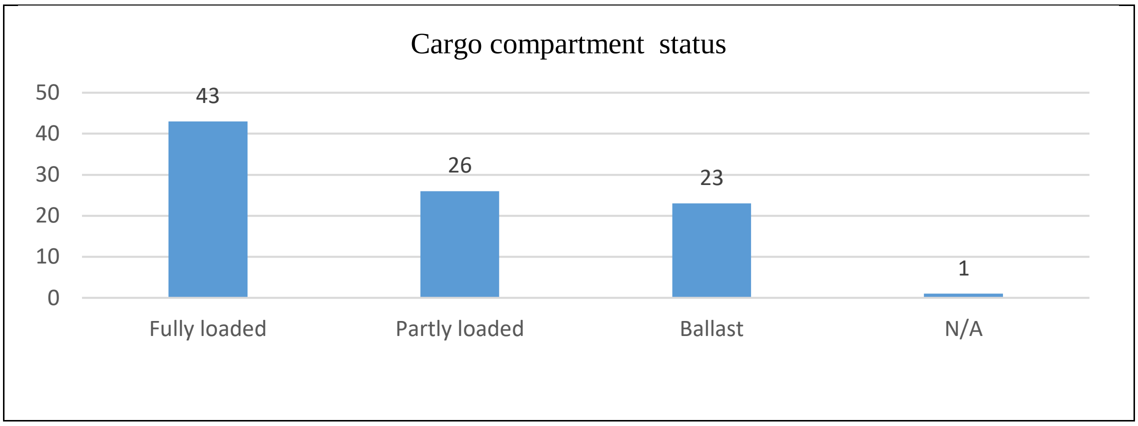


Figure 7-5 Cargo compartment status

7.6.1.4. Operation type

Knowing the operation type during the Near Miss occurrence is very important. The form that was distributed to the seafarers during the testing mode did not include all possible operations. This resulted in missing answers under this field in some of the forms. After considering the feedback from the participants, more options with operation types were included in the form. The options are; Loading, Discharging, Loading and Discharging, Inerting, Ballasting or De-Ballasting, COW, Maintenance or NA. Figure 7-6 below shows the operational type for each ship when the Near Miss occurred. Most of the ships were engaged in daily maintenance tasks while sailing. This outcome is logical as the seafarers have slacker timetable and they could focus and observe as many Near Misses as possible.

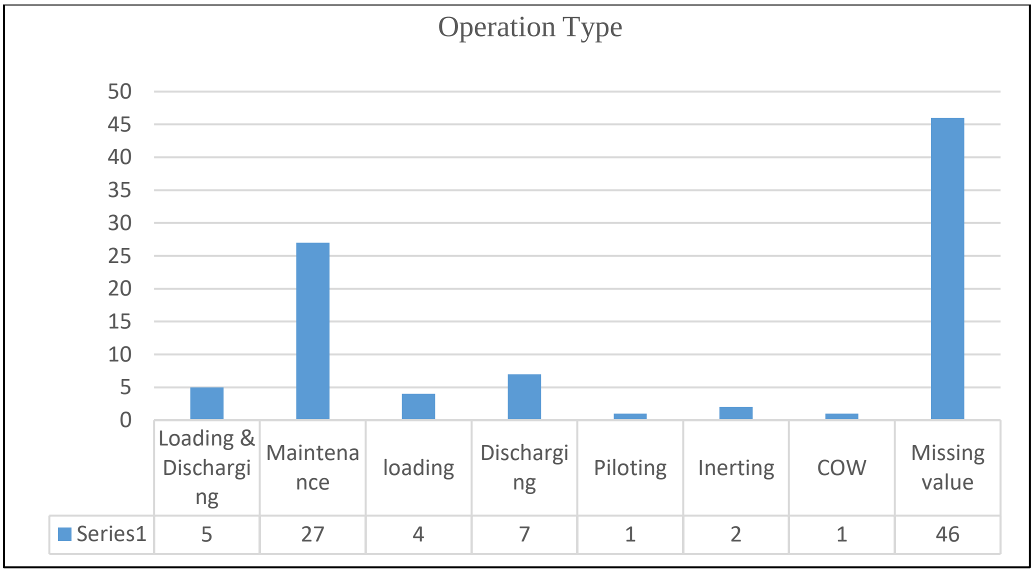


Figure 7-6 Operation Type

7.6.1.5. Frequency of the Near Miss to occur

Frequency of the unsafe act was never asked before in any of the Near Miss reports, and therefore, it was included during the design of the new reporting form. Asking this question would give the reporter an indication of how often such Near Miss occurs on-board the ship. In addition, the analysis team (marine superintendents) will be able to trigger the most common unsafe conditions for this specific Near Miss. Therefore, such data will not only generate a more effective recommendation through the newsletters but also it may force the company to update their SOPs to minimise the occurrence of such acts/conditions. Figure 7-7 below shows the frequency of the reported cases through the new reporting form. The option *"sometimes"* was selected by 51.6% of the cases.

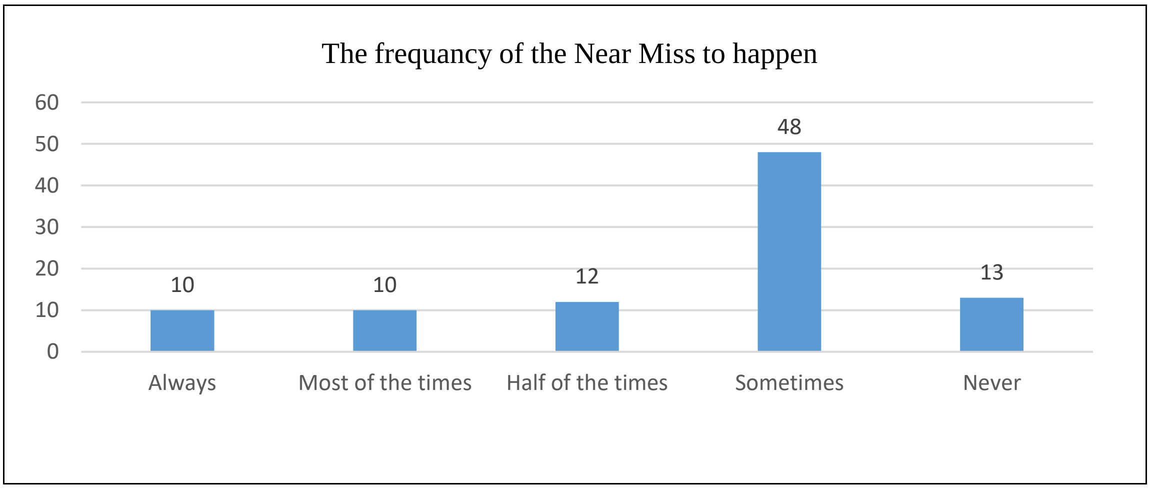


Figure 7-7 Frequency of this Near Miss to happen

7.6.1.6. The rating of the unsafe act

The rating of the hazardous act considered as one of the aspects that used to be underestimated in some cases or overestimated in some other cases among the existing reporting system of the company. Each case is required to be rated according to the cost of the consequences, as provided in the company's HSE manual. However, not all the seafarers can remember this exact information. In the new form, there is a star next to the field of the unsafe act rating. Therefore, the reporter can check the footer of the reporting form and estimate the cost of the consequence, if no action is taken. By this way, the given rate would be more reliable. Thus, the analysis team will receive an alert for the cases, which are rated as very high, and they will act accordingly. Figure 7-8 below shows the rating for the reported cases. Most of the cases were marked as low and medium, while only a few cases were rated as very high cost cases.

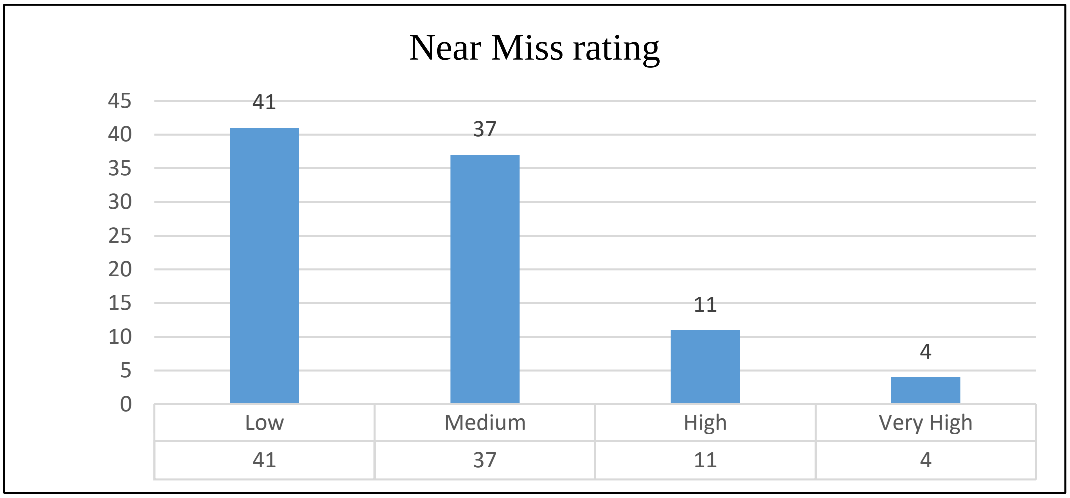


Figure 7-8 The rating of the Near Misses

7.6.1.7. The rank of the reporter

The rank of the reporter used to be collected in every reporting system. However, in the new reporting form, the rank of the reporter or his name is not required as the new form is anonymous. During the testing mode, there was a question about the crew rank after filling and submitting the report. The reason behind this question was to know which department and which rank of the seafarers on-board the ship is engaged most in the reporting. Figure 7-9 below shows the rank of the reporter. The Master was reporting most of the cases, as the masters were the first person who received the newly designed reporting form link at the Ships' Email address. The advantage of collecting reports from masters is to capture the point of view of the ships' top management personnel. However, the opinion of the rest of the crew is important as well since they will be involved in the reporting practice more intensively. Therefore, on an average, third of the ships have participated in filling the newly designed reporting form through their masters.

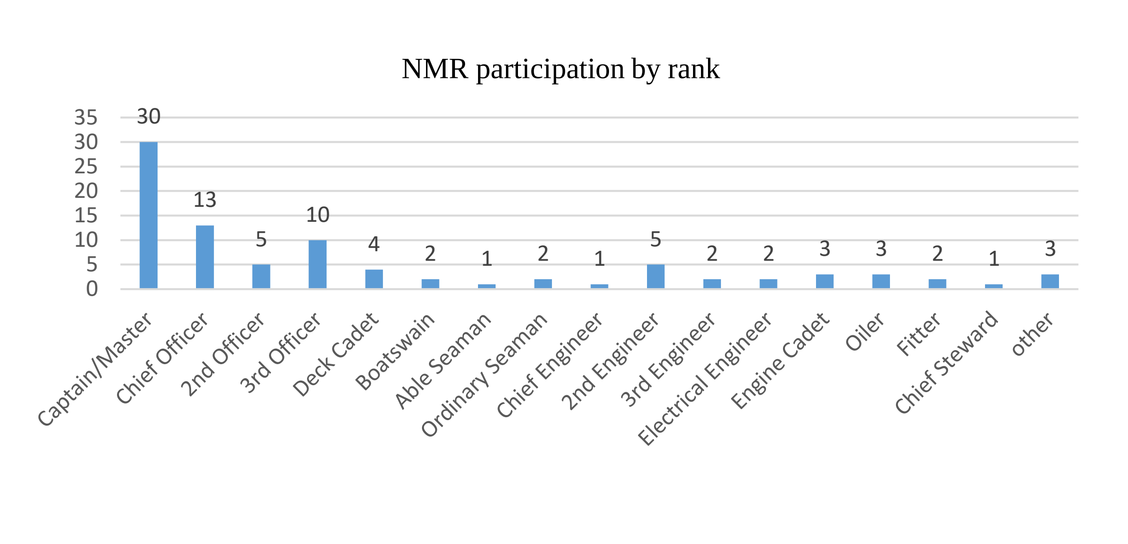


Figure 7-9 NMR participation by crew rank

7.6.1.8. Participants' department

The crew who participated in the testing of the new reporting form are from all departments within a ship. The expected outcome was to receive a balanced number of reports from the deck and the engine departments, as their nature of work is seen as risky. The catering department was expected to report less due to limited tasks they are involved in. However, the Deck department has reported the significant number of the cases as Figure 7-10 below shows. Thus, the crew who belong to the Engine department are required to be engaged more with the NMR. This shortage of NMR from the Engine department leads to deficiencies in addressing the safety-related issues and finding corrective action for the reported problems. Engine room crew is required to be more engaged and motivated to report as many Near Misses as they face to increase the safety resilience in the Engine room.

The same is applied to the crew from the deck department; most of their cases are reflecting the tasks done on the Deck. They need to address more issues reflecting the bridge watch practice such as; wrong course alteration that could lead to an accident, wrong practice in using the engine order telegraph or in using the VHF to communicate other vessels in the vicinity.

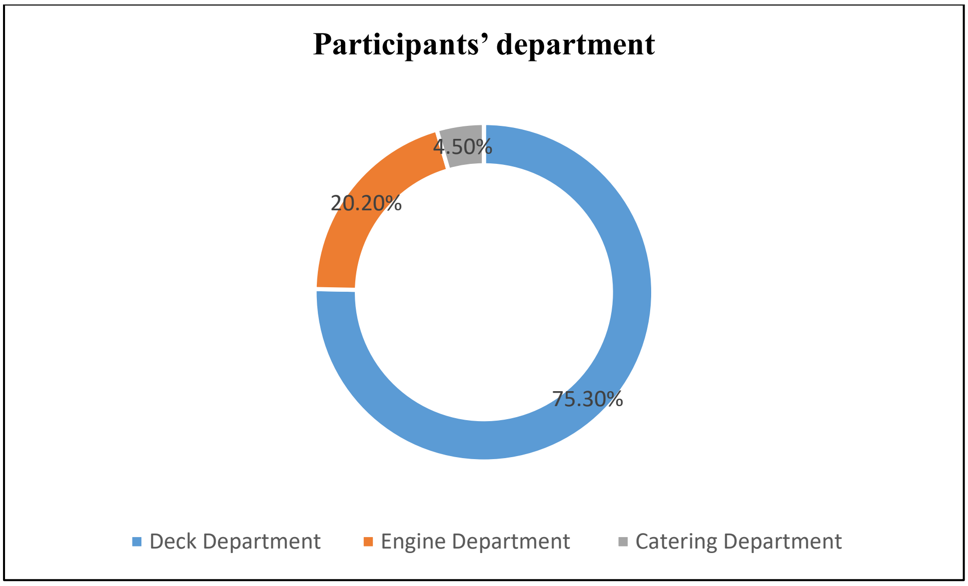


Figure 7-10 Participants' department

7.6.1.9. Participants' opinion towards the new reporting form for Near Miss

After completing the newly designed Near Miss reporting form, participants were also asked to compare and evaluate the new reporting form with the existing one. Two of the participants did not provide answers to those questions listed in Table *7-4* below. Thus, two missing responses were recorded among the seafarers' opinion toward the new reporting form. Figure 7-11 and *Table 7-4* below shows the questions asked along with the answers. The scale of the answer was the three-point Likert-Type scale. Thus, the answers were (Yes, Maybe, No)

Equation 7.1 below is showing the calculation method for the mean for Likert-type scale (3 points) is as follow:

$$Mean = \frac{(f*3)+(f*2)+(f*1)}{\text{sample size}} \qquad \text{(Eq 7.1)}$$

Where, f is the frequency of the agreement level based on the Likert Scale (3 points) for each question in the questionnaire.

Equation 7.2 below is showing how to convert the mean to a percentage. This equation will be used in the next section to calculate the score for each statement and each domain.

$$\text{Score in percentage (\%)} = \frac{\text{Mean}-1}{3-1} * 100 \qquad \text{(Eq 7.2)}$$

The mean limit which presented in *Table 7-3* was obtained using Equation 7-3 below for the Likert-type scale (7 points). The formula is:

(3-1) / 3 = 0.86 (Eq 7.3)

Table 7-3 Mean limits for each agreement degree and colour code

Agreement degree	Mean limits	Colour code
No	1.00 – 1.667	<33.35%
May be	1.668 – 2.336	33.36%-66.85%
Yes	2.337 – 3	>66.85%

The green colour code represents most of the participants' answer 'Yes' to the questions.

Table 7-4 Participants' opinion toward the new reporting form for Near Miss

Participants' opinion toward the new reporting form for Near Miss			
Question	**Mean**	**Stan. Dev**	**Agreement Score %**
Do you see this reporting form for Near Miss is user-friendly and more effective than the existing one?	2.49	0.751	74.5
Do you think the new reporting form is requiring less time to conduct compared with the existing one?	2.59	0.66	79.5
Do you recommend this form to be used as an official reporting form for Near Miss?	2.35	0.794	67.5
Average	**2.47**	**0.655**	**73.5**

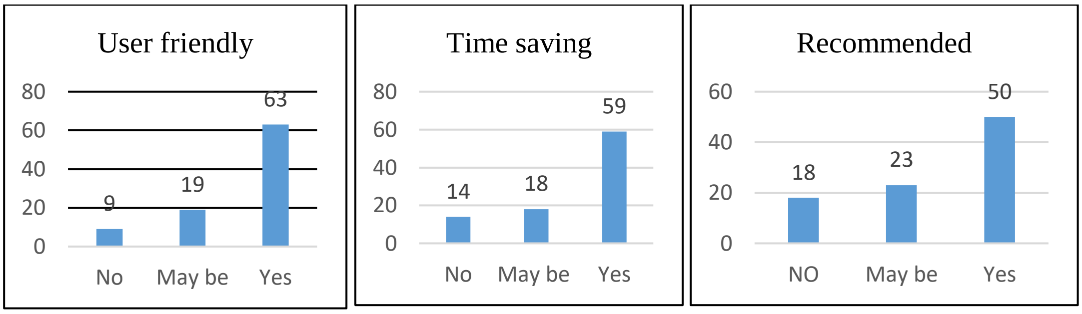


Figure 7-11 Participants' opinion toward the new reporting form for Near Miss

The overall average opinion of the participants towards the implementation of the new reporting form is within the acceptable range as the agreement score is 73.5%. The factors that influenced this score not to be higher was listed under the fourth question, which was asked to acquire the participants' opinion. The question is "What is the advantage, or the disadvantage of the new reporting form compared to the existing one?". Under this question, there were 91 responses. Those responses were considered carefully, then a list of the advantages and the disadvantages was created. Table 7-5 below shows all the recommendations that were highlighted by the participants while using the new reporting form for the Near Miss.

Table 7-5 Recommendation toward the newly designed reporting form

The advantage of the new reporting form	**The disadvantage of the new reporting form**
• Anonymous, which means freedom of the seafarers to report each Near Miss without fear of blame. • Wide range of options under the drop-down list. • The option that includes the third party which involved in the Near Miss. • Timesaving. • Positive colour. • Encourage the crew to think of	• Master approval is missing. • Crew members do not have time to adopt a new system. • Name of the person who takes the corrective action is missing. • Report saving option before the submission.

the root causes. • The separation between the classes of the unsafe act and the unsafe condition. • The analysis of the reports is assumed to be easier as much details are included in the new form.	

The advantages listed by the participants are appreciated, as they have proven the hypothesis. Regarding the disadvantage, some of it cannot be taken into consideration for some reasons. Such as; the Master approval, no time to adopt a new system and the saving option before submitting the report. Firstly, the Master validation and the saving option will be included in the new form after it passes the testing mood and when the company would like to implement as an official reporting form. In the testing mood, the researcher is the only person who is receiving those reports and conducting the analysis. That is why the Master approval was not necessary at that point.

Secondly, some of the participants have said there is no time to adopt a new system. The seafarers' busy schedule and overlapping duties cannot be denied. However, if the seafarers are familiar with the existing reporting form, then the new one will be indulged to the seafarers' minds without any efforts as the new reporting form is user-friendly and can be accessed through the company portal the same as the old one. Moreover, the details and terminologies that included in the new form is well-known and considered to be within their daily life.

Those disadvantages played a significant role in reducing the overall agreement score of making this form as the official form by the company. The new reporting form and flowchart has been presented to the company's key personnel for their considerations and tested by the company's seafarers for validation. The final decision will be taken by the shipping company to adopt the new reporting system for Near Misses or not after the completion of this thesis.

7.7. Conclusion

Based on some of the existing reporting form for Near Misses in the aviation sector and the maritime domain, the newly designed reporting form was introduced to the company. Some modifications have been applied to the form after conducting the interviews with the key personnel at the main office. The new reporting was launched to all the seafarers throughout the company using an anonymous link that allows the researcher to report Near Misses to examine its efficiency. The outcome that resulted from the new reporting form is very promising, and the analysis team who will be in charge to collect such a report will have a broader view to come up with more detailed results. That will help the company to take preventive actions for the most repeated Near Misses. Moreover, with tracing the root causes and consequences, an accident could be predicted by the analysis team at the company. Above all, standardising one of the IMO requirements will make seafarers life less complicated and increase their resilience and safety culture. This is the main aim after all. The next chapter will examine the content of the collected reports via the newly designed reporting form as well as presenting a comparison of the quality and the accuracy of the outcomes between the existing reporting form and the newly designed reporting form.

8. Comparison of the outcomes of the company’s existing NMR form and the Proposed NMR Form

8.1. Chapter Overview

This chapter presents and compares the outcomes of the collected Near Miss reports from the company’s existing NMR system and the newly designed NMR form. The comparison will be in the form of a descriptive analysis of the outcomes from each reporting form. In addition to that, experts' opinion on the quality of the reported cases for both reporting form will be taken into consideration while analysing the comparison. The subject matter experts from the shipping industry will evaluate the given rate to the reports, potential consequences, root causes and the immediate corrective action. The chapter is concluded by discussing the findings of the data analyses.

8.2. Introduction

The new reporting system for Near Misses was shared among the company seafarers to collect a sample of real Near Miss cases and the feedback on the proposed Near Miss Reporting form, as aforementioned in chapter 7. Most of the data collected from the NMR reports such as; the ship' type, ship's operations type and the voyage status of the ship at the time of the Near Miss were provided and analysed in chapter 7. The main description of the Near Misses such as; potential consequences, root causes and the immediate corrective action are further studied and will be listed and analysed in this chapter. Besides listing the outcomes, a comparison between the outcomes of both reporting forms will also be included in this chapter. The comparison will provide a clear picture of the feasibility and effectiveness of the newly designed Near Miss reporting form against the existing NMR.

All of the information available is the original information without any interventions by the author. In each table, a discussion on the quality of the listed Near Miss cases, descriptive analysis and the experts' opinion on each reported case is presented.

An evaluation of all the completed Near Misses from both reporting forms will also be discussed in this chapter. The evaluation will be conducted by taking experts' opinions on each completed case. Besides , the subject matter experts will classify the Near Misses based on the classifications that have been approved in the BERTRANC PROJECT by (European commission, 2000). The next section of this chapter presents the Near Miss cases from both reporting forms.

8.3. Evaluating criteria for the collected Near Misses

In order to evaluate the collected Near Miss reports from both reporting forms, the existing reporting form used by the company and the proposed reporting form, each participant's opinion was given a weighting based on his working experience, rank and current employment status. Table *8-1* below shows the details of the experts along with the weighting for each expert.

A total of five experts participated in the online workshop, and the evaluation of the cases by experts took place through an online link. Some of the experts were senior seafarers, and some others were researchers with seafaring experience and interested in the field of maritime safety.

Table 8-1 Experts' experience

Expert's Code	Working field	Experience	Weighting
Expert 1	Seafarer/Academic (Retired 2nd officer/professor Assistant)	11-15 years	3
Expert 2	Seafarers (Acting Captain)	15-20 years	4
Expert 3	Academic (Acting researcher in maritime safety)	6-10 years	1
Expert 4	Seafarers (Acting 2nd Officer)	6-10 years	2
Expert 5	Seafarers (Acting Chief Officer	11-15 years	3

The percentage of the accuracy of each reported case was calculated based on the weightings of the experts' opinion. Thus, if the parameters for a particular case were accurate according to the experts, then the case will be evaluated as 100% accurate and recorded as a valid Near Miss case. Table *8-4* below shows the percentage of the accuracy of the cases based on the weightings of the experts' opinion. The collected reports from the existing reporting form were evaluated by the experts by deciding if the case is valid Near Miss or not, then checking the accuracy of the four different parameters (Rate, Potential consequence, Root causes, Corrective action). Thus, based on the number of accurate parameters, the percentage was given to the case.

The second section of the workshop was the evaluation of the collected and reported cases by using the newly designed reporting form by asking the experts if the case was a valid Near Miss case or not. If yes, then they were asked to evaluate six different parameters for each case (Rate, Potential consequence, Root causes, Corrective action, Lessons learned, Class of the case). Based on the number of accurate parameters, the percentage was given to each case. Appendix K is presenting the full responses by the experts toward each case. The opinion of each expert was listed in a separate table. Each parameter will be given a colour code based on the total accuracy level, as shown in *Table 8-2* below.

Table 8-2 Limit of the colour code based on the accuracy level of each parameter

Colour code	Accuracy level limit for the reported Near Misses through the existing reporting form	Accuracy level limit for the reported Near Misses through the newly designed reporting form	Interpretation of the accuracy level limit and the colour code
Green	25% - 23.06%	16.66% - 15.36%	The parameter is reliable
Diminished green	23.05% - 19.22%	15.35% - 10.24%	The parameter is required a little improvement
Yellow	19.21% - 13.45%	10.23% - 8.96%	The parameter is required moderate improvement
Amber	13.44% - 9.61%	8.95% - 6.40%	The parameter is required significant improvement
Red	9.60% - 1.92%	6.39% - 1.28%	The parameter is not reliable
No colour code	Not accurate at all	Not accurate at all	

The second step was taking the sum of the percentages given by five experts for each reported case to give each case the final accuracy rate. Thus, the valid cases will be given colour code, as shown in Table *8-3* below. The green colour code is demonstrating the valid Near Miss cases that scored 90% and above of the accuracy scale. The diminished green colour code is demonstrating the valid Near Miss cases that scored 80% -89.99% of the accuracy scale. Cases from 60% - 79.99% on the accuracy scale are demonstrated in the yellow colour code. Cases from 40% - 59.99% on the accuracy scale are demonstrated in the amber colour code. Therefore, the rest of the cases below 40% on the accuracy scale is demonstrated in the red colour code.

Table 8-3 Accuracy rate and its interpretation of the valid Near Misses

Colour code	The Sum of the accuracy level of all of the parameters	Interpretation of the accuracy level limit and the colour code
Green	90% and above	The case’s parameters are reliable
Diminished green	80% - 89.99%	The case’s parameters are required a little improvement
Yellow	60% - 79.99%	The case’s parameters are required moderate improvement
Amber	40% - 59.99%	The case’s parameters are required significant improvement
Red	39.99% and below	The case’s parameters are not reliable

Some of the cases were evaluated as a valid Near Miss by some of the experts, while the remaining experts evaluated them as not valid Near Miss cases. Therefore, those cases were given the Sum of the accuracy percentage according to the experts who said they are valid Near Miss cases.

Table 8-4 value of the accuracy guidance based on the experts' load

Expert	MH (load 3)	OA (load 4)	MG (load 1)	NA (load 2)	HA (load 3)
Cases from the existing reporting form (4 parameters)	• 5.76% • 11.53% • 17.30% • 23.07%	• 7.69% • 15.38% • 23.07% • 30.76%	• 1.92% • 3.84% • 5.76% • 7.69%	• 3.85% • 7.69% • 11.53% • 15.38%	• 5.76% • 11.53% • 17.30% • 23.07%
Cases from the newly designed reporting form (6 parameters)	• 3.84% • 7.69% • 11.53% • 15.37% • 19.21% • 23.07%	• 5.12% • 10.25% • 15.38% • 20.50% • 25.63% • 30.76%	• 1.28% • 2.56% • 3.84% • 5.12% • 6.40% • 7.69%	• 2.56% • 5.12% • 7.68% • 10.24% • 12.80% • 15.38%	• 3.84% • 7.69% • 11.53% • 15.37% • 19.21% • 23.07%

8.4. Sample Reports of the Existing NMR System

During the visit to the head office of the shipping company, a sample of 189 Near Miss reports was collected from the company's system by taking screenshots. The selection of the reports was random and without looking at the ships' type to ensure the collection of a wide range of information and non-bias. One hundred fifty-six Near Miss reports out of the 189 were complete reported cases. Table *8-6* below provides details of 156 fully complete Near Miss cases which have the rate of the Near Miss, potential consequences, root causes and immediate corrective actions. This means 82.54% of the collected reports are complete cases. The full list of the 189 collected Near Miss reports is available in Appendix L. The reports that have missing information such as; (personal factor root causes and job factor root causes), (root causes comment) and (shipboard management comment) is still available in Table *8-6* below and has been evaluated by the experts during the workshop. Those reports are still valid Near Misses, as all of the necessary information are available along with each report. The personal factor root causes and job factor root causes are not making any difference to the quality of the report, as it can be written in the comment section. Moreover, the author has noticed that the list of all the personal factor root causes is the same as the root causes. Most of the reports were submitted without comments about the root causes. These are the reasons for keeping those reports in the Near Miss table given below. the accuracy rate for each parameter was calculated according to the criteria of the experts' weightings as mentioned earlier in Table *8-4* and section 8-3 above.

Figure 8-1 below shows the percentage of the cases that were selected by the experts as valid Near Miss cases. As Figure 8-1 shows, 91.02% (142 Near Miss) of the evaluated cases were classed as valid Near Misses as they have fulfilled the real meaning of Near Miss: *Unplanned action by any of the seafarers or unsafe condition detected at the time of the operation that could contribute to* *accidents or incidents if a series of Near Misses have not been intervened*. Each of the 142 Near Misses was rated out of 100% based on the criteria of the evaluation as aforementioned in section 8.3; the given rate, potential consequence, root causes and the immediate corrective action. They were followed by 32 Near Misses were rated 75% on the accuracy scale. The rest of the Near Misses were distributed on a scale of 50%, 25% and 0%. Only two Near Misses were evaluated as 0% accurate cases. The next section presents the cases, which were evaluated based on the experts' point of view.

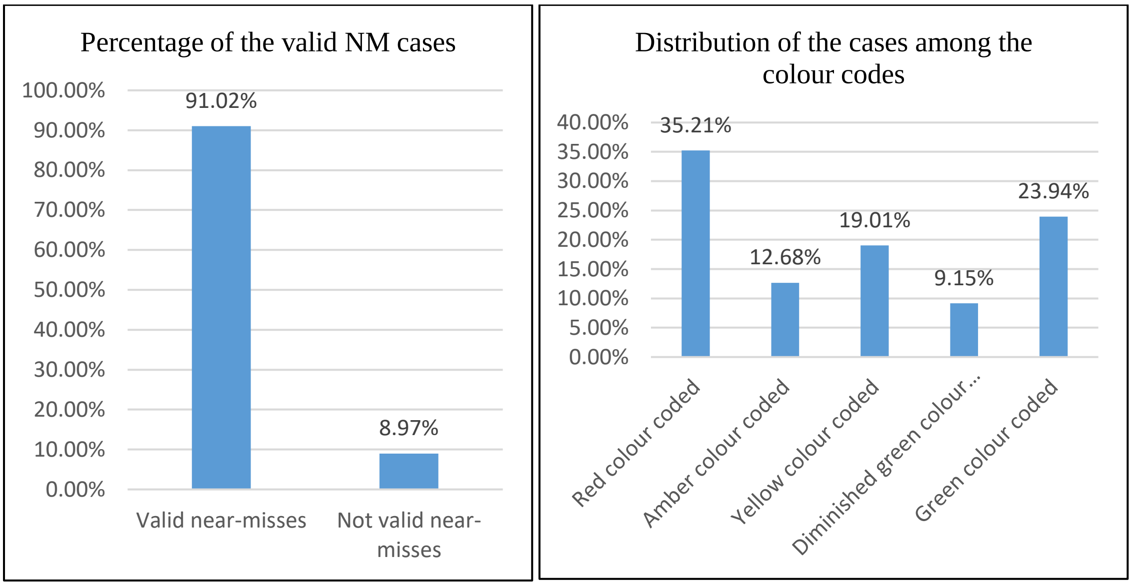


Figure 8-1 Initial evaluation of the cases

Generally, the mean of the accuracy and the score of the valid Near Misses that were reported via the existing reporting form are calculated and presented in Table *8-5* below. The mean values of Near Miss reports that were reported using the existing reporting form and the new reporting form will be compared at the end of this chapter to determine if any improvement was achieved by using the newly designed reporting form. Equation 8.1 below shows the calculation method for the mean using Likert-type scale (5 points):

$$Mean = \frac{(f*5)+(f*4)+(f*3)+(f*2)+(f*1)}{\text{sample size}} \qquad \text{(Eq 8.1)}$$

Equation 8.2 below shows how to convert the mean to a percentage. This equation will be used in the next section to calculate the score for each statement and each domain.

$$\text{Score in percentage (\%)} = \frac{\text{Mean}-1}{5-1} * 100 \qquad \text{(Eq 8.2)}$$

Table 8-5 Mean and score of the accuracy of the Near Misses collected via the existing reporting form

The case's parameters are not reliable	The case's parameters are required significant improvement	The case's parameters are required moderate improvement	The case's parameters are required a little improvement	The case's parameters are reliable	Mean	The score of the rate of accuracy
50	18	27	13	34	2.73	43.25%

Table 8-6 Evaluation of the existing reporting form by the experts

No	Near Miss description	Rate	Accuracy rate of the (Rate)	Rate according to experts	Potential consequence	Accuracy rate of the (potential con)	Root causes	Accuracy rate of the (root causes)	Immediate corrective action	Accuracy rate of the (corrective action)	Class according to experts	Accuracy of the case
1	burner electric motor has found burned out due to extreme local temperature	High		Low	Machinery damage	1.92%	Equipment failure	1.92%	replace the electric motor with a spare one	1.92%		5.76%
2	during a routine inspection, a burned plastic was found in the laundry room and blocked the dryer exhaust which led to damage to the dryer also the socket gets damaged	High	13.45%		Fire	19.22%	Incorrect use of equipment	1.92%	Circuit isolated	19.22%	Attitude, Actual behaviour at time of accident/occurrence	57.16%
3	during concocting cargo hose, the o ring was observed damaged	High	1.92%		Property damage	11.53%	Lack of maintenance	11.53%	The O ring was replaced immediately	11.53%		36.52%
4	one of the crew used the air compressor to blow himself from dust	High		Low	Health or illness	11.53%	Lack of skills	25%	He was instructed to not do this again	25%	Ability, skills, knowledge of the people involved, Actual behaviour at time of accident/occurrence	61.00%
5	during making a repair for steam pipe in the purifier room, the temperature of fuel oil was found 78 degrees instead of the designed temperature 90 degree	Low			Property damage		Lack of maintenance		The machine has been calibrated			Not a Near Miss
6	one of the mooring winches has no handle for the hydraulic brake system. in case of emergency, it will be very hard to open or close the break	Low	1.92%		Machinery damage	1.92%	Defective tool	1.92%	Using adjustable wrench to use the break			5.76%
7	fire extinguisher in the port safety locker was obstructed by few boxes this could lead to a delay in fighting a fire in case of fire	Low	25%		Fire	25%	Housekeeping	25%	Boxes were removed immediately	25%	Ability, skills, knowledge of the people involved, On board management	100%
8	While the taking over the watch I found the laminator machine switched on and very hot	Low	25%		Fire	25%	Carelessness	25%	The machine was switched off immediately	25%	Actual behaviour at time of accident/occurrence	100%

No	Near Miss description	Rate	Accuracy rate of the (Rate)	Rate according to experts	Potential consequence	Accuracy rate of the (potential con)	Root causes	Accuracy rate of the (root causes)	Immediate corrective action	Accuracy rate of the (corrective action)	Class according to experts	Accuracy of the case
9	during a fire drill on deck, one of the fires monitored valve was not able to be open by hand. also, the F-key was not in the area	Low			Fire		Poor work practice		pump man was informed to check to secure of the key all the times			Not a Near Miss
10	fire alarm in the workshop in the engine room was noticed during the test to have some delay	Low			Fire		Defective tool		The fire alarm was replaced by a new one			Not a Near Miss
11	rags were found next to diesel generator which could lead to fire	Low	1.92%		Fire	25%	Housekeeping	15.37%	Rags were removed	25%	Ability, skills, knowledge of the people involved, Attitude	71.14%
12	two of the portable foam extinguishers were not marked with the requirement	Low	1.92%		Fire	1.92%	Lack of skills	1.92%	Replaced with new ones	1.92%		7.69%
13	The securing padlock key for the fire monitor on deck found not secured in case if the key fall it may cause a spark	Low	25%		Fire	25%	Lack of skills	25%	The key was secured	25%	Ability, skills, knowledge of the people involved, Actual behaviour at time of accident/occurrence	61.52%
14	the kettle in the crew mess room was boiling water continually, and the steam was condensing on the ceiling near to the smoke detector	Low	1.92%		Fire	1.92%	Equipment failure	1.92%	A replacement kettle was put in the mess-room	1.92%		7.69%
15	two crew members were chipping in the manifold area without proper PPE (Helmet)	Low	15.37%		Health or illness	11.53%	Failure to use PPE	25%	They were advised to wear the helmet	25%	Attitude	82.20%
16	two gratings at the area around the ladder at steering gear room were noted missing and left a big gap	Low	1.92%		Health or illness	1.92%	Poor work practice	1.92%	The fitter was notified to fabricate new steps	1.92%		7.69%
17	during picking up some provisions from service boat, one of the crew was standing under the crane	Low	1.92%		Health or illness	25%	Lack of skills	25%	The safety officer notified him immediately	25%	Attitude, Actual behaviour at time of accident/occurrence	82.12%
18	one of the crew was climbing the stairs on the engine room with both hands full of heavy objects	Low	25%		Personal accident case	25%	Lack of skills	25%	Another crew helped him	25%	Attitude, Teamwork	100%

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19	during routine inspection for a watertight door, they noticed all butterfly screw was overpainted and could not unscrew. in case of emergency, escape route could be obstructed	Low	23.06%		Property damage	11.53%	Lack of skills	25%	The extra paint was removed	25%	Assignment of duties	84.08%
20	one Helmet was found in the stairs	Low	23.06%		Personal accident case	23.06%	Carelessness	23.06%	Helmet removed	23.06%	Attitude, Actual behaviour at time of accident/occurrence	92.28%
21	someone left a shackle on the stairway	Low	23.06%		Personal accident case	23.06%	Carelessness	23.06%	Immediately removed	23.06%	Attitude, Actual behaviour at time of accident/occurrence	92.28%
22	one of the engineers used hatch to go down for some task, and he left the hatch open without any guard around it to prevent anyone from falling	Low	1.92%		Personal accident case	25%	Failure to comply with proper procedure	25%	The duty engineer was called to come and close the hatch	25%	Attitude, Actual behaviour at time of accident/occurrence	76.89%
23	one of the oilers was using the stairs going down while he was carrying things in both hands	Low	25%		Personal accident case	25%	Failure to comply with proper procedure	25%	An oiler stopped him from helping	25%	Ability, skills, knowledge of the people involved, Attitude, Actual behaviour at time of accident/occurrence	100%
24	during the boarding of the agent and port authority, the clinometer of the gangway was not fixed	Low	1.92%		Personal accident case	1.92%	Failure to comply with proper procedure	1.92%	The crew were instructed to fix clinometer	1.92%		7.69%
25	while fixing the coupling of the air hose, the worker finds it difficult with gloves, so he decided to take it off. his fingers could be cut	Low	25%		Personal accident case	25%	Failure to use PPE	25%	The crew was immediately stopped	25%	Ability, skills, knowledge of the people involved, Actual behaviour at time of accident/occurrence	100%

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26	one of the crew was applying rust remover on a rusty area without wearing eye protection	Low	1.92%		Personal accident case	25%	Failure to use PPE	25%	The task was shut off immediately, and the crew was instructed to wear safety goggle	25%	Ability, skills, knowledge of the people involved, Attitude, Actual behaviour at time of accident/occurrence	76.89%
27	the frame of the basketball was damaged	Low			Personal accident case		Housekeeping		Stopped playing			Not a Near Miss
28	a trolley was found in the alleyway inside the accommodation with no securing while the ship is in the open sea	Low	23.06%		Health or illness		Incorrect use of equipment		Trolley removed immediately	23.06%	Attitude	46.13%
29	during washing seaside gangway by a high-pressure water hose, one of the crew was not wearing a safety harness.	Low	1.92%		Personal accident case	25%	Lack of skills	25%	The AB passed the harness to the crew	25%	Ability, skills, knowledge of the people involved, Attitude, Actual behaviour at time of accident/occurrence	76.89%
30	while preparing for anchoring the sea was slightly high, which resulted in the slipping of one of the crew. Luckily, he did not get injured, and he was able to keep his balance.	Low			Health or illness		Carelessness		The duty officer advised all of the crew in the area to hold any stationary object to not fall down			Not a Near Miss
31	while preparing one of the ballast tanks for inspection, the cover flange was open for ventilation and left unattended and without any mark	Low		Medium	Personal accident case	23.06%	Inadequate work standard	9.61%	The guard tape was installed immediately	23.06%	Procedures and standing orders communication (internal and external)	55.74%
32	during working on the provision crane, one of the crew was not wearing Helmet which could result in serious injury or even death	Low	11.53%		Personal accident case	25%	Carelessness	25%	He was asked to go to the accommodation to get the Helmet	25%	Attitude, Actual behaviour at time of accident/occurrence	86.51%

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33	during his watch, he saw one of the crew members working on the platform Infront of the bridge without a harness	Low	1.92%		None conformance	1.92%	Carelessness	15.37%	A harness was given to him to be fitted	25%	Attitude, Planning of work, Actual behaviour at time of accident/occurrence	44.20%
34	the escape hatch in the elevator at the nav deck was blocked with a padlock from outside. this was noticed during an annual check	Low	23.06%		None conformance	9.61%	Carelessness	9.61%	Hatch unlocked	23.06%	On board management and supervision, Procedures and standing orders communication (internal and external)	65.36%
35	a barricade tape was missing at the area with no gratings	Low		Medium	Health or illness		Carelessness	9.61%	The AB remains at the area and called another crew to bring the barricade	23.06%	On board management and supervision, Planning of work	32.67%
36	shekels and chain were secured badly at securing point	Low	23.06%		Property damage	23.06%	Lack of knowledge	23.06%	The shekels and the chain were re-secured again in the correct way	23.06%	Ability, skills, knowledge of the people involved	92.28%
37	during a routine check on deck, a nonsecure bag full of rags were found near to the incinerator, and the place was slightly oily due to leakage. this might cause slipping to any of the crew or even fire if the fire tringle was existing	Low	1.92%		Fire	25%	Carelessness	25%	The bag of the rags was removed	25%	Attitude, Actual behaviour at time of accident/occurrence	76.89%
38	during some tasks on the engine room, one of the crew was found without a harness	Low	1.92%		Personal accident case	25%	Lack of knowledge	25%	The crew was asked to come down to wear the harness	25%	Ability, skills, knowledge of the people involved, Actual behaviour at time of accident/occurrence	76.89%
39	a weathertight door on the port side of the accommodation was open without securing the hook while someone was working behind the door	Low	25%		Personal accident case	25%	Incorrect use of equipment	1.92%	The door was shut immediately	23.06%	Actual behaviour at time of accident/occurrence	74.46%

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40	chipping on deck without Helmet	Low	25%		Personal accident case	25%	Poor work practice	25%	He was asked to bring the Helmet	25%	Actual behaviour at time of accident/occurrenc e	100%
41	one of the crew was noticed by the Master while he fitted the chain block to pad eye without support to step ladder	Low	25%		Personal accident case	25%	Incorrect use of equipment	1.92%	The Master supported the ladder while he finishes the task	25%	Planning of work, Procedures and standing orders communication (internal and external)	76.89%
42	one of the crew was going down through the stairs while he was carrying a big box which was obstructed him from seeing the way	Low	25%		Personal accident case	25%	Poor work practice	25%	He was stopped, and someone helped him	25%	Attitude, Actual behaviour at time of accident/occurrenc e	100%
43	while working near to the main engine, the railing was found damaged. this could lead to serious injury or fatality	Low		Medium	None conformance	1.92%	Lack of maintenan ce	1.92%	The rails were fixed after notifying the fitter	1.92%		5.76%
44	during connecting a hose to the ship's manifold, they noticed one of the greeting sheets were partly corroded	Low		Medium	Property damage	1.92%	Lack of maintenan ce	1.92%	The corroded part has been replaced	1.92%		5.76%
45	one of the steps in the ladder going to garbage area was broken	Low		Medium	Personal accident case	1.92%	Excessive wear and tear	1.92%	The step to be fixed in the correct place	1.92%		5.76%
46	the local manual activation buttons for water mist and incinerators protection glass was broken, and the rest of the broken glass was left inside the frame of the button. then they cover it with duct tape which makes it impossible for anyone to find out whether the button is activated or not	Low		Medium	Machinery damage	11.53%	Incorrect use of equipment	1.92%	The tape was removed, and the button was replaced	25%	Ability, skills, knowledge of the people involved	37.93%
47	during a routine round on the engine room, the grainer in the workshop was found in working mode unattended. this could lead to injury	Low	23.06%		Machinery damage	25%	Incorrect use of equipment	25%	The grainer was shut off	25%	Ability, skills, knowledge of the people involved	97.54%

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48	some valves related to changing full mode were found shut down due to negligence	Low		Medium	Fire		Incorrect use of equipment	9.61%	The valve was turned on again	23.06%	Ability, skills, knowledge of the people involved, Procedures and standing orders communication (internal and external)	32.67%
49	one of the navigational shapes is not according to the requirement college annexe I 6 b	Low			None conformance		Incorrect use of equipment		Shape was corrected			Not a Near Miss
50	hospital weathertight door handle not in a position	Low			None conformance		Housekeeping		The handle is back again in position			Not a Near Miss
51	pressure gauge of sewage vacuum was fluctuating which make the pump in running condition continuously	Medium	1.92%		Machinery damage	1.92%	Housekeeping	1.92%	the peel of the fruit was removed from the valve flap	1.92%		7.69%
52	rescue line in the engine room escape trunk was found in the bottom of the platform	Medium		Low	Personal accident case	1.92%	Housekeeping	1.92%	rescue line was placed back	1.92%		5.76%
53	some of the crew left their PPE in the alleyway, which gives indication that someone in his cabin not in the master station in case of abandon ship.	Medium	9.61%		Personal accident case	25%	Housekeeping	15.37%	everyone keeps his shoes inside his cabin	15.37%	Attitude	64.85%
54	foam firefighting valve for the fixed system in the engine room found incorrectly set, the tank left with foam mixture more than 2%, and it must be less	Medium		High	Fire	11.53%	Incorrect use of equipment	11.53%	the valve was adjusted as per last foam analysis certificate	11.53%	Procedures and standing orders communication (internal and external)	34.09%
55	changing room door was left open by a door stopper. in case of fire inside the room, the fire will spread to our side	Medium	13.45%		Fire	25%	Equipment failure	1.92%	The faulty door was disconnected, and the door closed	25%	Ability, skills, knowledge of the people involved	64.85%
56	sampling hose in the gas meter was damaged	Medium	1.92%		Fire	1.92%	Equipment failure	1.92%	The hose was replaced	1.92%		7.69%
57	during maintenance for system on the purifier room, isolation material for one of the steam valves was found totally damaged. This could leak hot steam to any person nearby.	Medium	1.92%		Personal accident case	1.92%	Equipment failure	1.92%	The leak was sealed	1.92%		7.69%

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58	chipping without safety goggles	Medium		Low	Personal accident case	25%	Poor work practice	25%	He was asked to bring the safety goggles	25%	Attitude, Actual behaviour at time of accident/occurrence	74.46%
59	during working on pneumatic tools, one of the air hoses was lacking due to storing it in a sunny place, and the hose loses its flexibility	Medium		Low	Personal accident case	1.92%	Equipment failure	1.92%	The hose gets replaced	25%	Ability, skills, knowledge of the people involved	26.24%
60	during working on the ER store, the air hoist access cover between the store and the workshop was not secured. It might fall if someone tried to remove it.	Medium		Low	Property damage	1.92%	Housekeeping	1.92%	The cover was secured	15.37%	State of maintenance (not maintained, badly maintained)	16.64%
61	one of the crew was working on the light post without wearing a safety harness and pulling heavy tools from Hight.	Medium	23.06%		Personal accident case	25%	Failure to use PPE	25%	A harness was given to him to be fitted	25%	Ability, skills, knowledge of the people involved, Attitude	97.54%
62	some of the ratings in the engine room use their dirty gloves while going up and down on the stairs. that led to slippery handrails	Medium	13.45%		Health or illness	1.92%	Failure to comply with proper procedure	1.92%	This matter was discussed several times and no improvement	1.92%	Ability, skills, knowledge of the people involved, Attitude, Actual behaviour at time of accident/occurrence	18.71%
63	during conducting me overhauls, some contracture was not wearing Helmet	Medium	23.06%		Personal accident case	25%	Failure to use PPE	25%	A helmet was given to him to be fitted	25%	Ability, skills, knowledge of the people involved, Management commitment to safety	97.54%
64	while working on the midship crane lifting harmful material, some crew were not wearing safety goggles	Medium	23.06%		Personal accident case	25%	Failure to use PPE	25%	Safety goggles were given to him to be fitted	25%	Attitude	97.54%
65	during pump room inspection he noticed on of the ladder steps is not incorrect level which could lead to personal injury	Medium			Personal accident case		Poor access		informed the pump man to highlight the hazard			Not a Near Miss

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66	the fire alarm was sounded in the incinerator due to smoke coming from the bottom of that area in the sludge which resulted from leakage of waste through the air ventilation in the area. This event caused the incinerator to shut down.	Medium		Low	Fire	1.92%	Failure to comply with proper procedure	1.92%	The alarm was acknowledged, and the source of the smoke was checked	1.92%		5.76%
67	he has noticed that the oil temperature remote indication for all purifiers in the CAM are giving a wrong reading	Very High		High	Machinery damage	1.92%	Equipment failure	1.92%	the CPU at the purifier for was replaced	1.92%		5.76%
68	detection point for fire is not working. Discovered during the weekly check.	Very High		High	Machinery damage	1.92%	Equipment failure	1.92%	The old part was replaced	1.92%		5.76%
69	some fire detection call point in the engine were not activated	Very High	13.45%		Fire	15.37%	Equipment failure	1.92%	replace a call point from ship stock	15.37%	Equipment (availability, reliability), State of maintenance (not maintained, badly maintained)	45.63%
70	deck fire doors do not close due to some glue was applied to the door	Very High	9.61%		Fire	25%	Incorrect use of equipment	1.92%	door freed up	25%	Ability, skills, knowledge of the people involved	61.00%
71	during safety tour on deck, he found corn brooms were placed on the deck. this broom is a fire hazard	Very High	9.61%		Fire	15.37%	Housekeeping	25%	Remove from use	15.37%	Actual behaviour at time of accident/occurrence	64.85%
72	pump room firefighting system and general alarm were not working. and the air horn found totally damaged	Very High	1.92%		None conformance	1.92%	Defective tool	1.92%	spare horn was fitted in place	1.92%		7.69%
73	hot sparks were generating from some task in the workshop going to a working place where a crew was holding something contains a diesel	Very High	23.06%		Fire	25%	Carelessness	25%	The grinder was stopped	25%	Actual behaviour at time of accident/occurrence	97.54%
74	during disconnecting cargo hose, one of the crew was not wearing gloves	Very High		Low	Personal accident case	25%	Failure to use PPE	25%	The crew asked to wear gloves	25%	Attitude, Actual behaviour at time of accident/occurrence	74.46%
75	during the preparation for arriving port, he noticed the pilot ladder rope was damaged	Very High		Low	Personal accident case	1.92%	Lack of maintenance	1.92%	The crew were instructed to replace the damaged ladder with a new one	1.92%		5.76%

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76	during the elevator maintenance process, some accumulated oil was found on the shaft	Very High		Low	Machinery damage	1.92%	Failure to comply with proper procedure	1.92%	The accumulated oil was cleaned	1.92%		5.76%
77	someone get hit by the toilet door while he was inside without locking the door	Very High		Low	Personal accident case	23.06%	Carelessness	23.06%	Crew was warned	23.06%	Actual behaviour at time of accident/occurrence	69.20%
78	the shape hatch in the elevator at the nav deck was blocked with a padlock from outside. this was noticed during an annual check	Very High		Medium	None conformance	15.37%	Failure to comply with proper procedure	1.92%	The padlock was forced off	25%	survey and inspections, Planning of work	41.77%
79	unsecured pipes were found on the deck	Very High		Low	Health or illness	1.92%	Housekeeping	25%	Pipes were secured	25%	Actual behaviour at time of accident/occurrence	51.39%
80	one of the portable grinders does not have a safety guard. the user should have checked that before using it	Very High		Medium	Machinery damage	1.92%	Incorrect use of equipment	1.92%	This grinder should be checked before using	1.92%		5.76%
81	during disconnecting cargo hose, one of the crew members did not wear safety gloves	Very High		Low	Machinery damage		Defective tools	1.92%	The crew was asked to wear gloved	15.37%	Attitude, Actual behaviour at time of accident/occurrence	17.29%
82	while the pilot and the loading master were coming on-board using the pilot ladder, the winch has stopped working. The pilot and the loading master remained stuck for 15 minutes	High			Personal accident case		Equipment failure		The winch was fixed immediately			Not a Near Miss
83	while a crew was using a portable device on the ER workshop, I noticed the device does not have a safety instruction.	Low			Health or illness		Incorrect use of equipment		The instructions were posted next to the device			Not a Near Miss
84	a crew member in the ER was seen skipping a step in the stair while he was carrying things.	Low	23.06%		Personal accident case	23.06%	Failure to comply with proper procedure	13.45%	He was stopped immediately	23.06%	Attitude, Actual behaviour at time of accident/occurrence	82.66%

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85	a crew member in the ER was running down the stairs without caution	Low	25%		Fire	1.92%	Carelessness	15.37%	Turned off	1.92%	Attitude, Actual behaviour at time of accident/occurrence	44.20%
86	during taking over the watch, the laminator machine was switched on and very hot.	Low	25%		Fire	25%	Carelessness	25%	The machine was switched off immediately	25%	Attitude, Actual behaviour at time of accident/occurrence	100%
87	one of the engine crew was carrying a barrel of oil without covering it; the sea was rough	Low	25%		Health or illness	1.92%	Failure to comply with proper procedure	15.37%	He was stopped immediately	25%	Attitude, Actual behaviour at time of accident/occurrence	67.28%
88	while chipping near to the manifold area, one of the crew did not wear proper PPE (safety goggles)	Low	25%		Personal accident case	25%	Failure to use PPE	25%	goggles were given to him to be fitted	25%	Attitude, Actual behaviour at time of accident/occurrence	100%
89	hospital weather tide door was left open.	Low	23.06%		Fire	13.45%	Failure to use PPE		The door was closed	23.06%	Attitude	59.59%
90	while attending the weekly drill, one of the crew was running at the stairs without holding rails.	Low	25%		Personal accident case	25%	Poor work practice	15.37%	He was stopped, and someone helped him	25%	Attitude, Actual behaviour at time of accident/occurrence	90.35%
91	one of the hatches covers in the ER room was not fixed in the right position.	Low	1.92%		Property damage	1.92%	Poor work practice	1.92%	The cover was removed and replaced again in the position	1.92%		7.69%
92	during disconnecting cargo hose, a damaged O ring gasket on the cargo hose was observed.	Medium		Low	Property damage	1.92%	Lack of maintenance	1.92%	The O ring was replaced immediately	1.92%		5.76%
93	while loading crude oil and connecting cargo hose. One of the crews from the port authority was not wearing gloves.	Low	25%		Personal accident case	25%	Failure to use PPE	25%	gloves were given to him to be fitted	25%	Attitude, Actual behaviour at time of accident/occurrence	100%

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94	while crew members were doing chipping on the x platform on one of the valves. one of the crew was doing on the top of the valve and the 2nd on the bottom of the valve without the Helmet (PPE)	Medium	13.45%		Personal accident case	25%	Failure to use PPE	25%	A helmet was given to him to be fitted	25%	Attitude, Actual behaviour at time of accident/occurrence	87.92%
95	the crew member was observed doing chipping without safety goggles.	Low	25%		Personal accident case	25%	Failure to use PPE	25%	A goggle was given to him to be fitted	25%	Attitude, Actual behaviour at time of accident/occurrence	100%
96	while working with the air compressor and connecting the air hose, the hose was leaking.	Low			Machinery damage		Housekeeping		The hose was replaced			Not a Near Miss
97	while the vessel was at sea. The ladder goes to the big garbage observed wobbly. this could result in a fall	Low			Health or illness		Environmental damage		The fitter was notified to fabricate new steps			Not a Near Miss
98	while carrying out an inspection for FFLB, it was observed that circular guard rail on the vertical ladder leading to the platform for securing L/B to davit via shackle and chain was badly wasted at securing point to the railing	Medium	15.37%		Property damage	1.92%	Poor work practice	15.37%	The shekels and chain were re-secured	15.37%		48.06%
99	no barricade tape put around the area at emergency generator room entrance. where the grating has been removed for maintenance	Low	13.45%		Health or illness		Carelessness		The crew remains at the area and called another crew to bring the barricade	23.06%	Procedures and standing orders communication (internal and	36.51%
100	at steering gear room platform, a big gap between two plates was found.	Low			Health or illness		Poor work practice		The fitter was notified to fabricate new steps			Not a Near Miss
101	the ballast tank opening was left open with no Gard tape.	Low	15.37%		Health or illness	1.92%	Carelessness	1.92%	The crew remains at the area and called another crew to bring the barricade	25%	Ability, skills, knowledge of the people involved, Attitude, accident/occurrence	44.20%

No	Near Miss description	Rate	Accuracy rate of the (Rate)	Rate according to experts	Potential consequence	Accuracy rate of the (potential con)	Root causes	Accuracy rate of the (root causes)	Immediate corrective action	Accuracy rate of the (corrective action)	Class according to experts	Accuracy of the case
102	I saw a crew member in the ER climbing the stairs without the support of the railing as he was carrying boxes.	Low	25%		Personal accident case	25%	Poor work practice	25%	He was stopped, and someone helped him	25%	Attitude, Actual behaviour at time of accident/occurrence	100%
103	during a drill, the fire monitor on the main deck was not moving easily due to corrosion	Medium	1.92%		Property damage	1.92%	Lack of maintenance	1.92%	The corroded part has been chipped	1.92%		7.69%
104	while lifting the cargo hose by the crane, one of the cadets was supporting the hose and directing it to the manifold by his naked hand	Low	15.37%		Health or illness	1.92%	Lack of skills	25%	The CH/ENG notified him immediately	15.37%	Ability, skills, knowledge of the people involved, Attitude, Actual behaviour at time of accident/occurrence	57.66%
105	while picking up provisions from service boat one of the crew was helping to store the provision before the second load of the provision was landed on the deck, the clouds are injured.	Low	23.06%		Health or illness	9.61%	Lack of skills	9.61%	The safety officer notified him immediately	23.06%	Attitude	65.36%
106	while the ship was rolling heavily due to the heavy weather. One of the crew was running down the stairs and fall.	Low	23.06%		Personal accident case	23.06%	Poor work practice		He was stopped, and someone helped him	23.06%	Attitude, Actual behaviour at time of accident/occurrence	69.20%
107	during testing sprinkler system in the grease locker (engine casing STB side) found one nozzle choke.	Low	1.92%		Fire	1.92%	Lack of maintenance	1.92%	The sprinkler was fixed	1.92%		7.69%
108	while bunkering operation when one of the crew was using his phone on the 2nd floor of the accommodation.	High	23.06%		Fire	25%	Failure to comply with proper procedure	25%	The crew was advised to go inside the accommodation	25%	Attitude, Actual behaviour at time of accident/occurrence	97.54%
109	during the inspection of ship's portable UHF radio, it was discovered that one of the radios has damage rubber coating of the antenna. It makes equipment not intrinsically safe and leads to a fire hazard.	Medium		Low	Machinery damage	1.92%	Equipment failure	1.92%	Antenna was replaced	1.92%		5.76%

No	Near Miss description	Rate	Accuracy rate of the (Rate)	Rate according to experts	Potential consequence	Accuracy rate of the (potential con)	Root causes	Accuracy rate of the (root causes)	Immediate corrective action	Accuracy rate of the (corrective action)	Class according to experts	Accuracy of the case
110	during painting using spray equipment, one crew member was not wearing a mask.	Low	25%		Personal accident case	25%	Failure to use PPE	25%	The task was shut off immediately, and the crew was instructed to wear safety goggle	15.37%	Attitude, Planning of work, Actual behaviour at time of accident/occurrence	90.35%
111	I noticed a smell of tobacco on the 3rd floor of the accommodation; it turned out to be the oiler who was smoking in his toilet.	Low	13.45%		Fire	25%	Failure to comply with proper procedure	25%	The safety officer was informed, and the crew was asked to not do this again	25%	Attitude, Composition of the crew (competence/nationality), Actual behaviour at time of accident/occurrence	87.92%
112	after cleaning the accommodation side, two of the exhaust flaps for the ventilation were left closed.	Low	23.06%		Property damage	9.61%	Failure to comply with proper procedure	13.45%	The flaps were reopened again	23.06%	Ability, skills, knowledge of the people involved	69.20%
113	One of the pips within the COW system found with some leaking	High	1.92%		Fire	1.92%	Lack of maintenance	1.92%	Proper welding carried out in the leaking area	1.92%		7.69%
114	the level of the engine oil at the lifeboat was not at the right level.	Medium			Property damage		Lack of maintenance		The 3rd engineer was attended to refill the engine oil			Not a Near Miss
115	while doing the daily deck work, I observed one of the crew lifting heavy object while wearing oily gloves. The object cloud fell from his hand.	Low	25%		Personal accident case	15.37%	Failure to use PPE	11.53%	gloves were given to him to be fitted	1.92%	Attitude, Actual behaviour at time of accident/occurrence	53.82%
116	while painting the rescue boat, one of the ropes that was attached to the boat from the seaside was almost damaged.	Medium	11.53%		General hazard		Lack of maintenance		The rope gets replaced		State of maintenance (not maintained, badly maintained)	11.02%
117	while using the crane in the ER, the boiler was standing under the crane directly.	Low	15.37%		Health or illness	1.92%	Lack of skills	25%	The CH/ENG notified him immediately	15.37%	Attitude, Actual behaviour at time of accident/occurrence	57.66%

No	Near Miss description	Rate	Accuracy rate of the (Rate)	Rate according to experts	Potential consequence	Accuracy rate of the (potential con)	Root causes	Accuracy rate of the (root causes)	Immediate corrective action	Accuracy rate of the (corrective action)	Class according to experts	Accuracy of the case
118	in heavy weather and the ship was rolling, the OS was carrying paint with both hands and going down the stairs.	Low	1.92%		Personal accident case	11.53%	Poor work practice	1.92%	He was stopped, and someone helped him	25%	Attitude, Actual behaviour at time of accident/occurrence	40.36%
119	one engine personnel were carrying a bucket of diesel. On his way to the lower ER deck, he noticed that the floor plates were removed and left without any sign or notice.	Low		Medium	Health or illness		Carelessness		The crew remains at the area and called another crew to bring the barricade	23.06%	Attitude	21.12%
120	during the navigational watch, the traffic was very heavy, the OOW forgot to fix the ship's position on the chart as he was busy.	High	25%		General hazard	15.37%	Failure to comply with proper procedure	25%	The lookout reminded the OOW to plot the position	25%	Procedures and standing orders communication (internal and external), Traffic density	90.35%
121	during a drill, the AB was wearing the fire suit, and his assistance forgot to switch on the Oxygen valve. He was not able to breathe at the first 5 seconds. Then the Officer recognised the valve and switched on.	Low	13.45%		Personal accident case	25%	Failure to comply with proper procedure	25%	The O2 slander was opened	25%	Ability, skills, knowledge of the people involved, Teamwork	87.92%
122	a hot plate was found in the cadet's room.	High	1.92%		Fire	25%	Failure to comply with proper procedure	25%	The hot plate was removed from the cabin	25%	Attitude, On board management and supervision, Safety policy and philosophy, Actual behaviour at time of accident/occurrence	82.52%
123	the deck cadet was working on the deck without wearing safety shoes.	Low	25%		Health or illness	1.92%	Failure to use PPE	25%	They were advised to wear the safety shoes	11.53%	Attitude, Actual behaviour at time of accident/occurrence	63.43%
124	during anchoring operation, the AB was standing very close to the anchor chain.	Low	13.45%		Personal accident case	23.06%	Failure to comply with proper procedure	23.06%	the OOW asked him to keep clear	23.06%	Ability, skills, knowledge of the people involved, Attitude, On board management and supervision	82.66%

No	Near Miss description	Rate	Accuracy rate of the (Rate)	Rate according to experts	Potential consequence	Accuracy rate of the (potential con)	Root causes	Accuracy rate of the (root causes)	Immediate corrective action	Accuracy rate of the (corrective action)	Class according to experts	Accuracy of the case
125	one of the engine cadets has crossed the mooring lines while the ship was going alongside.	Low	15.37%		Personal accident case	25%	Failure to comply with proper procedure	25%	When the crew are inside the accommodation , the safety officer explained to the cadet the consequence	25%	Attitude, Actual behaviour at time of accident/occurrence	90.35%
126	the CH/Officer was holding the tugboat line with both hands, and the tug was pulling the ship.	Low	11.53%		Personal accident case	25%	Poor work practice	25%	The 3rd officer shouted on him to leave the line as the boat was pulling	25%	Ability, skills, knowledge of the people involved, Attitude, Actual behaviour at time of accident/occurrence	86.51%
127	rat guard was not fixed in position while the ship was at a port	Low	9.61%		General hazard	23.06%	Lack of skills	23.06%	Once the rat guard noticed missing, the CH/Off placed them on each mooring line	23.06%	Procedures and standing orders communication (internal and external)	78.82%
128	while conducting safety round at the main deck, one of the containers' lashing was not fixed in a good way	Medium	1.92%		General hazard	1.92%	Lack of skills	1.92%	The CH/OFF asked two of the crew to fix the lashing points and to check all other containers lashing	1.92%		7.69%
129	one of the crew did not wear a harness while working in a high area	Low	1.92%		Personal accident case	25%	Failure to use PPE	25%	A harness was given to him to be fitted	25%	Attitude, Actual behaviour at time of accident/occurrence	76.89%
130	one crew member left midship door in an open position without securing pin when the vessel was rolling and entered the store. Rolling can cause sudden closing of a door which can cause injury to crew members or damage to the door.	Low	25%		Personal accident case	25%	Carelessness	25%	The was shut closed immediately	25%	Ability, skills, knowledge of the people involved	100%

No	Near Miss description	Rate	Accuracy rate of the (Rate)	Rate according to experts	Potential consequence	Accuracy rate of the (potential con)	Root causes	Accuracy rate of the (root causes)	Immediate corrective action	Accuracy rate of the (corrective action)	Class according to experts	Accuracy of the case
131	the OS was doing chipping work on the aft deck without wearing proper PPE.	Low	25%		Health or illness	1.92%	Failure to use PPE	25%	The OS was asked to wear the Helmet as soon as possible	25%	Ability, skills, knowledge of the people involved, Attitude, Actual behaviour at the time of accident/occurrence	76.89%
132	safety equipment on the lifeboat was left without proper securing after checking the expiry date	Low	25%		General hazard	15.37%	Failure to comply with proper procedure	25%	The equipment was secured after noticing this issue	25%	Ability, skills, knowledge of the people involved	90.35%
133	using the wrong equipment for chipping while the ship is fully loaded (crude oil)	Very High	25%		Fire	25%	Incorrect use of equipment	25%	The proper equipment passed to him, and the potential consequence explained to the crew	25%	Ability, skills, knowledge of the people involved, Composition of the crew (competence/nationality), Procedures and standing orders communication (internal and external)	100%
134	the mess man was going down to the provision room using the stairs and not holding the rails.	Low	25%		Personal accident case	25%	Poor work practice	11.53%	He was stopped, and someone helped him	25%	Ability, skills, knowledge of the people involved, Attitude, Actual behaviour at the time of accident/occurrence	86.51%
135	using the fire hose to clean the main deck.	Low	23.06%		General hazard	13.45%	Incorrect use of equipment	23.06%	The job was stopped immediately	23.06%	Ability, skills, knowledge of the people involved	82.66%
136	while departing form Boustany, the master engaged with side talks with the pilot and they did not notice the crossing of a small boat. Then the OOW informed the master.	Very High	25%		General hazard	25%	Poor work practice	25%	The OOW informed the master after being hesitated for a while	25%	Composition of the crew (competence/nationality), Teamwork	100%

No	Near Miss description	Rate	Accuracy rate of the (Rate)	Rate according to experts	Potential consequence	Accuracy rate of the (potential con)	Root causes	Accuracy rate of the (root causes)	Immediate corrective action	Accuracy rate of the (corrective action)	Class according to experts	Accuracy of the case
137	at safety round in the pump room, the Ch/Officer and the two cadets were going down using the long ladders. One of the cadets was climbing down without caution. He was stopped immediately, and the explained what cloud happened to him	Low	25%		Personal accident case	25%	Carelessness	25%	He was stopped immediately, and the explained what cloud happened to him.	25%	Ability, skills, knowledge of the people involved, Actual behaviour at the time of accident/occurrence	100%
138	radar range was set at 24 miles during a rainy day, and this cloud leads to the appearance of fault targets	Low	25%		General hazard	25%	Lack of knowledge	25%	The range was set at a smaller rang	25%	Ability, skills, knowledge of the people involved, Composition of the crew (competence/nationality), Procedures and standing orders communication (internal and external)	100%
139	the anchor, winch was not working, then the master decided to use the other anchor to let go.	Medium	1.92%		Machinery damage	1.92%	Lack of maintenance	1.92%	A fixing plan was arranged	1.92%		7.69%
140	mooring rope storage was full of water as the water tide door was damaged as a result of a heavy weather	Medium	1.92%		General hazard	1.92%	Lack of maintenance	1.92%	The ropes were put on the main deck to dry out	1.92%		7.69%
141	one of the firefighting extinguishers in the anchor room was not working and expired for a long time	Low	1.92%		Fire	25%	Inadequate inspection	25%	A new fire extinguisher with same specifications was placed	25%	Regulations, survey and inspections	76.89%
142	while the ship was at berth, the gangway man did not keep recording each visitor in the visitor logbook.	Medium	25%		General hazard	25%	Poor work practice	25%	The gang-way man asked to do a proper security check	25%	Attitude, Actual behaviour at the time of accident/occurrence, Procedures and standing orders communication (internal and external)	100%
143	the new deck cadet attended a deck watch without boilersmith.	Low	25%		Personal accident case	25%	Failure to use PPE	25%	The cadet asked to wear the overall suit immediately	25%	Ability, skills, knowledge of the people involved	100%

No	Near Miss description	Rate	Accuracy rate of the (Rate)	Rate according to experts	Potential consequence	Accuracy rate of the (potential con)	Root causes	Accuracy rate of the (root causes)	Immediate corrective action	Accuracy rate of the (corrective action)	Class according to experts	Accuracy of the case
144	the LSA at the bridge was expired for more than three months	Medium	13.45%		Personal accident case	1.92%	Lack of maintenance	1.92%	The OOW asked to order a new LSA package	15.37%	On board management and supervision, Regulations, survey and inspections	32.17%
145	during discharging the cargo tanks, the CH/Officer was trying to open one valve from the CCR, but the valve was not responding. The AB went to the pump room to check on the valve. He found the valve overpainted.	Medium	1.92%		Property damage	1.92%	Lack of maintenance	1.92%	The AB asked to remove the paint immediately	1.92%	Ability, skills, knowledge of the people involved, On board management and supervision	7.69%
146	during the weekly inspection, one of the fire detection spots was not responding to the carbon monoxide	Low		Medium	Machinery damage	1.92%	Failure to use PPE	1.92%	Immediate replacement to the sensor	1.92%		5.76%
147	the electrical engineer was doing the routine inspection to the left as he found one of the chapels was slightly necked. He fixed the caplet immediately. And informed the Captain and the Ch/EN about it.	High	1.92%		Machinery damage	1.92%	Lack of maintenance	1.92%	A routine check has been placed for the lift	1.92%		7.69%
148	after the midnight watch, the cadet went to have some snakes. He put the food and the metallic spoon in the microwave by mistake. After a few seconds, he stopped the microwave as the spark gripped his attention	Low	25%		Personal accident case	5.77%	Poor work practice	1.92%	The clear instructions have been posted next to the microwave	25%	Ability, skills, knowledge of the people involved	57.66%
149	while cleaning the accommodation stairs, the OS left the fire door open using a door stopper	Low	9.61%		Personal accident case		Poor work practice	9.61%	He was stopped, and someone helped him			19.22%
150	the starboard sidelight of the ship was not clear due to some paint was applied by mistake in the previous day	High	1.92%		Property damage	25%	Lack of maintenance	1.92%	To remove the paint immediately	25%	Ability, skills, knowledge of the people involved	53.82%
151	the OOW was conducting an inventory to the lifeboat's equipment. He found the food was expired.	Medium	1.92%		Property damage	1.92%	Lack of maintenance	1.92%	The OOW asked to order a new food package for the lifeboat	1.92%		7.69%

No	Near Miss description	Rate	Accuracy rate of the (Rate)	Rate according to experts	Potential consequence	Accuracy rate of the (potential con)	Root causes	Accuracy rate of the (root causes)	Immediate corrective action	Accuracy rate of the (corrective action)	Class according to experts	Accuracy of the case
152	while measuring the O2 level at one of the cargo tanks, the cadet was standing against the direction of the wind and the cadet had to breathe the harmful gases intentionally.	Low	15.37%		Health or illness	15.37%	Failure to use PPE	1.92%	The cadet asked to wear the proper equipment	1.92%		34.60%
153	cargo tank number 5 at the port side ventilation was blocked. The OOW has noticed the blockage before the loading.	High	1.92%		Property damage	1.92%	Lack of maintenance	1.92%	The crew asked to clear the ventilation	1.92%		7.69%
154	the 3rd engineer measured the oil level at one of the tanks by himself without asking for help from one of the ER crew.	Low	25%		Personal accident case	25%	Poor work practice	25%	He was stopped, and someone helped him	25%	Teamwork	100%
155	the third officer was using a headset phone during his watch. By the time when the master came to the bridge, the OOW removed the headset phone.	Medium	9.61%		Personal accident case	1.92%	Lack of skills	11.53%	OOW was warned	25%	Ability, skills, knowledge of the people involved, Attitude, Composition of the crew (competence/nationality)	47.54%
156	some of the light that indicate the situation of the water tide doors was not working	Medium	1.92%		Property damage	1.92%	Equipment failure	1.92%	The light has been checked and replaced	1.92%		7.69%

8.4.1 Rate of the Near Miss cases reported in the existing reporting form

Figure 8-2 below presents the distribution of the Near Miss reports according to the reporter's best judgment using the four-level rates (very high, high, medium, low). The rate must be selected while reporting the Near Miss according to the cost of the potential damage. As per the shipping company's HSE manual, if the Near Miss leads to potential damage of (250.000 US$ and more the rate should be Very High), (100.000 US$ and more the rate should High), (10.000 US$ and more the rate should be medium) and (insignificant damage or estimated by less than 10.000 US$ the rate should be Low). 60.90% of the Near Miss reports were rated by the reporters as Low potential damage cases. On the other hand, a small percentage of the Near Miss reports were rated as High and Very High potential damage.

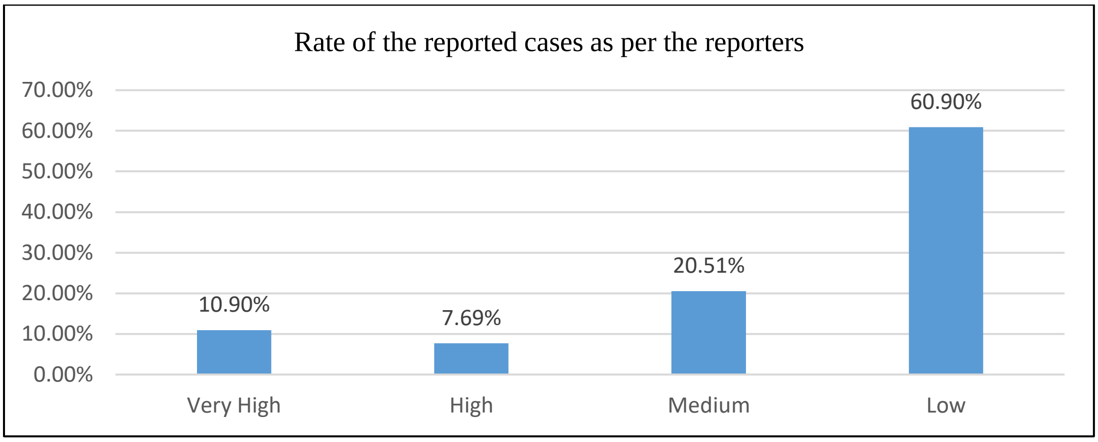

Figure 8-2 Rate of the reported cases as per the reporters

The highest percentage of the reported Near Misses were rated as Low, which means the cost of its potential damage is US$ 10.000 or less. Those Near Miss were investigated properly by the author, and he found a level of the inaccuracy of the given rate by the reporters. Near MissNear Miss the reason behind this underestimation for the Near Miss rate from the author's point of view is Near Miss most of the seafarers are not fully aware or cannot recall the criteria of rating the cases as written in the company's HSE. Therefore, the newly designed reporting form is including a small note at the bottom of the form to remind the reporter of the rating criteria. Section 8.6.1. will demonstrate the improvement of the accuracy of the given rate by the reporters who used the newly designed reporting form. The workshop which was conducted to evaluate the collected cases has proven the authors' claim about the inaccurate ratings for the collected Near Misses.

The percentage of the inaccurate Near Misses out of the valid Near Misses was distributed among the five different accuracy level limits, which were presented earlier in Table *8-3* above. Figure *8-3* below presents the distribution of the rate of the reported cases collected through the existing reporting form. 36.62% of the valid cases (52 Near Misses out of the 142 valid cases) were selected by the five experts as accurately rated cases using the existing reporting form. This means only 36.62% of the completed and valid reported cases via the existing reporting form were given an accurate rate and did not mislead the marine superintendent in conducting the analysis. On the other hand, the rest of the cases were rated inaccurately; 11.97% of the reported cases were grouped under the Yellow colour code (the parameters of the case are required moderate improvement), and 6.34% were grouped under the Amber colour code. Those cases were rated as partially accurate Near Misses as only two or three of the experts indicated that they were accurate. The big percentage of the reported cases were grouped under the two groups, the Red colour code (parameters of the case are not reliable) and not accurate at all. Thus, the total of those two groups makes up almost 45% of the reported cases. Those cases were given inaccurate rates which might have a very high potential consequence, and the analysis was misled due to the wrong rate, as the marine superintendents are giving priority to analyse the high rated Near Misses before the cases that were rated as low. In general, the given rate by the reporters toward the reported Near Misses via the existing reporting form scored 53% accuracy score, as shown in Table *8-7* below.

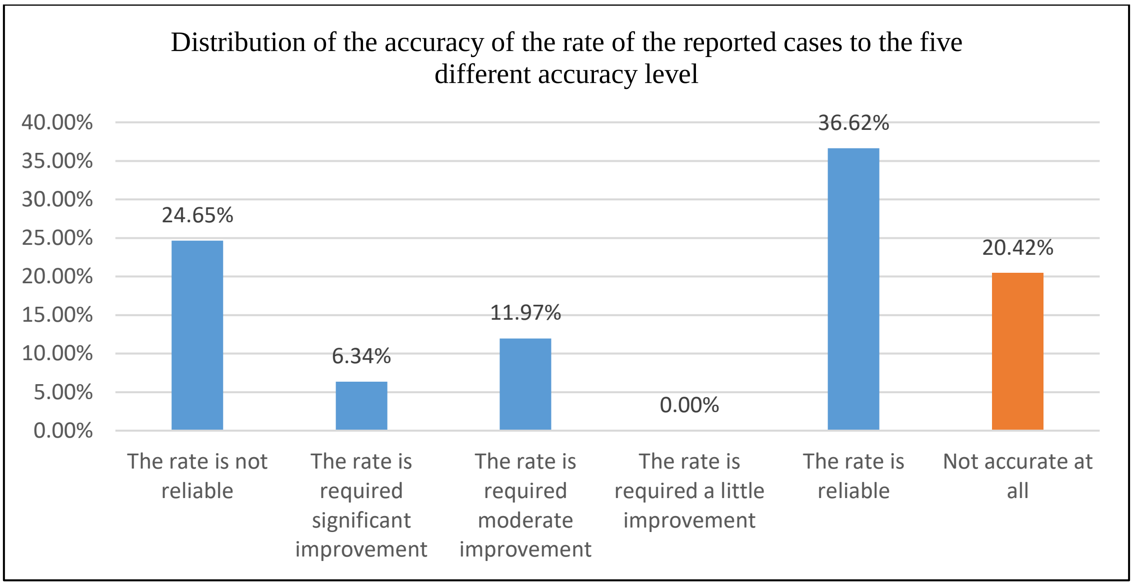

Figure 8-3 Distribution of the rate of the reported cases via the existing reporting form to the accuracy level colour codes

The mean accuracy rate of the reported cases via the existing reporting form is calculated and presented in the table below. The mean will be compared with the mean of the rate of the reported cases via the newly designed and proposed reporting form at the end of this chapter to highlight if an improvement was fulfilled by the newly designed reporting form outcomes.

Equation 8.3 below shows the calculation method for the mean for Likert-type scale (6 points) is as follow:

$$Mean = \frac{(f*6)+(f*5)+(f*4)+(f*3)+(f*2)+(f*1)}{\text{sample size}} \quad \text{(Eq 8.3)}$$

Equation 8.4 below is showing how to convert the mean to a percentage. This equation will be used in the next section to calculate the score for each statement and each domain.

$$\text{Score in percentage } (\%) = \frac{\text{Mean}-1}{6-1} * 100 \qquad \text{(Eq 8.4)}$$

Table 8-7 mean and accuracy score of the given rate

Not accurate at all	The rate is not reliable	The rate is required significant improvement	The rate is required moderate improvement	The rate is required a little improvement	The rate is reliable	Mean	The score of the rate accuracy
29	35	9	17	0	52	3.65	53%

Therefore, the cases that were grouped under the category of inaccurate at all were re-evaluated by the experts to be given a new rate according to their best judgment.

Figure *8-4* below shows the percentage of the Near Misses that were given a higher rate than the rate that was given by the reporters while reporting the cases, and this category was called by the author as the upgraded cases. In contrast, the cases which were given a lower rate by the experts are called the downgraded Near Misses. Thus, 34.48% of the Near Misses which were selected by the experts as inaccurate, were upgraded. Those cases, possibly, have been dealt with by the marine superintendent with less attention than they should have been given, as they were not rated accurately. The downgraded category is including 65.52% of the inaccurate Near Misses. Unfortunately, those cases were given a higher priority by the marine superintendent while analysing them more than what they deserve, as the company procedure stating that, the nearmisses that have been rated by the reporter as high and very high to be analysed as the priority cases.

The newly designed and proposed reporting form aims to maintain a better accuracy rate of the reported cases by reminding the seafarers of the rating criteria. The new reporting form has a note at the bottom of the form mentioning the criteria of rating the cases based on the cost of the potential damage. Thus, the newly designed and proposed reporting form is expected to have more accurate ratings.

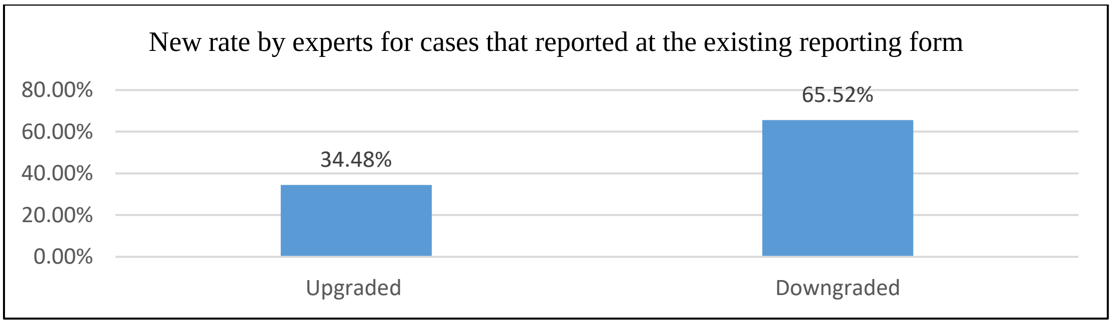

Figure 8-4 New rates by the experts

8.4.1. Potential consequences of the Near Miss cases reported using the existing reporting form

Figure 8-5 below shows the distribution of the Near Misses collected from the shipping company's existing system for reporting Near Misses based on the potential consequences. The shipping company has seven categories for the potential consequences: (Fire – General Hazard – Health or illness – Machinery Damage – None-Conformance – Personal Accident Case – Property Damage). The author expected to capture Navigational hazard, which includes all different types of the possible navigational accident within those categories. For instance, the potential consequence for case number 138 in Table *8-6* above should be Navigational hazard. Unfortunately, this category of the potential consequence is not available among the existing reporting form. This is one of the gaps in the existing reporting form.

The majority of the cases were leading to personal accident case as a potential consequence. This is an indication of a low level of applying and following the personal safety procedures by the seafarers, as they tend to ignore their own safety without giving much attention to the potential consequences. However, all of those Near Miss reports were subjected to an evaluation by experts to capture the accuracy of the parameters of the reports. This evaluation explored the validity of seafarer's practice of reporting Near Misses and selecting the potential consequence. The experts' opinion toward the accuracy of the potential consequence shows 35.21% (50 cases) of the valid collected cases were given a Red colour code (the parameter is not reliable), which means they have scored a very low accuracy rate. Moreover, 6.34%of the cases (9 Near Misses) was found by the experts as an inaccurate potential consequence, as shown in *Figure 8-6* below. On the other hand, 44.37% (63 cases) of the valid Near Misses were grouped under the Green colour code, as they were given an accurate potential consequence by the reporters. The rest of the valid Near Miss reports was allocated to the Diminished green code (the parameter is required a little improvement), Yellow code (the parameter is required a moderate improvement) and the amber colour code (the parameter is required significant improvement. The main reason behind the inaccurate selection of the potential consequences by the seafarers is the lack of feedback given to the reporter on each single reported case. The feedback is critical to educate the seafarers on their reporting practice and show them how to enhance the quality of the reported cases. The Master or the Chief engineer should check all the generated reports within their own vessel to make sure the accurate reporting practice and all the parameters of the Near Miss reports to ensure a proper analysis by the marine superintendent. Unfortunately, the top managerial level on-board the shipping company's vessel is not allowed to interfere or to give feedback to the seafarers in case of observing a wrong reporting practice. Overall, the accuracy of the given potential consequences by the reporter scored 58.4%.

The newly designed reporting flowchart has three stages of filtering the Near Misses, as aforementioned in chapter 7. Those filtration aims to enhance the seafarers' reporting practice and educate them to overcome the common mistakes while reporting.

Moreover, the newly designed reporting form allows the reporter to include more details on each case, such as; lessons learned and the class of the Near Miss. Those parameters make the reporter think carefully before selecting the appropriate option on each parameter. The comparison section at the end of this chapter will demonstrate the quality of the outcome of both reporting forms.

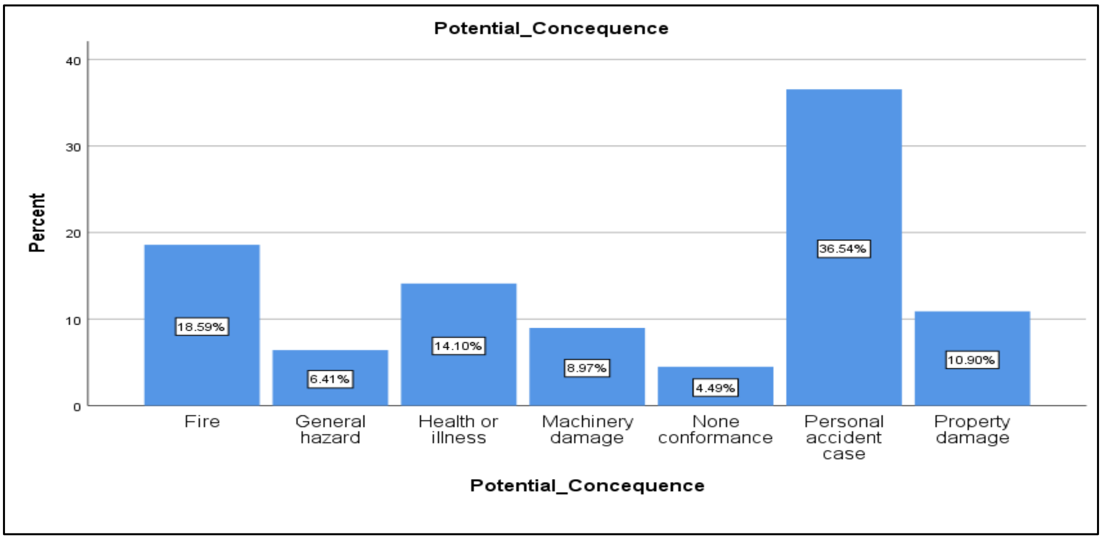

Figure 8-5 Potential consequences of Near Misses reported via the existing reporting form

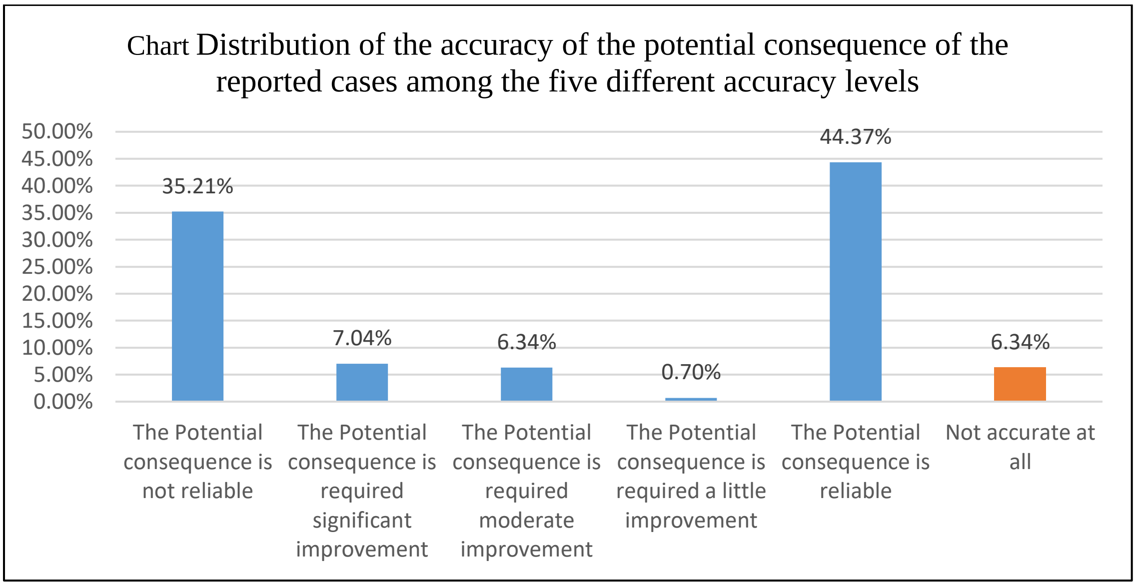

Figure 8-6 Accuracy of the Potential Consequence

The mean of the accuracy of the potential consequences of the reported cases via the existing reporting form is calculated and presented in Table 8-8 below. The mean value will be compared with the mean rate of the reported cases via the newly designed and proposed reporting form at the end of this chapter to highlight if there is an improvement achieved by using the newly designed reporting form.

Table 8-8 Mean and score of the accuracy of the potential consequence

Not accurate at all	potential consequence is not reliable	potential consequence is required significant improvement	potential consequence is required moderate improvement	potential consequence is required a little improvement	potential consequence is reliable	Mean	The score of the potential consequence accuracy
9	50	10	9	1	63	3.92	58.4%

8.4.2. The Root Cause of Near Misses reported in the existing reporting form

Figure 8-7 below is showing the distribution of the Near Miss cases among the different type of root causes. The existing reporting form in the shipping company has a list of 16 root causes, as shown in the figure below. Those 16 root causes were listed in the existing reporting form without referring to any of the well-known taxonomy of root causes. Therefore, some of the root causes in this form is considered as a classification of the unsafe occurrences; such as ,Lack of skills and lack of maintenance (European commission, 2000). Thus, the new reporting form was designed to have two options; root causes and classification of the unsafe occurrence, to ensure classifying the Near Misses according to the approved classes as per BERTRANC PROJECT by (European commission, 2000). The highest percentage of registered root causes among the collected Near Misses via the existing reporting form was the failure to use PPE. This is a logical result, as such failure is leading to Personal Accident Cases, as mentioned in *Figure 8-5* below. However, the workshop and the experts' opinion will validate this result.

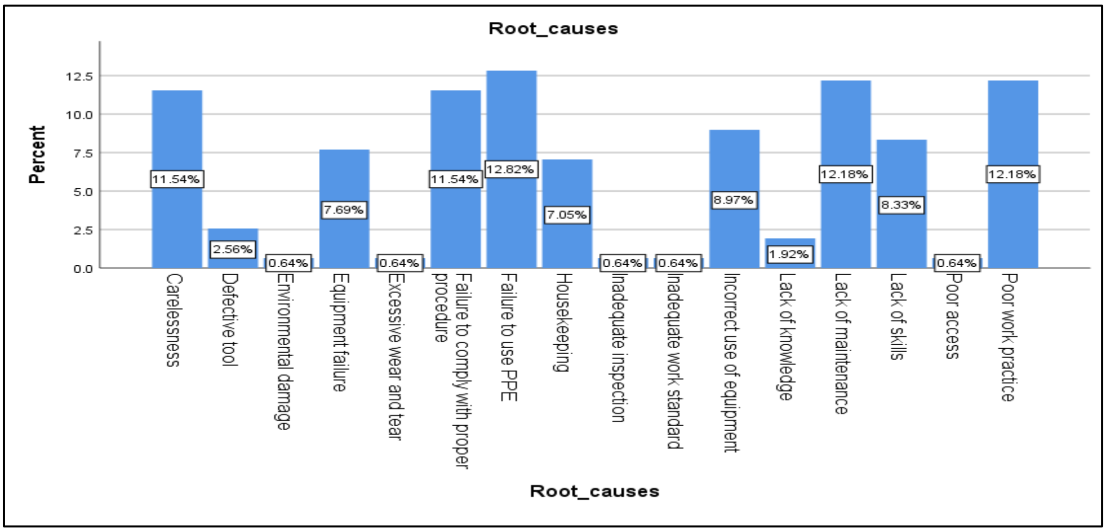

Figure 8-7 Root causes of Near Misses

According to Figure *8-8* below, 44.37% of the Near Misses(63 Near Misses) have been grouped under the Green colour code (the parameter is reliable) of the accuracy level. On the contrast, the total of the Red colour code (the parameter is not reliable), which indicates a very low level of accuracy of root causes and the completely inaccurate root causes are forming 41.55% (59 Near Misses). The rest of the Near Misses were distributed to the diminished green (the parameter is required a little improvement), yellow (the parameter requires a moderate improvement) and the amber codes (the parameter is required a significant improvement). Thus, Table *8-9* presents the mean accuracy of the root causes of the collected reports via the existing reporting form is 3.93, which reflect a score of 58.6%. Therefore, the root causes are required to be reported more effectively by the seafarers. The main reason behind the inaccurate selection of the root causes by the seafarers is the wide range of root cause choices, and some of them are not logical as root causes for Near Misses such as; (excessive wear and tear, equipment failure and environmental damage). Besides , the lack of feedback given to the reporter on each single reported case affects the effectiveness of the Near Misses as the feedback is meant to educate the seafarers on their reporting practice and show them how to enhance the quality of the reported cases. The newly designed and proposed reporting form aims to overcome the lack of feedback issues, as each Near Miss reports will pass through four different stages of reviews as well as the option for providing feedback. Three of the review stages are conducted within the shipping company. The fourth review and feedback will be in the future, by the time when the national database is created.

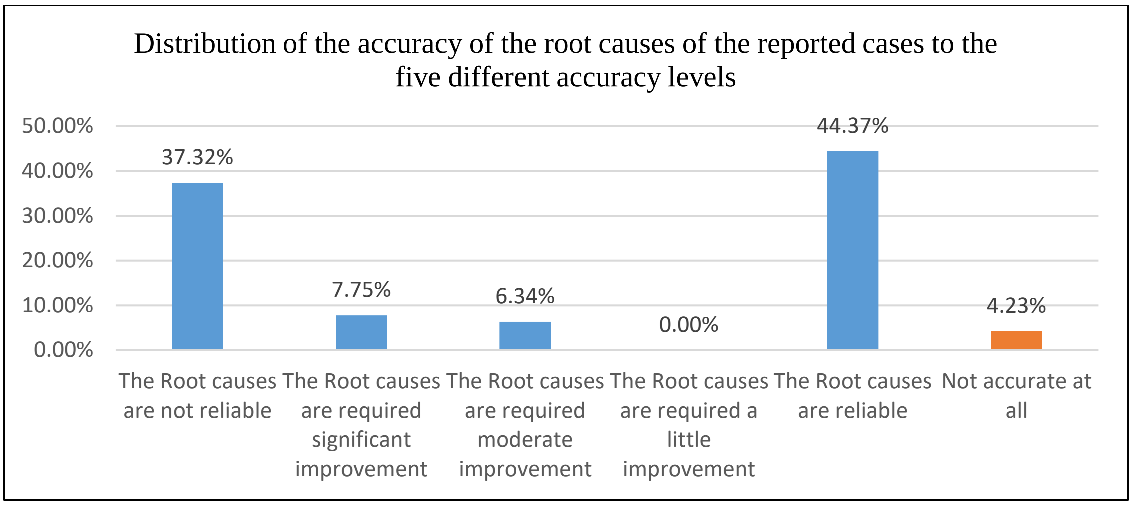

Figure 8-8 Accuracy of the Root causes

Table 8-9 Mean and score of the accuracy of the root causes

Not accurate at all	Root Causes are not reliable	Root Causes are required significant improvement	Root Causes are required moderate improvement	Root Causes are required a little improvement	Root Causes are reliable	Mean	The score of the Root Causes accuracy
6	53	11	9	0	63	3.93	58.6%

8.4.3. Corrective actions

Figure 8-9 below shows the distribution of the accuracy level of the corrective actions using the five different accuracy levels. 61.27% (87 Near Misses) of the 142 valid reported cases were grouped under the green colour code (Parameter is reliable). On the contrast, the sum of the accuracy level of the Near Misses which were grouped under the red colour code (Parameter is not reliable) and completely inaccurate was 28.87%. This distribution among the accuracy levels gives a mean of 4.61 and a score of the accuracy of the corrective actions taken by the seafarers at the time of reporting of 72.2%, as shown in Table *8-10* below. This score is relatively high compared to the rate, potential consequences and root causes, which indicate an acceptable level of the seafarers' capability in taking immediate corrective actions at the time of the Near Miss. However, to reach an acceptable level of resilient operation on-board the ships, this percentage is required to be improved significantly. The newly designed reporting form is expected to capture more accurate parameters related to the Near Miss reporting practice. Section 8.6 of this chapter will examine the outcomes of the newly designed reporting form.

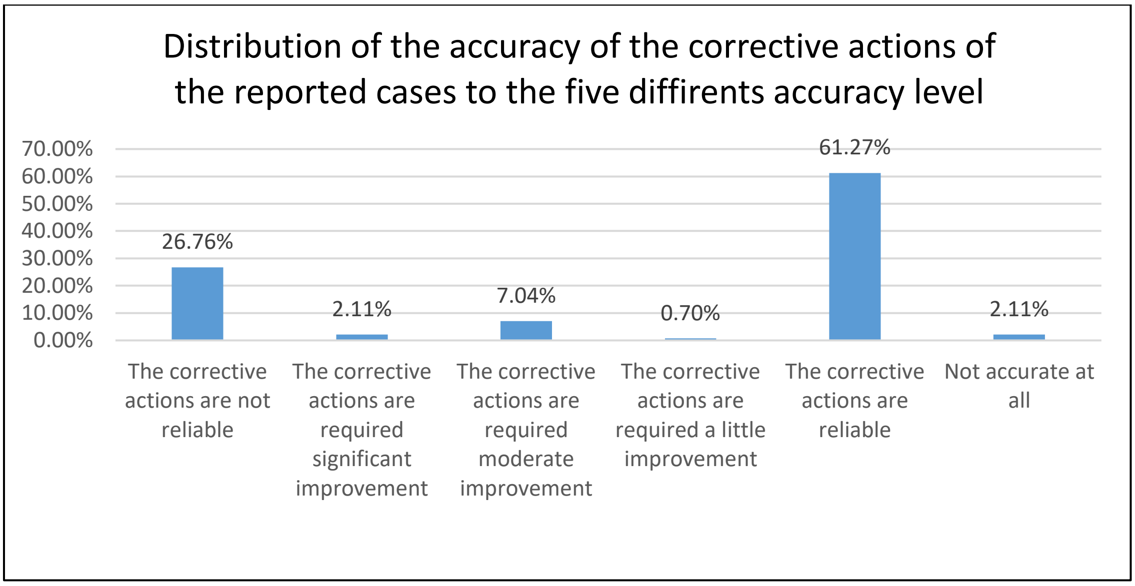

Figure 8-9 Accuracy of the corrective actions

Table 8-10 Mean and score of the accuracy of the corrective actions

Not accurate at all	Corrective Actions are not reliable	Corrective Actions are required significant	Corrective Actions are required moderate	Corrective Actions are required a little improvement	Corrective Actions are reliable	Mean	The score of Corrective actions accuracy
3	38	3	10	1	87	4.61	72.2%

8.5. Deficiencies among the reporting practice at the existing reporting form

The existing reporting form for Near Misses does not allow the reporters to identify the reported cases in term of the unsafe act and the unsafe conditions. For this reason, the analysis above does not mention the percentage of the reported Near Misses, which are considered as unsafe acts and unsafe conditions. This issue was overcome in the newly designed reporting form. The second deficiency is the lack of diagnostic information provided in the existing reporting form such as the (voyage status, loading condition, operation type, ship's location and the frequency of this Near Miss to happen). All of those diagnostic details are available at the newly designed reporting form and have been analysed earlier in chapter 7. The third deficiency is the limited reported details related to the Near Miss such as; (the lessons learned and the class of the Near Miss). The absence of all of the details that have been mentioned in this section leads to inaccurate analysis of the Near Misses. Therefore, the newly designed reporting form is expected to provide the analysis team at the shipping company a wider view and extended range of information that enhances the outcome quality of the Near Miss analysis. Subsequently, most of the human errors will be managed, and more lessons learned will be gained by the seafarers.

8.6. Reports Sample from the proposed NMR System

The new reporting form was distributed to all sea personnel through Qualtrics link as aforementioned in chapter 7. The diagnostic details have been analysed in chapter 7. This section aims to analyse the content of the Near Misses themselves and compare them to the Near Misses collected using the existing reporting form. The aim was to collect 90 reports, on average one Near Miss report from each ship. In total, 89 reports were collected as aforementioned in chapter 7. The 89 reports were grouped under two lists based on the complete reported cases and incomplete reported cases. Thus, the completed cases will be evaluated by the experts in term of their feasibility, the accuracy of the rate, potential consequences, root causes, corrective actions, lessons learned and the classification to each case by the reporters. 78 reports out of 89 were found to be complete cases, which mean 87.64% of the reported cases through the newly designed reporting form of Near Misses were complete cases. The incomplete reports were reported with one or more of the essential report's parameters (rate, potential consequence, root causes, corrective action, lessons learned or the class of the event).This gives an improvement of 5.1% between the existing and the newly designed reporting form in reporting completed cases. This improvement is not that significant, but worth mentioning. This improvement is the result of the anonymity of the new reporting form, whereas, the reporter feels free to report and include all the necessary parameters related to the case without any concern of blame or punishment. Therefore, when the seafarers become familiar with the newly designed reporting form, the little improvement in the reporting form will translate to a significant improvement in terms of complete Near Miss reports. *Table 8-12* below shows the completed cases along with the experts' opinion on each report.

The evaluation of the Near Miss cases by the experts took place through an online link due to the lockdown of the University as a precautionary measure to limit the spread of COVID 19. Some of the experts are senior seafarers, and some others are researchers interested in the field of maritime safety. A total of 5 experts participated in the online workshop as aforementioned in Table *8-1* Experts' experience above.

All of the completed Near Miss cases that have been evaluated by the experts resulted in being valid Near Miss cases. However, the valid Near Miss cases are distributed into the five accuracy rates as mentioned earlier in (Table *8-3* Accuracy rate and its interpretation of the valid Near Misses) according to their accuracy rates as *Figure 8-10* below shows. 38.46% (30 Near Misses) of the Near Miss cases were grouped under the green colour code. On the other hand, 20.51% (16 Near Misses) of the cases were grouped under the red colour code. The rest of the Near Misses have been distributed under the other three colour codes. The distribution of the Near Misses collected via the newly designed reporting form under the five accuracy rates has resulted in a higher mean than the mean of the Near Misses collected via the existing reporting form. Thus, the mean the accuracy level of the Near Misses collected via the newly designed reporting form is 3.47, the score of the accuracy is 61.75% as listed in Table *8-11* below.

Therefore, the accuracy of the Near Misses reported via the newly designed form has improved by 18.5% compared to the accuracy of the Near Misses reported via the existing reporting form.

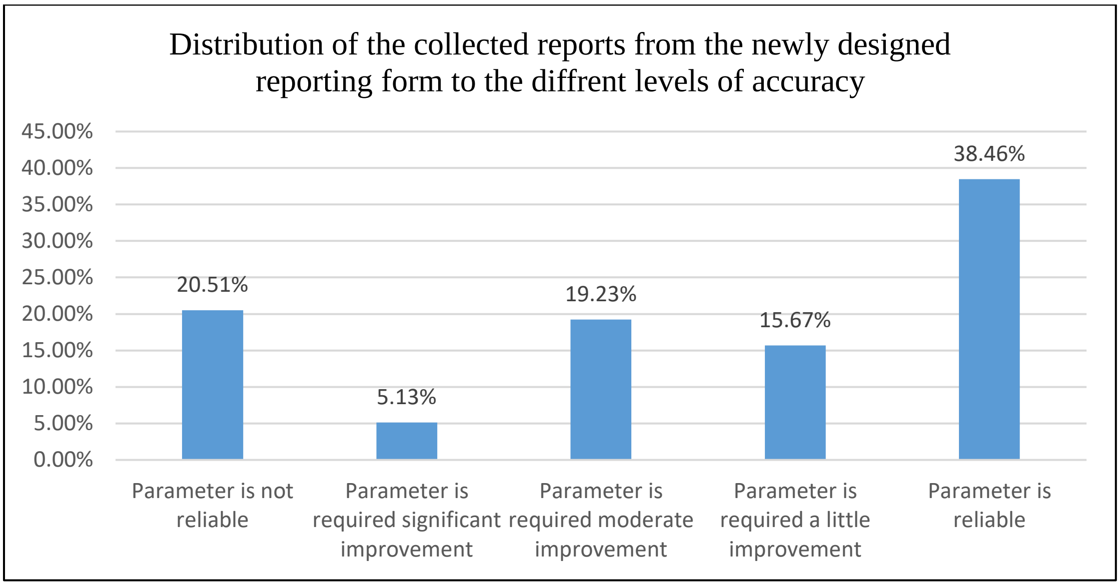

Figure 8-10 Distribution of the collected reports from the newly designed reporting form to the colour code

Table 8-11 Mean and score of the accuracy of the collected Near Misses via the newly designed reporting form

The case's parameters are not reliable	The case's parameters are required significant improvement	The case's parameters are required moderate improvement	The case's parameters are required a little improvement	The case's parameters are reliable	Mean	The score of the rate accuracy
16	4	15	13	30	3.47	61.75%

Table 8-12 newly designed reporting form outcomes

No	Near Miss description	Rate	Accuracy rate	Rate as per experts	Unsafe act or con	Potential Consequence	Accuracy rate	Root Causes	Accuracy rate	Immediate Corrective Action	Accuracy rate	Lessons Learned	Accuracy rate	Classification of the Near Miss	Accuracy rate	Accuracy of the Near Miss
1	not wearing Helmet	L	16.66%		Act	Injury or fatality	16.66%	Carelessness	16.66%	wear Helmet	16.66%	Be careful	1.28%	ability, skills, knowledge of the people involved	16.66%	84.48%
2	today, while passing through an a-deck alleyway to the duty mess room, a broken lid of the dustbin which had sharp screws protruding from the lid struck my hand lightly. Luckily no injury occurred.	L	16.66%		Act	Injury or fatality	16.66%	Housekeeping	16.66%	The dustbin was removed from the place, and the broken lid was fixed back.	16.66%	All the broken/ damaged items which have sharp edges to be made good or removed from the place at the earliest as it may possess danger to the persons passing nearby.	16.66%	ability, skills, knowledge of the people involved	16.66%	100%
3	wrong plating instruction	M	16.66%		Act	General hazard to the ship	7.68%	Housekeeping	7.68%	New instruction	16.66%	Good Housekeeping	1.28%	activities prior to the accident/occurrence	16.66%	66.56%
4	during daily round was found at the port side of accommodation are located boxes with anti-piracy spike and free access to the fire plan holder was blocked.	L	16.66%		Act	Injury or fatality	7.68%	Failure to comply with procedure	16.66%	Bosun was informed about non-conformance about safety equipment procedures. Boxes were shifted to the main deck and free access to the fire plan restored.	16.66%	Crew members were refreshed knowledge about follow up all safety procedures and safety precaution for work and planning to work with fire equipment.	16.66%	planning of work	16.66%	90.88%
5	during fire drill (fire in the chemical locker), it was observed that one of the crew members entering the space did not carry the fire axe and Flashlight along with the Fireman's outfit.	M	16.66%		Act	Injury or fatality	16.66%	Failure to comply with procedure	16.66%	The crew member was corrected, and Flashlight provided before entering the space.	16.66%	All crew members explained the importance of wearing proper PPE and Fireman's outfit in case of any fire. In a real scenario, such lapses might result in an injury. Matter to be discussed in a safety meeting.	16.66%	the organisation of on-board training and drills	16.66%	100%

No	Near Miss description	Rate	Accuracy rate	Rate as per experts	Unsafe act or con	Potential Consequence	Accuracy rate	Root Causes	Accuracy rate	Immediate Corrective Action	Accuracy rate	Lessons Learned	Accuracy rate	Classification of the Near Miss	Accuracy rate	Accuracy of the Near Miss
6	while isolating aft air conditioning compressor, the cap of condenser outlet valve was removed to enable closing of the valve. On removing the cap, found that the valve gland cover had unscrewed and was stuck inside the cap. With the cover removed, the gland packing blew out.	L	1.28%		Act	Damage to the environment	1.28%	Equipment failure	1.28%	Valve opened hard up, so that valve was sealing on the opening seat. This caused the leak to stop and packing refitted, and gland cover screwed back on.	1.28%	To be aware that the valve has an opening seat as well as closing seat.	1.28%	equipment (availability, reliability)	1.28%	7.68%
7	during engine round, it was noticed by me that one of a crew member was working without fastening the chin strap of his Helmet.	M	15.36%		Act	Injury or fatality	16.66%	Failure to use PPE	16.66%	the crew member was stopped from work and explained the correct use of proper PPE as per SMS	16.66%	use of proper PPE must always be done	16.66%	ability, skills, knowledge of the people involved	16.66%	98.56%
8	in the engine control room, which has a first aid kit was placed. And so, while doing some counter check of it, it was found out that one medicine namely silver sulfadiazine (burn cream) was not included on the list of inventories.	L	1.28%		Condition	Injury or fatality	1.28%	Failure to comply with procedure	1.28%	Immediately informed 2E and 2nd Officer. First Aid kit stock replenished.	1.28%	Training on the importance of following procedures and maintaining First Aid kits is required.	1.28%	management commitment to safety	1.28%	7.68%
9	two senior officers from the same department travel at the same time with the elevator although it is prohibited (large notice with a warning was posted in the elevator).	M	16.66%		Act	Injury or fatality	1.28%	Carelessness	1.28%	Warn them not to do it.	16.66%	Seniors should be a good example of the work and 11behavior, not to violate the rules.	16.66%	attitude	7.68%	60.16%
10	one crew member was mixing a paint without using an appropriate face mask.	L	16.66%		Act	Injury or fatality	16.66%	Failure to use PPE	16.66%	Stop operating and request him to use the face mask.	16.66%	Some of the crew members required extra training and familiarisation.	16.66%	ability, skills, knowledge of the people involved	16.66%	100%

No	Near Miss description	Rate	Accuracy rate	Rate as per experts	Unsafe act or con	Potential Consequence	Accuracy rate	Root Causes	Accuracy rate	Immediate Corrective Action	Accuracy rate	Lessons Learned	Accuracy rate	Classification of the Near Miss	Accuracy rate	Accuracy of the Near Miss
11	the laminating machine left switched on unattended, and it is a source of heat nearby some papers.	L	16.66%		Act	Injury or fatality	7.68%	Carelessness	16.66%	The laminator switched off. Warning poster "Don't leave unattended" exhibited to avoid any similar situation in the future.	16.66%	Any electric equipment (chargers, heaters, microwaves, etc.) shouldn't work unattended.	16.66%	ergonomics of equipment and the working environment	16.66%	90.88%
12	during elevator maintenance one of the crew members assumed the maintenance was completed and tried to use the elevator even though the notice posted near the entrance stating, "elevator under maintenance".	M	15.36%		Act	Injury or fatality	16.66%	Carelessness	16.66%	The concerned crew member was briefed about the seriousness and the importance of Lockout / Tag-out procedures which is to be followed and complied. And that the elevator was still being tested after completing the necessary work.	16.66%	Always lockout / Tag-out procedures to be followed and complied. Any doubts - ask your superior.	16.66%	equipment (availability, reliability)	16.66%	98.56%
13	during p/room inspection it has been noticed that all cargo and ballast pumps bearings grease releasing valves and plugs are overpainted and most of them not moving. Hence during greasing of the bearings, excessive grease and pressure cannot be removed from the bearing posing risk of overheating and damage to the bearing.	M	16.66%		Condition	Fire/Explosion	16.66%	Incorrect use of equipment	10.24%	Crew instructed to wire brush all valves and plugs for free operations.	16.66%	Recently, I find frequently pumps bearings to be over greased as the crew has no knowledge about the proper greasing procedure.	16.66%	ability, skills, knowledge of the people involved	16.66%	93.44%
14	cleaning chemical with no instructions in English or common language. unsafe to use due to possible incorrect strength mixing causing injury to personnel	L	1.28%		Condition	Damage to the Property	1.28%	Tools deficiency	1.28%	Removed from use and disposed of.	1.28%	Stores to be checked on receipt	1.28%	regulations, survey and inspections	1.28%	7.68%

No	Near Miss description	Rate	Accuracy rate	Rate as per experts	Unsafe act or con	Potential Consequence	Accuracy rate	Root Causes	Accuracy rate	Immediate Corrective Action	Accuracy rate	Lessons Learned	Accuracy rate	Classification of the Near Miss	Accuracy rate	Accuracy of the Near Miss
15	the d/cadet was found using jet chisel but not using PPE as protective goggles.	M	7.68%		Act	Injury or fatality	16.66%	Failure to use PPE	16.66%	He was ordered to stop the job immediately and advised to wear proper PPE. Chief Officer informed.	16.66%	Always take five before running into any job. Engage the brain before the hands.	16.66%	ability, skills, knowledge of the people involved	16.66%	90.88%
16	the vessel at anchor in Jose - Venezuela. During disembarking of port authorities, noticed one of the visitors is using his mobile phone to take pictures on deck.	L	16.66%		Act	Damage to the Property	10.24%	Carelessness	1.28%	Duty officer in charge immediately instructed mentioned visitor to stop taking pictures and switch off his phone.	16.66%	All crew de-briefed and instructed when escorting visitors from the vessel, to remind them about the importance of switching off all equipment prior to leaving accommodation and not to use same on deck. The matter discussed among SMT during the daily planning meeting, to be included in next SCM as well.	16.66%	attitude	16.66%	78.08%
17	during an inspection of the crew recreation room, one metallic ashtray has been found broken (one lid missing). Its mean ashtray has been not fully protected from cigarettes end.	M	16.66%		Act	Injury or fatality	1.28%	Carelessness	16.66%	Ashtray has been disposed of. New one placed.	16.66%	Any defective item to be reported immediately & should be replaced at once	16.66%	attitude	16.66%	84.48%
18	water fountain leaking and invisible water slick are on deck so someone can slip and get injured.	L	1.28%		Condition	Injury or fatality	1.28%	Equipment failure	1.28%	Water to the fountain shut, area cleaned, fountain repaired and put back to service.	1.28%	Every defect, no matter how minor, should be immediately reported and attended.	1.28%	state of maintenance (not maintained, badly maintained)	1.28%	7.68%
19	while the vessel was rolling ship, staff try to use port side provision crane to pick up the fabricated shelf from the engine room.	L	10.24%		Act	Fire/Explosion	1.28%	Carelessness	1.28%	immediately ask to stop the operation and inform safety officer. stop work authority	16.66%	proper planning with due consideration to weather & ship's movement	16.66%	composition of the crew (competence/nationality)	16.66%	62.72%

No	Near Miss description	Rate	Accuracy rate	Rate as per experts	Unsafe act or con	Potential Consequence	Accuracy rate	Root Causes	Accuracy rate	Immediate Corrective Action	Accuracy rate	Lessons Learned	Accuracy rate	Classification of the Near Miss	Accuracy rate	Accuracy of the Near Miss
20	during regular deck rounds, observed security measures were not fully implemented on deck. Anchor pipe was covered with securing plates; however, due to the design of plates, the same was not properly secured aligned open it from the side.	M	16.66%		Act	Fire/Explosion	16.66%	Incorrect use of equipment	16.66%	Informed chief Officer to instruct deck team to put additional securing measures on plates and to rig razor wire around chain as additional protection.	16.66%	Deck crew gathered and de-briefed on proper security measures to be implemented during Venezuela call. Near Miss to be mentioned during the next SCM. Chief Officer to make regular security inspection during anchor stay to verify security measures are as per company standards.	16.66%	ability, skills, knowledge of the people involved	16.66%	100%
21	one of the fire hydrants on weather deck (deck #5) was blocked by wooden dunnage stowed on the deck and close to the hydrant. Approaching and using the hydrant should be Difficult or impossible during an emergency.	H	16.66%		Act	Injury or fatality	1.28%	Lack of competency	16.66%	Chief Officer informed immediately, and wooden dunnage is removed and stowed on a safe place. The fire hydrant is clear and ready for use in an emergency.	16.66%	All safety equipment must be clear from any obstructions and ready for use all the time.	16.66%	ability, skills, knowledge of the people involved	16.66%	84.48%
22	after bridge watch I went down to my cabin and found that ceiling in the alleyway near my cabin with two sharp edges was facing front /open area not to wall, the ceiling was removed for some maintenance purpose.	L	1.28%		Act	Injury or fatality	1.28%	Carelessness	1.28%	I removed the metal ceiling and secured were the ceding been kept sharp edges facing the wall	1.28%	always secured the items removed in a place which does cause an injury to s.	1.28%	design	1.28%	7.68%
23	the crew member was going down the stairs in the accommodation with a mobile phone in front of his eyes held by two hands.	M	10.24%		Act	General hazard to the ship	1.28%	Carelessness	16.66%	the crew member was stopped and explained that it was the dangerous practice with the potential of falling on the stairs as not looking at the path.	16.66%	While walking on, stairways always look at the path.	16.66%	ability, skills, knowledge of the people involved	16.66%	78.08%

No	Near Miss description	Rate	Accuracy rate	Rate as per experts	Unsafe act or con	Potential Consequence	Accuracy rate	Root Causes	Accuracy rate	Immediate Corrective Action	Accuracy rate	Lessons Learned	Accuracy rate	Classification of the Near Miss	Accuracy rate	Accuracy of the Near Miss
24	during mooring operation at the port of Yanbu. I noticed one crew member passing walk through nearby on the bitts area wherein the tug line makes fast while the tugboat still pulling /assisting the vessel for docking. Unsafe of the crew member involved.	L	16.66%		Act	Injury or fatality	16.66%	Carelessness	7.68%	Unsafe action of the crew member immediately advice/remind	16.66%	to be discuss next SCM	1.28%	ability, skills, knowledge of the people involved	16.66%	75.52%
25	during fire, safety & security rounds after my morning watch, it was observed few wet boiler suits on the top of working dryer machine. This is a potential danger of the ignition fire in case water seeps in the dryer circuit or due to heat from the dryer.	M	16.66%		Act	General hazard to the ship	16.66%	Carelessness	16.66%	Immediately removed from the top of the dryer.	16.66%	The instruction carried out with all crew members. Additional poster attached in the laundry. Will discuss on the next SCM	16.66%	ability, skills, knowledge of the people involved	16.66%	100%
26	air hose to blasting machine burst	M	1.28%		Act	Injury or fatality	1.28%	Lack of competency	1.28%	Replace the hose	1.28%	Always check the equipment before use and know the consequences of part failure	1.28%	equipment (availability, reliability)	1.28%	7.68%
27	a crew member was going down the stairs in the accommodation with a mobile phone in front of his eyes held by two hands.	M	16.66%		Act	Injury or fatality	16.66%	Carelessness	16.66%	the crew member was stopped and explained that it was the dangerous practice with the potential of falling on the stairs as not looking at the path.	16.66%	Look at the path of your walk	16.66%	ability, skills, knowledge of the people involved	16.66%	100%

No	Near Miss description	Rate	Accuracy rate	Rate as per experts	Unsafe act or con	Potential Consequence	Accuracy rate	Root Causes	Accuracy rate	Immediate Corrective Action	Accuracy rate	Lessons Learned	Accuracy rate	Classification of the Near Miss	Accuracy rate	Accuracy of the Near Miss
28	found trash/garbage bins obstructing access to electrical power supply distribution board on the bridge. All electrical panel board/distribution board should keep in easily accessible condition. Nothing should be kept in front of the electrical panels, which block the access in emergency conditions.	L	16.66%		Act	Fire/Explosion	16.66%	Carelessness	16.66%	Removed Garbage/trash Bins from the location. Found the suitable locations for Garbage / Trash Bins. Warning signs put in place to avoid such Near Miss in future.	16.66%	Less space/work area caused this unidentified hazardous work practice on-board.	16.66%	ability, skills, knowledge of the people involved	16.66%	100%
29	shipping by hammer	L	15.36%		Act	Injury or fatality	1.28%	Incorrect use of equipment	16.66%	Stopped the work and been reported	16.66%	Provide knowledge and instructions	16.66%	ability, skills, knowledge of the people involved	16.66%	83.20%
30	equipment not proper secured	L	16.66%		Act	Injury or fatality	16.66%	Carelessness	16.66%	Equipment was secured	16.66%	equipment must be secured all the time	1.28%	ability, skills, knowledge of the people involved	16.66%	84.48%
31	working without proper PPE	L	16.66%		Act	Injury or fatality	16.66%	Failure to use PPE	16.66%	stopping the work	16.66%	needs a reminder every time	16.66%	ability, skills, knowledge of the people involved	16.66%	100%

No	Near Miss description	Rate	Accuracy rate	Rate as per experts	Unsafe act or con	Potential Consequence	Accuracy rate	Root Causes	Accuracy rate	Immediate Corrective Action	Accuracy rate	Lessons Learned	Accuracy rate	Classification of the Near Miss	Accuracy rate	Accuracy of the Near Miss
32	two crewmembers were doing some paintwork at the monkey island near to the radar danger zoon after taking permission from the OOW. After lunchtime, they came back to complete the painting. This time they did not inform the OOW that they are back to commence their work.	H	16.66%		Act	Injury or fatality	1.28%	Carelessness	16.66%	door secured on securing pin.	16.66%	Watertight doors to be secured by securing the pin in the open position.	16.66%	procedures and standing orders communication (internal and external)	16.66%	84.48%
33	during safety rounds on deck, I found one shore rigger who is walking around near open deck without any personal gas meter.	M	16.66%		Act	Injury or fatality	1.28%	Carelessness	7.68%	Immediately told the shore rigger to get inside.	16.66%	Always be attentive and assess the situational awareness to minimise risks.	16.66%	ability, skills, knowledge of the people involved	16.66%	75.52%
34	noticed one of the crews working on the forward Mast without wearing Helmet.	M	15.36%		Act	Injury or fatality	16.66%	Carelessness	16.66%	Stop him and advised him to work with proper PPE.	16.66%	Safety is First	16.66%	ability, skills, knowledge of the people involved	16.66%	98.56%
35	the crossing of mooring lines	M	15.36%		Act	Injury or fatality	16.66%	Carelessness	16.66%	The person was stopped and informed of the potential danger	16.66%	Newer use shortcuts	16.66%	ability, skills, knowledge of the people involved	16.66%	98.56%
36	the galley stove hood exhaust screen was not inserted in place after cleaning while cooking was in progress.	L	16.66%		Act	Fire/Explosion	7.68%	Failure to use PPE	1.28%	Placed hood exhaust screen on the duct.	16.66%	Always Take five before performing the job. Consult always Manufacturer instructions. Apply Risk Assessment, in writing, if required by Company manuals. If not sure about the job, ask your Supervisor or/and Senior Officer for clarification.	16.66%	planning of work	16.66%	75.52%

No	Near Miss description	Rate	Accuracy rate	Rate as per experts	Unsafe act or con	Potential Consequence	Accuracy rate	Root Causes	Accuracy rate	Immediate Corrective Action	Accuracy rate	Lessons Learned	Accuracy rate	Classification of the Near Miss	Accuracy rate	Accuracy of the Near Miss
37	carrying of the cutter without securing properly	M	16.66%		Act	Injury or fatality	16.66%	Carelessness	16.66%	Advised to keep it away and secure it in a safe place.	16.66%	Always pay attention to what you're inside your pocket	16.66%	ability, skills, knowledge of the people involved	16.66%	100%
38	my room was locked, and the key was left with a crew how was on the deck observing the discharging process. So, I went to the deck with my slipper and pyjama to take my keys.	H	6.40%		Act	Injury or fatality	16.66%	Failure to use PPE	16.66%	I did not take any corrective action. But the boatswain had stopped me in when I was on my way back to the accommodation and explained to me this was wrong and advised me to write the report to not forget the importance of being careful in the future.	16.66%	This might lead to injury or fatality as the deck was slippery. Also, will reflect a bad reputation for the company if someone from the port authority saw that.	16.66%	ability, skills, knowledge of the people involved	16.66%	89.60%
39	I was cleaning my room during the weekly check for the crew's cabin. And I left a candle on my room, and I went to my duty.	VH	16.66%		Act	Fire/Explosion	16.66%	Carelessness	16.66%	during the inspection, the master saw that. He shut the candle down and conduct an urgent meeting. Everything was explained to me as it could lead to a fire.	16.66%	There is a safety type of candle that can shut itself down when it is finished. Anyway, candles are not allowed on board.	16.66%	ability, skills, knowledge of the people involved	16.66%	100%
40	while a was plotting a position on the paper chart. I draw the Sample of the visual position instead of the position of a gap.	M	16.66%		Act	Injury or fatality	1.28%	Lack of competency	16.66%	the duty officer corrected my mistake and explained to me the difference between the samples.	16.66%	Now I'm aware of the difference between al samples and when to use each one.	16.66%	Ability, skills, knowledge of the people involved	16.66%	84.48%

No	Near Miss description	Rate	Accuracy rate	Rate as per experts	Unsafe act or con	Potential Consequence	Accuracy rate	Root Causes	Accuracy rate	Immediate Corrective Action	Accuracy rate	Lessons Learned	Accuracy rate	Classification of the Near Miss	Accuracy rate	Accuracy of the Near Miss
41	one engine personnel were about to carry out fuel oil filter cleaning and carrying a bucket of diesel. On his way to the Leer ER deck where the cleaning area is located, he noticed that the floor plates were removed and left without any sign or notice. This could lead to an injury if the personnel fall into the opening and could lead damage to the machinery or even fire.	H	6.40%		Act	Injury or fatality	16.66%	Lack of competency	16.66%	tiger rope was placed around the removed floor plates as a warning sign.	16.66%	Do not leave any low-ranking crew without supervision.	16.66%	ability, skills, knowledge of the people involved	16.66%	89.60%
42	The boiler has noticed a spot of oil spell in the ER.	M	7.68%		Act	Injury or fatality	7.68%	Housekeeping	7.68%	I stopped him and instructed him to carry one by one or ask for help from a crew. The consequences were explained to him, as well.	7.68%	Always keep an eye on the low ranking as they think I'm able to do multi-tasks at a time.	7.68%	Regulations, survey and inspections	7.68%	46.08%
43	one of the crew was observed standing under the crane while picking up some stuff from the surface boat.	H		Medium	Act	Injury or fatality	10.24%	Failure to comply with procedure	16.66%	asked him to keep clear of the dangers area.	16.66%	Some of the new crew wats to proof themselves by doing any things even if it was dangerous. So, they need special observation all the times.	16.66%	ability, skills, knowledge of the people involved	1.28%	61.44%
44	during a routine inspection, the rescue boat forward painter was in bad condition. This could lead to breaking while in use.	M	10.24%		Condition	Injury or fatality		Lack of competency	10.24%	the CH.OFF was informed, and the painter was renewed.	10.24%	Painters need extra inspections from time to time. No one knows when the emergency will happen.	10.24%	Regulations, survey and inspections	10.24%	51.20%
45	during watch on deck, I observed one of the crew lifting the ventilation with greasy gloves. This might slip the vent on his hand.	L	16.66%		Act	Injury or fatality	16.66%	Carelessness	16.66%	I told him to take new gloves.	16.66%	To be very careful while doing any job	16.66%	ability, skills, knowledge of the people involved	16.66%	100%

No	Near Miss description	Rate	Accuracy rate	Rate as per experts	Unsafe act or con	Potential Consequence	Accuracy rate	Root Causes	Accuracy rate	Immediate Corrective Action	Accuracy rate	Lessons Learned	Accuracy rate	Classification of the Near Miss	Accuracy rate	Accuracy of the Near Miss
46	during the afternoon routine inspection round in the ER, the 4th engineer was noted replenishing the oil in topping air compressor. Due to age sight glass is not transparent, and it is not possible to clearly determine the exact oil level in the compressor. The compressor is protected by automation from running with L oil level only. But H level of oil can also be dangerous.	M	16.66%		Condition	Injury or fatality	7.68%	Lack of competency	16.66%	4th engineer stopped. Sight glass was replaced.	16.66%	This need to be discussed clearly with all members in the ER to be careful.	16.66%	equipment (availability, reliability)	16.66%	90.88%
47	during the round check, the crude oil wash line was leaking.	H	1.28%		Condition	Injury or fatality	1.28%	Equipment failure	1.28%	the CH.OFF was informed the line was drained and depressurised. Rubber expansion joint replaced with a new one.	1.28%	To replace the joint expansion rubber frequently before the leak happens.	1.28%	state of maintenance (not maintained, badly maintained)	1.28%	7.68%
48	noticed few exhaust flaps around the accommodation closed	L	16.66%		Act	Injury or fatality	7.68%	Carelessness	16.66%	informed responsible person and flap opened. Once again flaps need to be opened and to be closed only in port and cargo operation.	16.66%	The crew need a reminder all the time. Never left without supervision.	16.66%	ability, skills, knowledge of the people involved	16.66%	90.88%
49	while cabins inspection, one of the crew was smoking on the bed	H	16.66%		Act	Damage to the Property	1.28%	Carelessness	16.66%	the ashtray was replaced. The crew member was informed of the consequences.	16.66%	The crew was learned to be extra careful next time.	16.66%	Attitude	16.66%	84.48%
50	during painting using spray equipment, one crew member was noted working without the chemical respirator. He wears a dust mask.	H	8.96%		Act	Injury or fatality	16.66%	Housekeeping	1.28%	job stopped and asked to wear the correct PPE. With an explanation of the difference.	16.66%	Each PPE and its purpose must be clear to all crew.	16.66%	Planning of work	16.66%	76.80%

No	Near Miss description	Rate	Accuracy rate	Rate as per experts	Unsafe act or con	Potential Consequence	Accuracy rate	Root Causes	Accuracy rate	Immediate Corrective Action	Accuracy rate	Lessons Learned	Accuracy rate	Classification of the Near Miss	Accuracy rate	Accuracy of the Near Miss
51	The 4th engineer was about to transfer diesel oil from tank to tank without following the working procedure. The CH/E saved the situation immediately.	L	1.28%		Act	Fire/Explosion	7.68%	Lack of competency	15.36%	the transfer was stopped immediately, and the correct procedures were explained	6.40%	procedures must be read and followed	6.40%	planning of work	16.66%	53.76%
52	while bunkering operation when I was taking tank sounding, I saw bunker supervisor beside me using his phone while the bunker sounding pipe was open, and the fumes were coming up	M	7.68%		Act	Injury or fatality	1.28%	Carelessness	7.68%	he was stopped immediately.	16.66%	People from outside the ship has a lower level of safety, so be careful.	16.66%	Attitude	16.66%	66.56%
53	during testing sprinkler system in the grease locker (engine casing stab side) found one nozzle choke.	H		Medium	Condition	Fire/Explosion	1.28%	Tools deficiency	1.28%	nozzle removed cleaned and tested, and it was operational.	1.28%	Check regularly.	1.28%	regulations, survey and inspections	1.28%	6.40%
54	while the ship was rolling heavily due to the heavy weather. One of the crew was running down the stairs, and he lost his balance. he missed one of the steps and almost fall	L	16.66%		Act	Injury or fatality	10.24%	Carelessness	16.66%	he was told to walk slower and pay more attention while the ship is rolling.	16.66%	While the ship is in heavy weather, everything needs to be secured, and even the crew needs to be careful.	16.66%	Ability, skills, knowledge of the people involved	16.66%	93.44%
55	The OOW had adjusted the echo sounder setting at the last minute of approaching shallow water.	L	15.36%		Act	Fire/Explosion	10.24%	Carelessness	1.28%	The master warns the OOW to follow the standing orders carefully	16.66%	Master standing orders must be followed	16.66%	procedures and standing orders communication (internal and external)	16.66%	76.80%
56	One of the crew has mixed the garbage.	M	16.66%		Act	Damage to the environment		Carelessness	16.66%	he was instructed to move away.	8.96%	This occurrence is happening all the time. The crew needs to continue supervision.	16.66%	regulations, survey and inspections	16.66%	75.52%

No	Near Miss description	Rate	Accuracy rate	Rate as per experts	Unsafe act or con	Potential Consequence	Accuracy rate	Root Causes	Accuracy rate	Immediate Corrective Action	Accuracy rate	Lessons Learned	Accuracy rate	Classification of the Near Miss	Accuracy rate	Accuracy of the Near Miss
57	while connecting the cargo hose at the manifold one of the grating noted corroded.	L	1.28%		Condition	Injury or fatality		Lack of competency		the Ch. OFF was informed, and a replacement has taken place.	1.28%	Grating needs to be checked more frequently.	1.28%	state of maintenance (not maintained, badly maintained)	1.28%	5.12%
58	during a fire drill. The fire monitor valve was hard to open by hand, and the f key was not in its position as a standby for use.	L	1.28%		Condition	Navigational hazard		Carelessness		F key was secured back to be ready in the future	1.28%	in case of a real fire, the fire monitor will not be usable	1.28%	state of maintenance (not maintained, badly maintained)	1.28%	5.12%
59	At night the deck cadet was cooking at the galley without informing the Chief cook.	L	15.36%		Act	Damage to the environment	15.36%	Carelessness	16.66%	the cadet was stopped and asked to leave the galley	15.36%	Galley to be locked at night and no one is allowed to cook without asking the chief cook	15.36%	attitude	16.66%	94.72%
60	at steering gear room platform, near the stairway from mezzanine decks, a big gap between two plates was found	L	1.28%		Condition	Fire/Explosion	1.28%	Tools deficiency	1.28%	one of the plates was relocated to narrow the gap	1.28%	maintain regular inspection to all places within the ship.	1.28%	state of maintenance (not maintained, badly maintained)	1.28%	7.68%
61	before going unmanned in the ER, it was noticed that workshop fire alarm still on delay. it was found the delay clock is seized	L	1.28%		Condition	Fire/Explosion	1.28%	Tools deficiency	1.28%	ETO was immediately informed, and he cleaned the unit.	1.28%	do not ignore any tools without inspection	1.28%	state of maintenance (not maintained, badly maintained)	1.28%	7.68%
62	no barricade tape put around the area at emergency generator room entrance. where the grating has been removed for maintenance	L	15.36%		Act	Injury or fatality	15.36%	Carelessness	15.36%	the tape was put in place	15.36%	before removing any late or grating, the tape needs to be prepared.	15.36%	planning of work	15.36%	92.16%

No	Near Miss description	Rate	Accuracy rate	Rate as per experts	Unsafe act or con	Potential Consequence	Accuracy rate	Root Causes	Accuracy rate	Immediate Corrective Action	Accuracy rate	Lessons Learned	Accuracy rate	Classification of the Near Miss	Accuracy rate	Accuracy of the Near Miss
63	OOW did not make a double check after plotting position by the lookout.	L	15.36%		Act	Injury or fatality	8.96%	Lack of competency	16.66%	The next position was plotted by the OOW	15.36%	Plotting position is one of the OOW duties	15.36%	composition of the crew (competence/nationality)	16.66%	88.32%
64	during working with the pneumatic tool was found that air hose near connection has a crack and air leak. The air hose crack appeared due to rubber over dry and lost its flexibility.	M	6.40%		Condition	Injury or fatality	6.40%	Tools deficiency	6.40%	the work was stopped, and the rubber was replaced	6.40%	each equipment must be checked before starting the job	6.40%	equipment (availability, reliability)	6.40%	38.40%
65	The junior cadet left alone in the navigational watch as the OOW was fully drunk and could not wake up.	M	15.36%		Act	Navigational hazard	16.66%	Carelessness	16.66%	the work was stopped	15.36%	this case has happened more often, and they never learned the lessons.	15.36%	teamwork	16.66%	96.00%
66	while crew members were doing chipping on the x platform on one of the valves. one of the crew was doing on the top of the valve and the 2nd on the bottom of the valve without the Helmet (PPE)	L	16.66%		Act	Injury or fatality	16.66%	Carelessness	16.66%	, he was instructed to put on his Helmet	16.66%	working on deck needs to continue observation. The crew usually violate the rules.	16.66%	Ability, skills, knowledge of the people involved	16.66%	100%
67	after the discharging. And disconnecting the cargo hose. One of the crews from the port authority was not wearing gloves.	VH	1.28%		Act	Injury or fatality	1.28%	Failure to use PPE	16.66%	he was pushed back	16.66%	briefing for the crew before such a job to make sure they are safe enough.	16.66%	ability, skills, knowledge of the people involved	16.66%	69.12%
68	The master gave the pilot the command while approaching the port.	L	10.24%		Act	Navigational hazard	16.66%	Housekeeping	1.28%	Ch. Off was informed for further action	16.66%	to be very careful when stepping on a very shiny and clean surface.	16.66%	teamwork	16.66%	78.08%

No	Near Miss description	Rate	Accuracy rate	Rate as per experts	Unsafe act or con	Potential Consequence	Accuracy rate	Root Causes	Accuracy rate	Immediate Corrective Action	Accuracy rate	Lessons Learned	Accuracy rate	Classification of the Near Miss	Accuracy rate	Accuracy of the Near Miss
69	during off cargo hose, a damaged o ring gasket on the cargo hose was observed.	H	1.28%		Condition	Damage to the environment		Lack of competency		loading master and pilot and Ch. OFF was informed. A replacement has taken place.	1.28%	this need to be checked in advance	1.28%	equipment (availability, reliability)	1.28%	5.12%
70	during working in the ER store, it was noticed that the access cover between the workshop and the central store for the air hoist is not secured and might fall while a person wants to remove it.	M	10.24%		Act	Injury or fatality	10.24%	Housekeeping	1.28%	a rope was fixed to the cover to prevent it from falling in case of removal.	10.24%	Housekeeping must be under supervision.	10.24%	state of maintenance (not maintained, badly maintained)	10.24%	52.48%
71	it was observed that while taking atmosphere check to an enclosed space via the gas meter, that the sampling hose was damaged.	M	1.28%		Condition	Navigational hazard	1.28%	Tools deficiency	1.28%	the sampling hose was replaced	1.28%	make calibration for the gas meter all the times.	1.28%	equipment (availability, reliability)	1.28%	7.68%
72	while doing ME to overhaul the contractors were instructed about safety and the emergency stop of the cranes. during overhauling me to was noticed that contractors were not wearing Helmet	M	16.66%		Act	Injury or fatality	16.66%	Carelessness	7.68%	the safety instruction was told again, and they instructed to wear the Helmet	16.66%	keep an extra eye on the people from outside the ship	16.66%	ability, skills, knowledge of the people involved	15.36%	89.60%
73	one of the engine crew was working with a wire brush. After he finished, he blows himself using the compressor to take the dust out.	H	1.28%		Act	Injury or fatality	7.68%	Failure to use PPE	7.68%	he was stopped, and I explained this might harm his body and get him an infection.	7.68%	Never use high pressure to blow your body from dust	7.68%	ability, skills, knowledge of the people involved	7.68%	39.68%
74	during taking over the watch, the logbook was not updated with the voyage details for the last watch	L	15.36%		Act	Navigational hazard	16.66%	Carelessness	16.66%	The next OOW filled the logbook	15.36%	Not filling the logbook is affecting the taking over negatively	15.36%	procedures and standing orders communication (internal and external)	16.66%	96.00%

No	Near Miss description	Rate	Accuracy rate	Rate as per experts	Unsafe act or con	Potential Consequence	Accuracy rate	Root Causes	Accuracy rate	Immediate Corrective Action	Accuracy rate	Lessons Learned	Accuracy rate	Classification of the Near Miss	Accuracy rate	Accuracy of the Near Miss
75	The helmsman was not acknowledging the master order.	L	15.36%		Act	Injury or fatality	8.96%	Lack of competency	15.36%	The master dismissed him and asked another AB to hold the steering	15.36%	To acknowledging the steering order	15.36%	attitude	16.66%	87.04%
76	while a crew was using welding tools in the ER, he did not secure the working area from catching fire material.	VH	16.66%		Act	Fire/Explosion	16.66%	Lack of competency	8.96%	The job was stopped by the duty engineer	16.66%	Always follow the hot work permit procedures	16.66%	planning of work	16.66%	92.16%
77	The deck cadet changed the radar setting without informing the duty officer while passing Malaga straight.	L	15.36%		Act	Navigational hazard	16.66%	Incorrect use of equipment	16.66%	The radar was reset according to the master standing order	15.36%	The cadet must be under the supervision	15.36%	procedures and standing orders communication (internal and external)	15.36%	94.72%

No	Near Miss description	Rate	Accuracy rate	Rate as per experts	Unsafe act or con	Potential Consequence	Accuracy rate	Root Causes	Accuracy rate	Immediate Corrective Action	Accuracy rate	Lessons Learned	Accuracy rate	Classification of the Near Miss	Accuracy rate	Accuracy of the Near Miss
78	by the time the two pilots embarked the VLCC, the dry bulb temperature came close to that of the wet bulb, and nobody saw it coming. Normally, wet/dry bulb temperatures are recorded regularly on the ship's logbook, but in this case, it seemed to be the task with least importance, given the current situation. This causes the sudden appearance of Very High dense fog, which was unexpected by the bridge team during SPM approach. There was a lot of panic on the bridge, and suddenly the ship had to report to the VTS centre, and ships in the vicinity, and work with fog signals. with too much work and communication procedure that had to be followed in a short time, the ship came close to collide with a maintenance boat, but it was evaded on the last minute	L	16.66%		Act	Navigational hazard	16.66%	Carelessness	10.24%	communicating with the maintenance boat, and arrange irregular manoeuvrability (one that is not based on COLREGs)	16.66%	Keep people on-board for carrying out regular boring work, because small details may cause huge damage	16.66%	procedures and standing orders communication (internal and external)	16.66%	93.44%

8.6.1. The rate of Near Misses reported at the newly designed reporting form

Figure 8-11 presents the distribution of the rate of the reported Near Misses via the newly designed reporting form under the accuracy level colour code.=. The majority of the Near Misses were grouped under the green colour code with a percentage of 61.54% (48 Near Misses). On the other hand, 20.51% of the Near Misses were categorised as low accurate cases under the red colour code, and 2.56% of the cases were seen by the experts as (completely inaccurate). The rest of the cases have been distributed under the remaining colour codes. The distribution of the rate of the Near Misses under the five different colour codes gives a mean of 4.73 and accuracy score of 74.62%.

By comparing the mean and the score of the rate between the two reporting models, an improvement of 23.35% is recorded with the accuracy rate among the reported cases through newly designed reporting form. This improvement is a result of the small note which has been written at the bottom of the newly designed reporting form to remind the seafarer of the rating criteria based on the potential consequence cost.

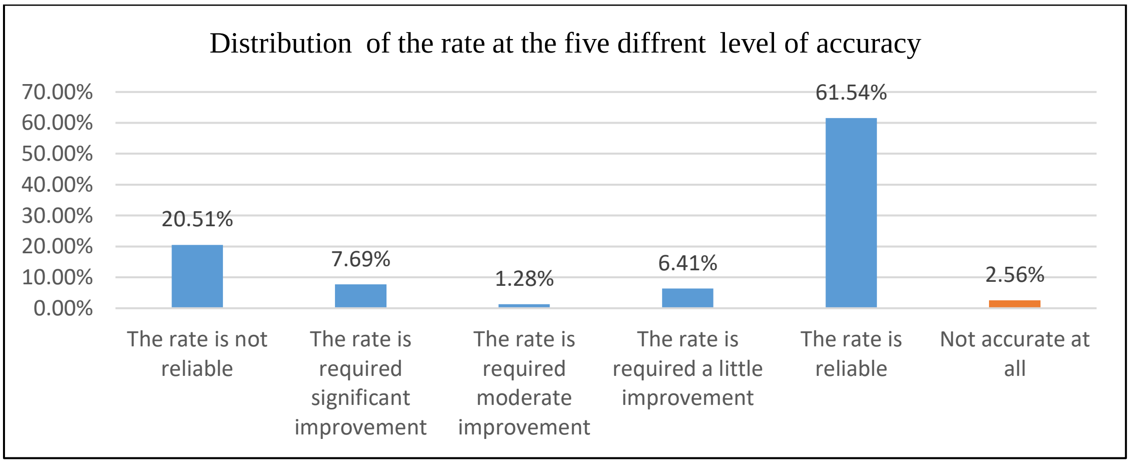

Figure 8-11 Distribution of the rate of the reported Near Misses via the newly designed reporting form at the accuracy level colour code

Table 8-13 Mean and score of the accuracy of the rate of the reported cases via the newly designed reporting form

Not accurate at all	Rate is not reliable	Rate is required significant improvement	Rate is required moderate improvement	Rate is required a little improvement	Rate is reliable	Mean	The score of the rate accuracy
2	16	6	1	5	48	4.73	74.62%

8.6.2. Nature of Near Misses reported in the newly designed reporting form

The main aim of implementing the Near Miss reporting by the ISM code is to capture unsafe conditions and acts observed on-board ships by the seafarers as much as possible. While examining the existing reporting form for Near Misses at the shipping company, it was identified that the form was designed to capture unsafe act and conditions without asking the reporter clearly about the nature of the Near Miss. Therefore, the newly designed reporting form has a specific field to ask the reporter about the nature of the case, whether it is an Act or Condition. Thus, this question would alert the reporter about the real meaning of the Near Miss, which is defined as 'unplanned action by any of the seafarers or unsafe condition detected at the time of the operation that could contribute to accidents or incidents if a series of Near Misses have not been intervened'. Seafarers are expected to be more aware while reporting every single unsafe condition as some of the unsafe conditions might be considered as a Near Miss in some circumstances (if the cases observed during the time of the operation), and the same observation might not be a Near Miss (if the case was observed at the time of maintenance or routine inspection). For instance, Near Miss number 69 in Table *8-12* above, was marked by the reporter as an unsafe condition, and the expert has categorised it as a valid Near Miss. If the same occurrence was observed at a time of routine daily inspection, then the case will not be a valid Near Miss, as it does not have any potential consequences.

The reported cases via the existing reporting form were evaluated earlier in chapter 7 to categorise the nature of the collected Near Misses. *Figure 8-12* below shows the percentage of the unsafe acts and the unsafe conditions reported by the two reporting forms.

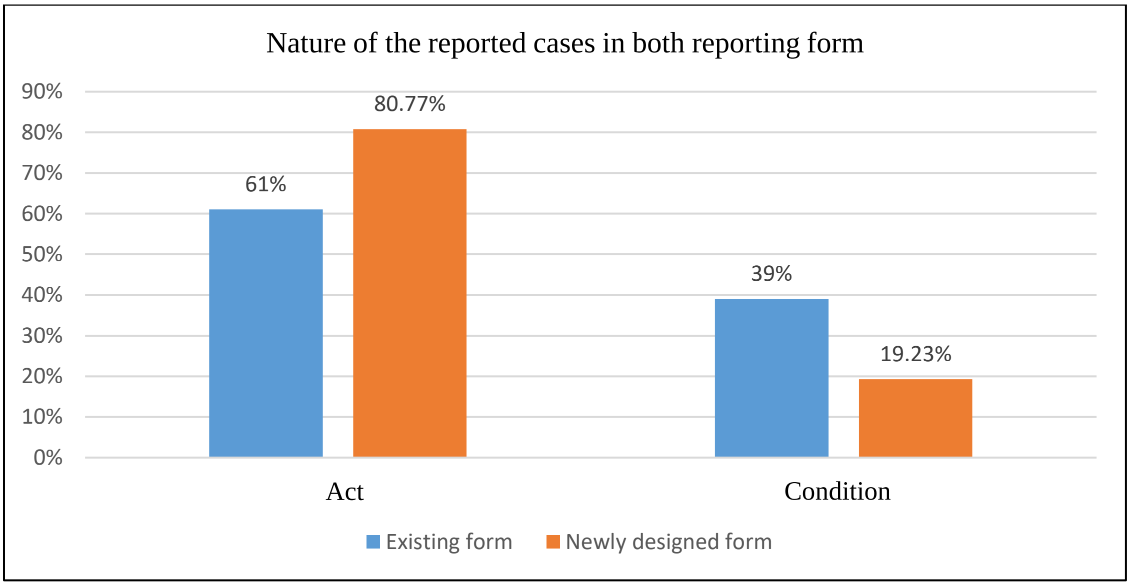

Figure 8-12 Nature of Near Misses reported at both reporting forms

8.6.3. Potential consequences of Near Misses reported using the newly designed reporting form

Figure 8-13 below shows the distribution of the Near Miss cases collected using the newly designed reporting form according to the potential consequences. The new form has six categories for the potential consequences: (Health or illness - Fire/Explosion – Navigational hazard — Damage to the environment – Damage to the property – General hazard to the ship). Those six categories were selected to be on the newly designed form after examining options in the existing reporting form and evaluating the feasibility of each option. For example; the two options in the existing reporting form (Health/illness and Personal accident case) are confusing for the seafarers. It is noticeable that most of the inaccurate potential consequences in *Table 8-6 Evaluation of the existing* reporting form above are related to the health/illness, as the illness and the health condition might be affected as a result of the personal accident case. This is the reason for eliminating this category and replace it with (injury or fatality). In addition to that, the option of Navigational hazard was required to be one of the available categories, as some of the cases would have resulted in Navigational hazard. Thus, the newly designed form for reporting Near Misses has the Navigational hazard as one of the possible choices, as it will boost the Near Miss analysis process by the MS.

The existing reporting form assumed that the option ‘General hazard’ would be sufficient and would include environmental damage. Therefore, a new category (Environmental damage) was included in the newly designed reporting form, as the expression of environmental damage is more explicit and straight to the point in describing the potential hazard.

Results show that 62.82% of the cases were leading to Injury/fatality as the potential consequence according to *Figure 8-13*. This is an indication of a low level of applying and following the safe working practice by the seafarers, as they do not take all the precautions as per the company’s SOP to stay away and be safe from any personal harm. This percentage might be reduced if the shipping company enforced some courses to educate the seafarers on the importance of implementing safe working practice/procedures to stay safe.

Following the analysis of the reported cases, The experts indicated that 42.31% (33 Near Miss) of the valid reported cases were given accurate potential consequences by the reporters and were grouped under the green colour code (the parameter is reliable), as shown in

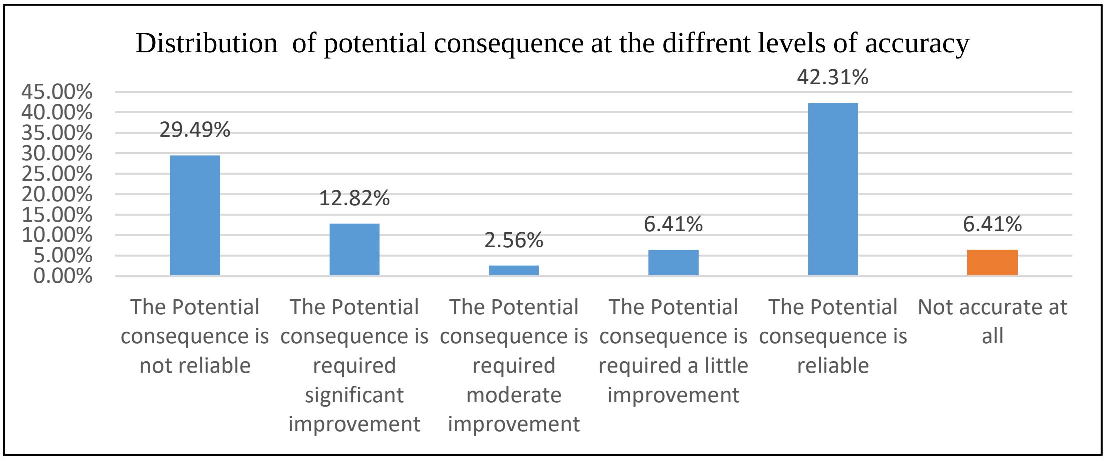

Figure 8-144. On the other hand, the Near Misses that were grouped under the red colour code and reflected a very low accuracy rate are forming 29.49% of the valid Near Misses. Besides, completely inaccurate cases form 6.41% of the whole cases. This leads to the mean value of 4 and the score of the accuracy of 60% with regards to the potential consequences for the reported cases through the newly designed reporting form. As shown in Table *8-14* below, although the result is disappointing, it is still slightly higher than the mean and the score of the reported cases via the existing reporting form by almost 1.5%. This result suggests that either seafarers do not take the selection of the potential consequence seriously while reporting the Near Miss or they are not able to judge the consequences. Therefore, the shipping company is required to conduct more intense courses to educate the seafarers about the importance of understanding and selecting the potential consequence. It will boost the analysis process for the Near Miss reports and will result in a better classification and categorisation of the Near Miss. The seafarers need to be aware that their role in reporting accurate Near Miss reports is as important as the key personnel at the shore-based office.

More improvement is expected when the new Near Miss reporting approach is properly implemented officially, as each reporter will receive individual feedback on the Near Miss case that he/she reported. The feedback will play a significant role in educating and motivating the seafarers on how to report Near Misses appropriately.

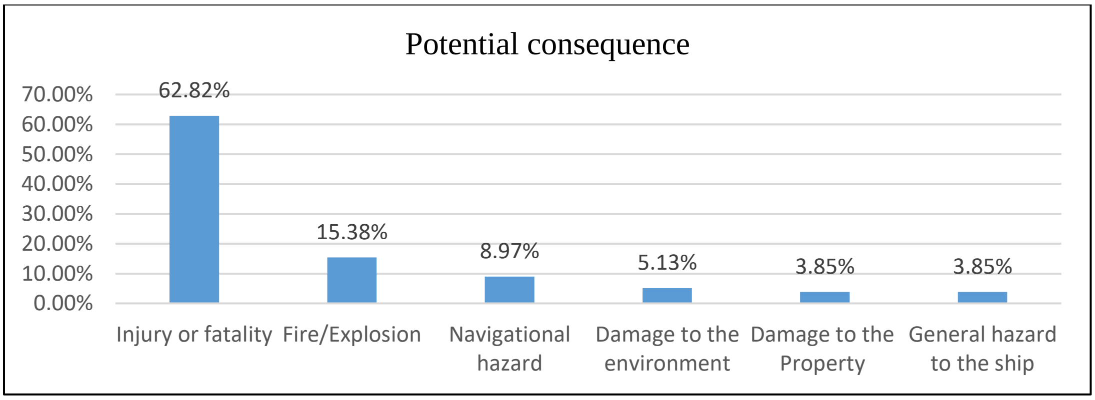

Figure 8-13 Potential consequences of Near Misses reported using the newly designed reporting form

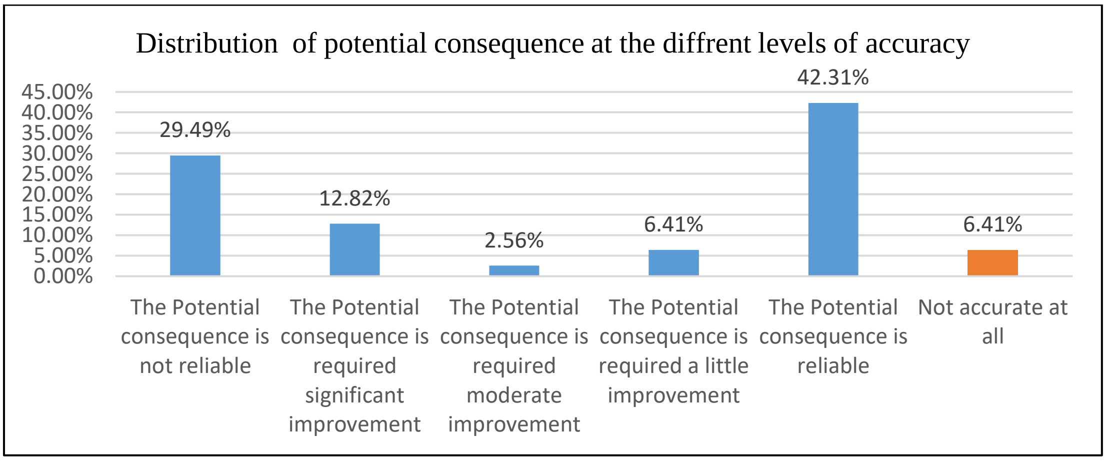

Figure 8-14 Distribution of the potential consequence at the accuracy level colour code

Table 8-14 Mean and score of the accuracy of the potential consequence of the reported cases via the newly designed reporting form

Not accurate at all	potential consequence is not reliable	potential consequence is required significant improvement	potential consequence is required moderate improvement	potential consequence is required a little improvement	potential consequence is reliable	Mean	The score of the rate accuracy
5	23	10	2	5	33	4	60.00%

8.6.4. Root causes of Near Misses reported using the newly designed reporting form

Figure 8-15 below shows the distribution of the Near Miss cases among the different type of root causes. The newly designed reporting form has a list of only eight root causes as shown in *Figure 8-15*. Those eight root causes were listed in the newly designed reporting according to the well-known taxonomy of root causes related to the human factors. Some of the root causes in the existing reporting form are considered as a classification of the unsafe act, such as lack of maintenance as mentioned in BERTRANC PROJECT (European commission, 2000). Thus, the new reporting form was designed to have two options; root causes and classification of the unsafe occurrences, to ensure classifying the Near Misses according to the approved classes as per BERTRANC PROJECT (European commission, 2000).

According to *Figure 8-15* below, the highest percentage of root causes that resulted in the occurrence of Near Misses was the carelessness. This is a logical result, as such failure is leading to injury/fatality cases, as mentioned in *Table 8-12 newly designed reporting form outcomes*. The workshop and the opinion of the experts will validate this result.

According to the experts, the accurate root causes make up 56.41% (44 Near Misses) of the valid reported cases using the newly designed reporting form, as shown in *Figure 8-16*. On the other hand, the inaccurate root causes, according to the experts, are 3.85% of the valid Near Misses.

Besides, the Near Misses that were grouped under the low accuracy rate are 24.36%. Thus, the mean and the score of the accuracy of the root causes are 4.46 and 69.23% respectively. This result is considered as an improvement when the accuracy results between the existing reporting form and the newly designed reporting form are compared. The main reason behind this improvement is the elimination of the confusing choices of the root causes. Separation of the root causes and the classifications according to the approved classifications by (European commission, 2000) improves the quality of the reporting as it eliminates any confusion. Thus, the shortlisting of the root causes improves the quality of the reporting.

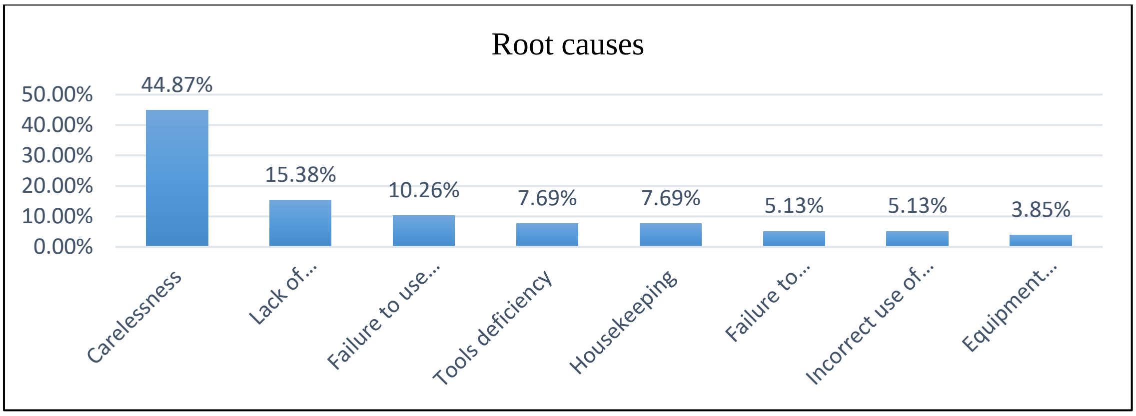

Figure 8-15 Root causes of Near Misses reported at newly designed reporting form

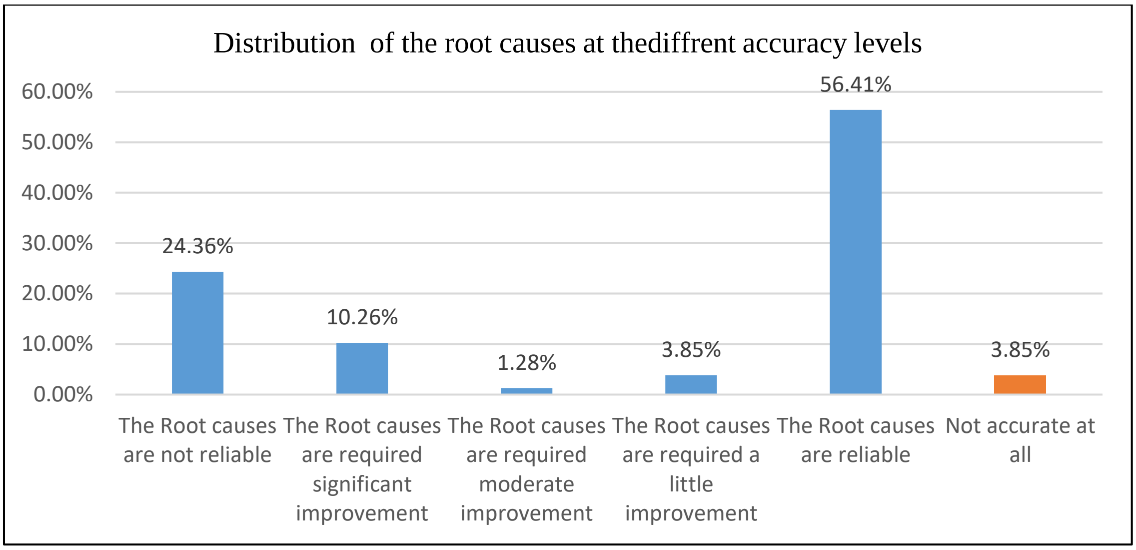

Figure 8-16 Mean and score of the accuracy of the potential consequence of the reported cases via the newly designed reporting form

Table 8-15 Mean and score of the accuracy of the root causes of the reported cases via the newly designed reporting form

Not accurate at all	Root Causes are not reliable	Root Causes are required significant improvement	Root Causes are required moderate improvement	Root Causes are required a little improvement	Root Causes are reliable	Mean	The score of the rate accuracy
	19	8	1	3	44	4.46	69.23%

8.6.5. Corrective action

Figure *8-17* below shows the distribution of the accuracy rate of the corrective actions taken by the reporter at the time of the Near Miss according to the experts' opinion. 73.08% of the reported Near Misses via the newly designed reporting form were grouped under the green colour code (the parameter is reliable), as they were accurate corrective actions. None of the corrective actions has been seen by the experts as inaccurate, while 17.95% of the reported Near Misses were grouped under the red colour code (the parameter is not reliable). Therefore, the mean and the score of the accuracy rate of the corrective actions taken at the time of the Near Miss is 5.07 and

81.54% respectively. When these results are compared to the accuracy rate of the corrective actions of the reported Near Misses via the existing reporting form, an improvement of 9.29% can be observed. This improvement is a result of the anonymity of the reporting process and considered as acceptable improvement initially, as the newly designed reporting form was tested for a short period only. It is expected to achieve more enhancement with the accuracy of the corrective action when the anonymous reporting form is used as an official platform for reporting Near Misses.

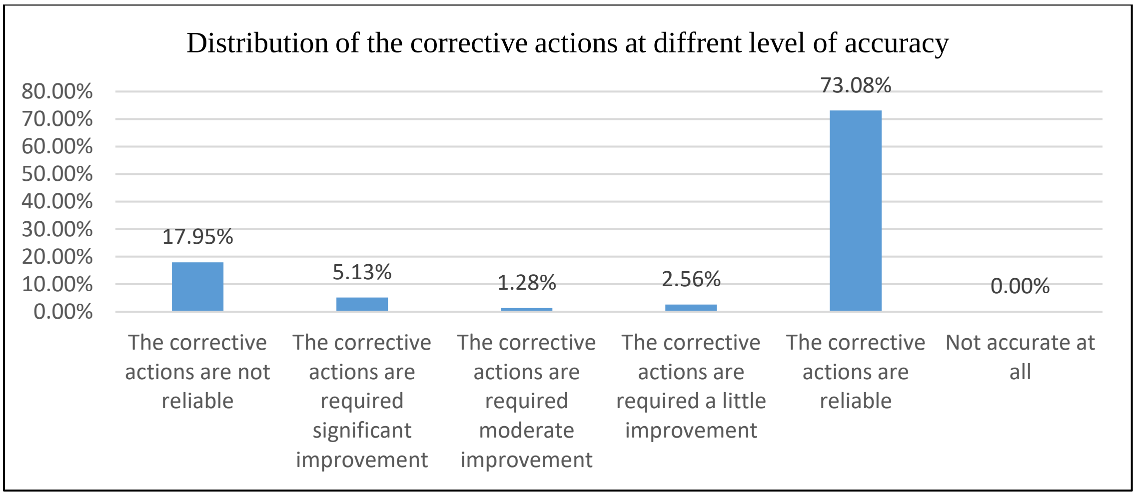

Figure 8-17 Distribution of the accuracy of the corrective actions

Table 8-16 Mean and score of the accuracy of the corrective action of the reported cases via the newly designed reporting form

Not accurate at all	Corrective actions are not reliable	Corrective actions are required significant improvement	Corrective actions are required moderate	Corrective actions are required a little improvement	Corrective actions are reliable	Mean	The score of the rate accuracy
0	14	4	1	2	57	5.07	81.54%

8.6.6. Lessons learned

Figure *8-18* below shows the distribution of the accuracy of the lessons learned that were written in the reporting form while reporting the Near Misses using the newly designed reporting form. This parameter is not available in the existing reporting form. Thus, no comparison will be made below. Nevertheless, the seafarers learn the lessons accurately as the mean of 4.89, and the score of the accuracy rate of the lessons learned at the time of the Near Misses are 77.95% respectively. The seafarers are required to be aware of their mistakes and the unsafe conditions that lead to Near Misses, subsequently. The shipping company should motivate the masters and the Chief Engineers to demonstrate some valid examples of accurate lessons learned during the weekly safety meetings as it will enhance the safety culture and the performance of the seafarers.

By including the lessons learned field in the reporting form, the MS will be allowed to capture the capability of the seafarers in taking effective and accurate lessons from their mistakes. Subsequently, such data can be used to train the crew to enhance the overall safety culture among seafarers.

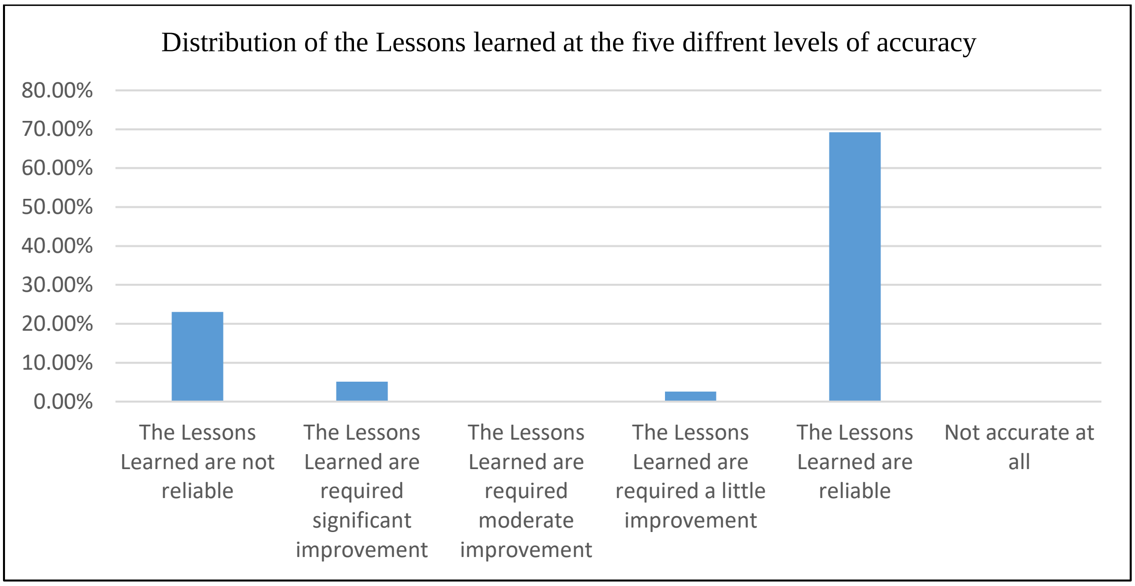

Figure 8-18 Distribution of the accuracy of the lessons learned

Table 8-17 Mean and score of the accuracy of the lessons learned

Not accurate at all	Lessons learned are not reliable	Lessons learned are required significant improvement	Lessons learned are required moderate improvement	Lessons learned are required a little improvement	Lessons learned are reliable	Mean	The score of the rate accuracy
0	18	4	0	2	54	4.89	77.95%

8.6.7. Class of Near Misses reported in the newly designed reporting form

Figure 8-19 shows the distribution of valid Near Misses under different classifications. The classifications were included in the newly designed reporting form based on the (European Commission, 2000), as they have a list of 40 different classes of unsafe acts. The 40 classes were grouped under six main categories as *Table 8-18* below shows:

Table 8-18 Classification of Unsafe act by (European commission, 2000)

<table>
<tr><th>People factors</th><th>Organisation on board</th><th>Working and living conditions</th><th>Ship factors</th><th>Shoreside management</th><th>External influences and environment</th></tr>
<tr><td>ability, skills, knowledge of the people involved</td><td>division of tasks and responsibilities</td><td>level of automation</td><td>design</td><td>policy on recruitment</td><td>weather and sea conditions</td></tr>
<tr><td>personality (mental condition, emotional state)</td><td>composition of the crew (competence/nationality)</td><td>ergonomics of equipment and the working environment</td><td>state of maintenance</td><td>safety policy and philosophy</td><td>port and transit conditions (VTS, pilots etc.)</td></tr>
<tr><td>physical condition (medical fitness, fatigue, use of alcohol or drugs)</td><td>workload (both overloads, and underload)/complexity of tasks</td><td>adequacy of living conditions</td><td>equipment (availability, reliability)</td><td>management commitment to safety</td><td>traffic density</td></tr>
<tr><td>activities prior to the accident/occurrence</td><td>work hours/rest hours</td><td>adequacy of food</td><td>cargo characteristics, including securing, handling and care</td><td>scheduling of leave periods</td><td>ice conditions</td></tr>
<tr><td>assigned duties at the time of accident/occurrence</td><td>procedures and standing orders</td><td>opportunities for recreations</td><td rowspan="6">certificates</td><td>general management</td><td rowspan="6">regulations, survey and inspections</td></tr>
<tr><td>actual behaviour at the time of accident/occurrence</td><td>communication (internal and external)</td><td rowspan="5">vibrations, heat, noise ship motion</td><td>assignment of duties</td></tr>
<tr><td rowspan="4">attitude</td><td>onboard management and supervision</td><td rowspan="4">ship-shore communication</td></tr>
<tr><td>the organisation of on-board training and drills</td></tr>
<tr><td>teamwork</td></tr>
<tr><td>planning of work</td></tr>
</table>

The majority of the Cases were classed under *'ability, skills, knowledge of the people involved'* category. This is an indication of the amount of the training and improvement courses that are required to be delivered to the seafarers to minimise the large number of Near Misses grouped under the ability and skills category. Moreover, the ability, skills and knowledge of the seafarers are required to be updated to keep the pace of the recent enhancements with technology, regulatory framework and operations. Implementing the newly designed reporting form by the shipping company will allow the MS to Identify what kind of improvement they must make to enhance the skills of the seafarers and the general safety on-board.

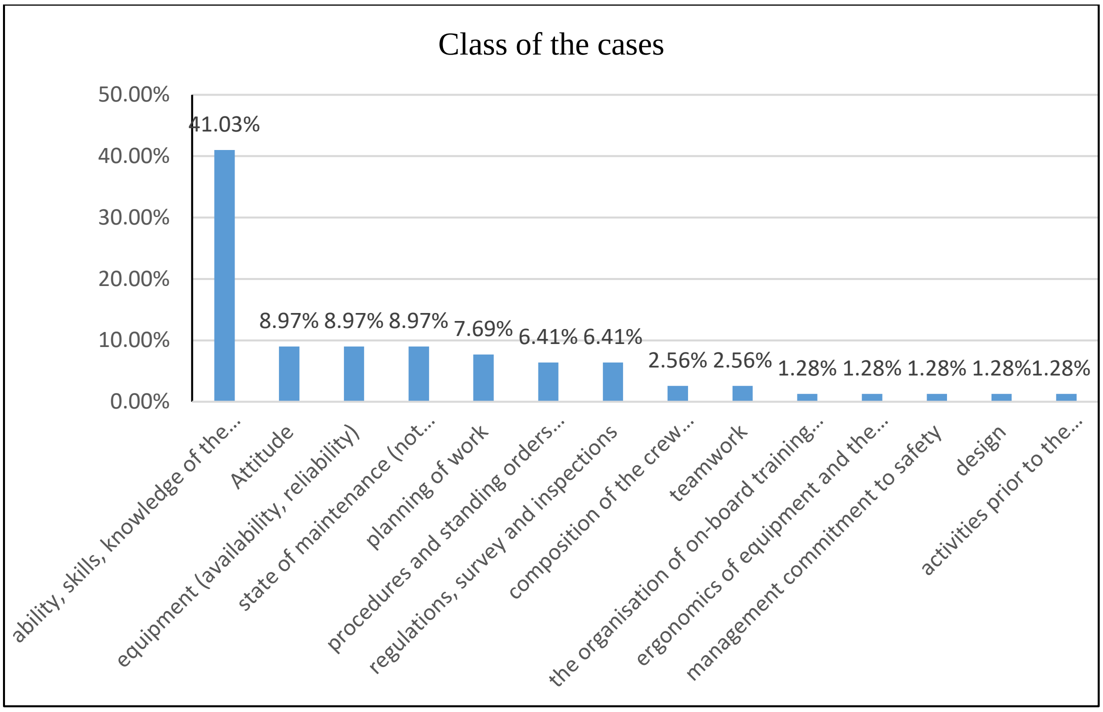

Figure 8-19 Class of Near Misses reported using the newly designed reporting form

The accuracy of the selected classes by the reporter at the time of reporting the Near Misses under the five different accuracy levels has resulted in 73.08% of the Near Misses to be grouped under the green colour code (the parameter is reliable). On the other hand, 19.23% of the Near Misses were rated by the experts as low inaccuracy in terms of the class and grouped under the red colour code. Generally, the mean of the accuracy of the chosen class by the seafarers is 5.05, and the score of the accuracy is 81.03%. This percentage is acceptable to some extent. However, the improvement should be continuous, and it is expected to have a higher score in terms of the accuracy of the class after the seafarers become familiar with the newly designed reporting form.

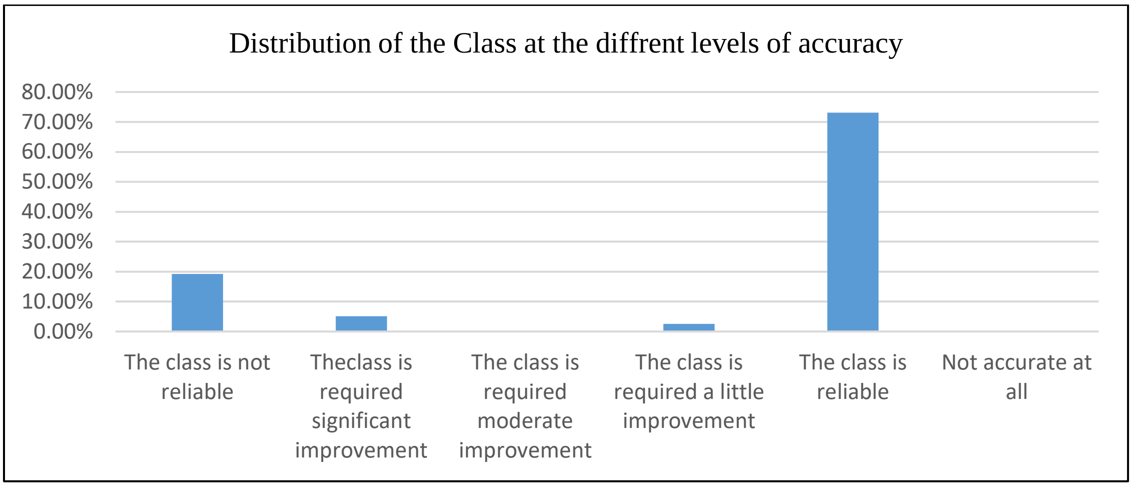

Figure 8-20 Distribution of the accuracy of the lessons learned

Table 8-19 Mean and score of the accuracy of the class

Not accurate at all	Class is not reliable	Class is required significant improvement	Class is required moderate improvement	Class is required a little improvement	Class is reliable	Mean	The score of the rate accuracy
0	15	4	0	2	57	5.05	81.03%

8.7. Key Findings

Figure 8-21 below shows a full comparison of the outcomes from the existing reporting form and the newly designed reporting form for Near Misses. As aforementioned, the comparison includes the percentage of the complete cases which have rate, potential consequence, root causes and corrective actions as well as the percentage of the cases that were chosen by the experts to be valid Near Miss cases. Furthermore, the accuracy of the given rate, the accuracy of the potential consequence, the accuracy of the root causes and the accuracy of the corrective actions were also compared. The key findings are summarised below:

- The newly designed reporting form has succeeded to acquire more complete cases than the existing reporting form by a percentage of 5.1%. This is not a big achievement. However, by the time when the seafarers are familiar with the anonymous reporting system, they will feel free to report more complete cases and fill all the required fields. Moreover, the valid cases using the existing reporting form were 91.02%. On the other hand, the newly designed reporting form has succeeded to score 100% valid Near Miss cases.
- The newly designed reporting form allows the reporter to differentiate between unsafe acts and the unsafe conditions by asking it explicitly. Therefore, the seafarers will start to build awareness to differentiate between the circumstances that make the unsafe condition as a Near Miss or normal observation during the routine inspection.
- The newly designed reporting form for Near Misses has a note at the bottom of the form to remind the reporter of the criteria of rating the cases. This small note has paid off as the score of the accuracy rated cases has jumped from 51.27% in the existing reporting form to 74.62% in the newly designed reporting form.
- Shortlisting the options of the root causes and making it standardised as per the (European Commission, 2000) played a role in improving the accuracy of the root causes. While using the existing reporting forms, the score of the accuracy of the root causes was 58.73%, the accuracy of the root causes using the newly designed reporting forms was recorded as 69.23%. This shows good improvement.
- Lastly, the score of the accuracy of the corrective actions among the existing reporting form was 72.25%. This rate increased to 81.54% as a score of the accuracy of the corrective actions using the newly designed reporting form. In a nutshell, the newly designed and proposed reporting form has improved reporting efficiency.

- More improvement is expected as the newly designed reporting form is used officially, as each new system needs at least one year in circulation to collect enough data that allow a proper comparison. Thus, the shipping company is strongly advised to implement it to capture as many critical Near Miss cases as possible. This will naturally lead to significant improvement of the general safety on-board the ships that the company has in its fleet.

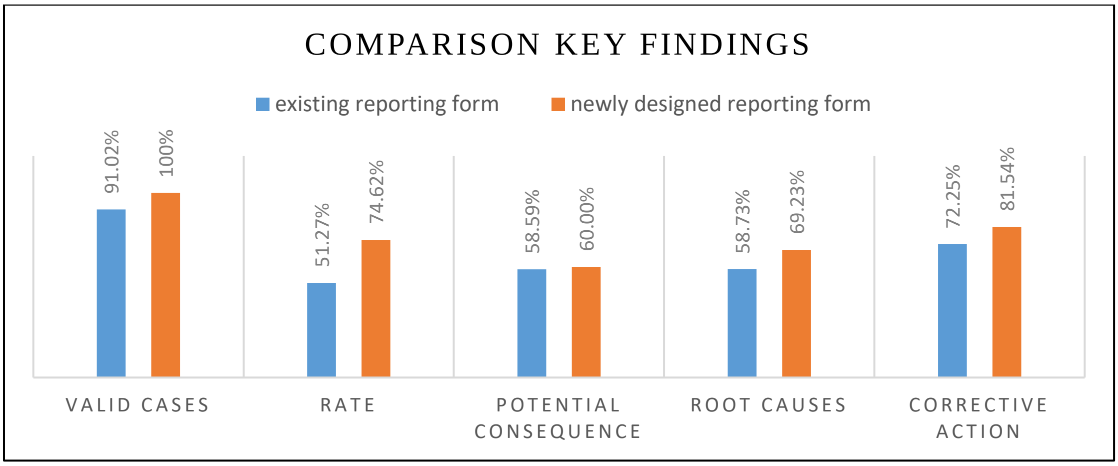

Figure 8-21 Comparison Key Findings

8.8. Chapter Summary

The Shipping Company's NMR reporting form was studied, and the newly designed Near Miss reporting form was proposed to improve the Near Miss reporting. Furthermore, data collected using the existing and proposed forms were assessed by the experts via an online workshop. The comparative analysis presented in this chapter showed a big improvement in term of the accuracy of the reporting.

9. Discussion

9.1. Chapter Overview

This chapter presents the overall results generated during this PhD research, together with the contribution of research toward the aims and the objective of the PhD study. The novelty and the major contribution of this research toward the safety of the maritime industry are presented while the limitation of the study, future work and recommendations are also included in this chapter.

9.2. Achievement of Research Aims and Objectives

The main aim of this study is to enhance shipping safety by assessing the reporting culture within a specific shipping company, as the assessment for the reporting culture helps to improve the overall safety culture and increase resilience of the individuals and the organisation (shipping company). This aim was achieved by meeting the objectives listed in Chapter 2. Details of the work on each of the objectives are given below.

- Reviewing the literature with regards to the reporting culture as part of the safety culture, type of failure that leads to accidents (mainly human errors) and Near Miss reporting systems within the maritime and the aviation.

A wide range of review about the reporting culture and its importance toward the improvement of the safety culture was performed. Some of the safety culture assessment methods such as the maturity level among the safety culture and the layers of the safety culture were also presented. Based on those methods, a general evaluation was made toward the safety culture among the maritime industry. The barriers against the good reporting practice for Near Misses were also explored to capture the main reasons behind the underreporting phenomenon that exists among most of the shipping companies, according to the scholars in the field.

Moreover, the widely used Near Miss reporting platforms in the Aviation domain and the Maritime sector were studied, critically evaluated and compared with each other. This method was the baseline to develop the newly designed NMR system and the framework that aimed to increase the resilience of the shipping company's safety according to the concept of the RE..

- A comprehensive assessment of NMR culture to measure the efficiency of the existing NMR system in the shipping company (case study). The measurement aims to evaluate the strengths and weaknesses of the current system.

This objective was achieved under the Reporting Culture Assessment (Chapter 5). A questionnaire aimed to measure the following areas among the seafarers at the shipping company was developed:

- ➢ Competency and Confidence in Communicating and Reporting Unsafe Acts.
- ➢ The attitude of the Shore-based Managers towards Safety Issues.
- ➢ None-Native Speakers Using the English Language.
- ➢ English Language Enhancement Program.
- ➢ Near Miss Reporting Culture.

The significant findings about Near Miss reporting practice were presented in Chapter 5 (Reporting Culture Assessment). Semi-structured interviews were performed with key personnel at the company in aligning with the distribution of the questionnaire. The aim of the interviews was to examine the existing Near Miss system at the company and to validate certain aspects in the questionnaire. Based on the result of the questionnaire, NMR at the shipping company was analysed and discussed. The author wanted to compare the five domains with other similar studies. However, due to the unavailability of the similar data the comparison was not made.

- Assessment of the shipping company’s KPIs to identify the level of safety at the company in general and how the NMR influences the overall safety within the shipping company (the case study).

Key performance indicators were collected from the shipping company to measure several safety aspects of the company fleet. Some of the KPIs that affect other safety performance measures positively or negatively are listed in KPI Assessment Results (Chapter 6) with extended details. In addition to that, a correlation between the questionnaire outcomes and the KPIs was also conducted in the same chapter.

- Development of a new reporting form for Near Miss and implement it to the shipping company for a short period of time as a testing mode to evaluate its feasibility and efficiency and compare the outcome with the existing NMR form.

Based on the details collected during the review of various Near Miss reporting platforms, the newly designed and standardised reporting system for Near Misses has been developed. The new reporting form was activated through an online link which was made available to all the seafarers in the company to collect real Near Miss reports and examine the feasibility of the new form. At the same time, the flowchart and the system mechanism were discussed with the key personnel at the company during the interviews. All the details were presented in Chapter 5 under section 5.3.7.2.10.1. the proposed Framework

9.3. Novelties and Contribution to the Maritime Safety

In this PhD, a new approach for assessing the reporting culture among the shipping companies is presented. The assessment of the reporting culture covers all aspects related to the reporting practice from two different points of views. Firstly, the seafarers’ practice of reporting Near Misses using the English Language effectively and their understanding of the importance of reporting Near Misses. Secondly, the key personnel's attitude towards the reported Near Misses. Thus, the proposed method of assessing the reporting culture is a new contribution to the maritime field to help the shipping companies to evaluate the performance of the seafarers and the key personnel at the shore-based office in relation to the Near Miss reporting practice. In addition to this contribution, two main novelties have been addressed in this thesis as given below:

- ✓ The safety-related Key performance indicators to determine the effectiveness of the Near Miss Reporting practice at the shipping company was utilised in this study. Thus, it has resulted in significant findings. The KPIs analysis has shown a major gap in the company's safety performance-related issues. The current NMR practice at the shipping company was positively correlated with all of the number of PSC inspections, which is illogical, as the increasing number of the PSC is reflecting the non-compliance or diverting from the requirements by seafarers. In contrast, the increasing number of the NMR is reflecting the seafarers' awareness of the importance of complying with the requirements. Therefore, this illogical correlation indicates the ineffective NMR system at the shipping company. Moreover, the number of the safety meeting on-board and number of inspections by the MS were also positively correlated with the number of PSC inspections, which is again illogical. This significant finding indicates that the current Near Miss practice has not achieved its primary goal. despite the increasing number of NMR raised by the ship's personnel, and more inspections by Marine Superintendents, and the increasing number of the safety meeting on-board the number of PSC inspections have not decreased yet. This indicates that Near Miss reports were not addressed properly, or real-problems were not reported by the on-board crew. Another indication is the safety meeting on-board and the MS inspections are not playing role in improving the compliance with the requirements. Subsequently, PSC inspection and finding number is still high. Thus, the current NMR practice is required to be changed to a new and standardised practice that assure the anonymity of the reporter. The final result would be, more critical and valid Near Misses will be reported to the shore-based office, then more unsafe issues will be addressed by the middle management which will lead to less findings by the PSC.

The number of the inspection by the MS, the number of safety meeting on-board ships and number of finding during the Internal Audits were positively correlated with current NMR system at the shipping company. Moreover, the assessment of KPIs has shown a high rate of LTIF and TRCF compared with other similar studies with other shipping companies. This high rate would be related to the effectiveness of the NMR practice indirectly. Thus, by applying the new reporting system for Near Misses at the shipping company, improved rate of LTIF and TRCF would be achieved. Without such a study, the shipping company would not be able to capture the relation between the NMR practice and the rest of the safety-related KPIs. Therefore, it is highly recommended to adopt this method by all shipping companies to measure the efficiency of the Near Miss reporting practice.

- ✓ NMR has been made mandatory by the ISM code to help the shipping companies to capture as many Near Misses as possible and to take corrective actions to avoid unfortunate accidents. However, the ISM code does not give clear and explicit criteria for the Near Miss Reporting Systems (reporting form, reporting framework) to be applied among the shipping companies. Thus, shipping companies around the globe have improvised their own NMR systems. The improvisations lead to a non-standardisation in the NMR systems among the shipping companies and the maritime organisations.

Moreover, (Thoroman, Goode, and Salmon, 2018) have mentioned in their study, none of the current Near Miss system is fulfilment the desired criteria. Therefore, the efficiency of the Near Miss reporting systems around the world are not similar, and its outcomes are not precise and as affective as expected to help to manage the human errors. Consequently, no lessons learned would be taken; no effective corrective action would be carried out, and the quality of the reports will not be up to the expected level to address and solve real and critical unsafe issues that could lead to an accident.

In the shipping company studied in this thesis, the ineffectiveness of the Near Miss reporting system was captured via assessing the Reporting Culture among the seafarers and analysing the safety-related KPIs. Therefore, the newly designed reporting form and framework for Near Miss was created to enhance the reporting practice within the shipping company. The newly designed reporting form was tested to collect real Near Miss cases. The outcomes of the newly designed reporting form were compared with the outcomes of the existing reporting form. The comparison clearly indicated that the newly designed reporting form had given a more accurate rate among all the primary parameters of the Near Misses reports. The enhanced outcomes from the newly designed reporting form were due to the anonymity adopted and the precise and non-confusing options under each field within the reporting form. Moreover, the newly designed reporting form was designed to make the reporter aware of the chosen rate of the reported case and the nature of the case, whether it is an unsafe condition or act. Subsequently, the corrective action will be effective to stop the hazard, and the analysis of the case by the MS will prioritise the cases to be addressed based on the accurate rate of each case.

This PhD thesis has successfully created a standardised Near Miss reporting system to be adopted by the shipping companies. The new Near Miss framework and reporting forms are ensuring to overcome and eliminate the root causes of the accidents effectively by applying appropriate corrective actions and taking memorable lessons learned.

These two novelties have a common area of interest which is enhancing the shipping safety through managing the human errors by implementing a standardised reporting system for Near Misses.

9.4. Limitations of the Work

The assessment for the reporting culture, the KPI and the new reporting form has encountered some limitations during the implementation and the analysis stages of the new NMR approach. These kinds of limitations are acceptable among the researchers as they cannot be influenced by the researcher. Limitations of this study are given below:

- The shipping company that was cooperated with the researcher to conduct this study has over 500 seafarers. However, during the distribution of the questionnaire, the researcher was able to collect 108 responses only. This small number of participants was justified to the researcher by the company's Chief Executive Officer. The company, in cooperation with one of the classification society, had just finished their safety culture assessment. Thus, the majority of the seafarers felt that they do not need to participate in a similar study twice during a short period of time. Therefore, if the assessment was performed at another shipping company with a higher number of participants, the hypothesis of this research will be proven in the same way presented in this thesis. However, the accuracy of the result would be improved as the high number of participants would enhance the accuracy of the result. Moreover, the number of the participants in the interview are four MS. Is the author succeeded to interview more MS the idea would be made clearer.

- The collected the KPIs from the shipping company is not comprehensive. The researcher tried in more than one occasion to get more KPIs from the company as more KPIs would increase the strength of the acquired result after conducting the assessment. However, the company has not provided further KPIs, and they implicitly stated that they do not record any further KPIs. This could be considered as a limitation in the study, as more KPIs such as the accident-free days in a yearly basis and number of detentions by the PSC will boost the KPIs analysis and may result in significant findings. However, from another point of view, it may be considered as an area of improvement for the company to enhance its KPI data. Subsequently, they would be able to trigger more safety deficiency and improve them accordingly.
- The shipping company conducted a safety Climate Assessment (SCA) in cooperation with a classification society in 2017. A comparison between the SCA and the Reporting Culture Assessment may have resulted in significant findings. However, there was no similarity between the two assessments in term of presenting the data, and therefore it was not possible to compare them. The SCA was designed in a very wide range of variety of questions that are not related to the Reporting Culture Assessments. Moreover, the SCA analysis was not in the form of statistical analysis; it shows frequencies only, unlike the way the Reporting Culture Assessment was analysed. Thus, a comparison of the two assessments would take a considerable time.
- During the distribution of the newly designed reporting form for Near Misses, it would have been ideal to link those real reports to the company's system to allow the Marine Superintend to process and analyse the new reports. However, this was not possible, according to the IT officer at the company, which indicated that approval from a higher managerial level should be given to the IT department. Thus, it was decided to conduct

this stage in further study as it requires more time to be spent at the shipping company and more resources.

9.5. Recommendation and Future work

- Before conducting the data, collection and distributing the questionnaire to the shipping companies, the seafarers should be informed and well prepared to participate in this survey. The most accurate and more participation leads to better results.
- After conducting this study, the researcher would recommend applying the same assessment at more shipping companies as this assessment will give the shipping companies a clear opportunity to evaluate their Near Miss reporting culture. Besides, it will allow the shipping companies to correlate the efficacy of the NMR system with other safety aspects, especially with the existence of the blame culture among the shipping companies.
- The newly designed Near Miss reporting framework and form is highly recommended to be used among shipping companies for at least three months. As the given result on this thesis was promising that this new NMR system would play a significant role in enhancing shipping safety and manage human errors.
- Special recommendation to the same shipping company that cooperated with the researcher to conduct his study is to adopt the new NMR system. Then the other companies in the same region will adopt the standardisation of Near Miss reporting system after identifying the level of the enhancement at the company's safety level.
- A regional common accident, incident and Near Miss platform, which aims to collect data and create a database for all other Near Miss systems for all shipping companies is required as most of the developed countries are having a national or regional voluntarily Near Miss Reporting platform. The main aim of these platforms is to collect reports from

all the shipping companies within the region and provide them with the lessons learned. Thus, the shipping companies will be able to avoid some of the unfortunate accidents by eliminating the root causes, if such common database existed. In the near future, the author will contact the transportation ministry at the area to arrange the necessary cooperation to establish the foundation of a national reporting platform for Near Misses.

9.6. Chapter Summary

In this chapter, a summary of the achievement with regards to the aims and objectives of this research was presented. This work has faced some limitations and difficulties which were listed in this chapter as well. Due to the limitation in the time frame for the researcher, some extra tasks related to this thesis was not realised. Thus, those aspects have been addressed under the recommendations for future work.

10. Conclusion

This thesis has provided a considerable amount of insight into the Near Miss Reporting systems that implemented among the maritime industries in general, and for a specific shipping company in practice. The information was gathered and analysed in this thesis, in order to find the gaps with regards Near Miss reporting and its effect on the shipping safety. Subsequently, the solution was found to manage Near Miss reporting and hence human errors, which play a significant role in enhancing shipping safety. This study was conducted in three main stages as given below.

Firstly, Reporting Culture assessment for a shipping company which agreed to cooperate with the researcher to conduct this study was carried out. The main issues identified were as follows:

- Non-Native speakers are struggling while dialoguing in English.
- Near Miss Reporting system among the company is required to be improved.
- Blame Culture still exists among the shipping company and should be eliminated.

The next stage was evaluating the shipping company's KPIs and find out how it is affecting the company's safety performance. The significant finding was that a robust negative correlation between the total number of accident-free days with the following KPIs:

- Number of Near Miss Reports.
- Number of Port State Control Inspections.
- Number of Safety Inspections.
- And the number of Safety Meeting.

The shipping company is required to increase the number of aforementioned KPIs in order to decrease the total number of ships with a higher rate of accident-free days. Near Miss reports will allow the company to identify more unsafe acts and conditions, then take corrective action, educate the seafarers in order not to repeat the same act and in some cases take preventive action. If the NMR in the shipping company along with the, Safety Inspection and safety meeting were conducted according to the highest standards, then the overall Safety among the shipping company would be enhanced. Therefore, less unfortunate occurrences will occur among any shipping companies' vessels, and the PSC inspections which is required to be conducted on foreign ships by the port authorities will end up successfully. Subsequently, maximum two inspections by PSC per ship per year as required will be recorded at the company's yearly KPIs.

The third stage was creating a new framework and reporting form for Near Miss. The new Near Miss reporting form was proposed to the shipping company to examine its validity and to run it for a short period of time as a testing mode. The resulted outcome from the new reporting form for Near Miss according to the company's seafarers was promising. The majority of the participants recommend the new reporting form for Near Miss as it is much user-friendly, takes less time to be filled and contains more useful details related to the unsafe act.

In a nutshell, the shipping company's reporting system for Near Miss requires significant improvement by making it anonymous and more detailed and structured. Moreover, analysing the company's safety performance has given the researcher an indication of the lack of desired safety level in the shipping company due to the ineffectiveness of the current Near Miss reporting system. Thus, the new reporting form is highly recommended, as presented in chapter 8, the outcomes of the new reporting form were more accurate than the outcomes of the current reporting form. The improvement of the accuracy was noticeable among all the reporting form parameters (rate, potential consequence, root causes, corrective actions). Besides, the new parameters such as; lessons learned, and the class of the Near Miss have added significant value to the reported cases. All of those parameters and the improvement in making the new reporting form standardised will be worthless if the newly designed reporting system is not anonymous. Therefore, the anonymity of reporting the Near Misses is very important to make the system effective and successful.

Another improvement required at the shipping company is the way of recording some of the KPIs; such as the accident-free days. The way the shipping is currently recording the accident-free days is meaningless as mentioned earlier in chapter 6, as it does not follow the standard KPI, which is used by the shipping industry. This is based on the best of researcher’s knowledge as it is not possible to gain insight into a company’s safety performance. Especially with the absence of some of the critical KPIs, as mentioned in the limitations of the study.

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Appendixes

Appendix A: IMO guideline for NMR in a flowchart design

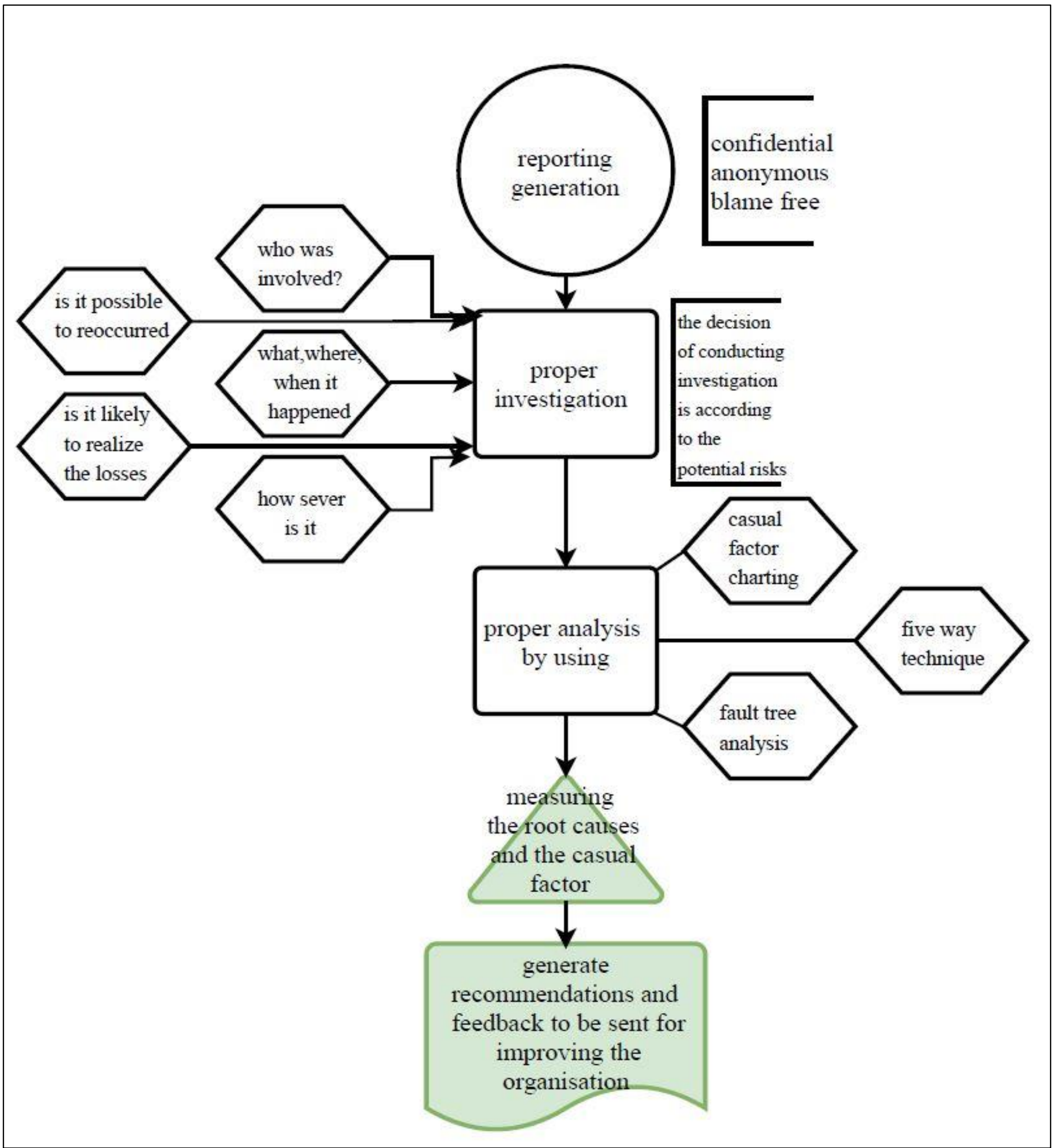


Figure 11-1 IMO guideline for NMR

Appendix B: CHIRP Maritime reporting form


Contact
Vessel
Incident
Images
Save/Submit Report

Your Personal Details

Contact Name: saleh ghonaim
Address:
Post Code:
E-Mail: ghonaimsaleh@gmail.com
Phone:
Position/Role in Organisation:

Event / Situation Details

Vessel Name:
Vessel Location:
Flag:
IMO Number:
Vessel Type:

Description of Event / Situation

Date/Time of Incident:
Initial Description of Incident:
Lessons Learned:

Supporting Documents

Uploaded Files: No files uploaded
Upload Files/ Pictures/ Documents: Choose File No file chosen
Description: Description
Upload

Figure 11-2 CHIRP reporting form

Appendix C: MARS reporting form

International Mariners' Alerting

Reporter's Name, Rank/Occupation
Contact address (Please supply a contact address in case any point requires clarification)
Email:

Factual
Details of the Accident, Incident or Near Miss

Analysis

Results of the investigation

Fatigue Involved?

(If fatigue is suspected give a short summary of the person's work-rest history going back at least 72 hours from the time of the event).

Root Cause and Contributing Factors

Lessons Learned

Risk reduction measures or other actions taken subsequent to investigation

Appendix D:

Participant Information Sheet for [the shipping company employees]

Name of department: Naval Architecture, Ocean and Marine Engineering

Title of the study: Enhancing shipping safety by managing human error through increased resilience

Introduction

The study which will be introduced in the next section is performed by me; Saleh Ghonaim a PhD student at the University of Strathclyde, NAOME department, and supervised by Professor Osman Turan the Departmental REF director.

Contact details:
Full name: Saleh Ghonaim Occupation: PhD student at University of Strathclyde, Glasgow, UK Email: saleh.ghonaim@strath.ac.uk Mobile: +447482020531 Address: Department of Naval Architecture, Ocean & Marine Engineering, University of Strathclyde, Henry Dyer Building, 100 Montrose Street, Glasgow G4 0LZ, United Kingdom

What is the purpose of this investigation?

This investigation aims to examine the existing system for Near Misses reporting in the company by inspecting its procedure and conducting semi-structured interviews with some key personnel. The interview has designed to measure the efficacy of the reporting system and to know what the participant thinks about it. After that, a new framework for the Near Miss reporting will be proposed along with a new reporting form to the participants to discuss its feasibility.

Do you have to take part?

Participation in the study is completely voluntary; there is no obligation to participate in the study. Withdrawal from the study can be made at any point during the study with no detrimental consequences. You are free to refuse to participate or to withdraw from the project at any time, up to the point of completion, without having to give a reason and without any consequences.

What will you do in the project?

An interview will be conducted, and data gathering such as a document and an anonymous, old and random Near Miss reports from any of the ships in the company. Therefore, the participants are expected to answer some questions from the semi-structured interview, provide some documents about the existing Near Miss reporting form and to give their opinion as an expert in this field. Some part of the investigation will be in the form of observation for the seafarer on-board a ship (if I get the approval). To see how the seafarers are indulged in the Near Miss reporting practice.

Why have you been invited to take part?
You are invited to take part in the investigation as we seek to capture the efficacy of the Near Miss reporting system and the practice. In addition to that, you are taking your opinion as an expert regarding the new proposed reporting framework and the new reporting form.

What are the potential risks to you in taking part?
There will be no risk at all at the interview part. No physical contact and no sensitive information will be taken. Regarding the observation, the participants will be followed like a shadow. Consequently, the participants may get distracted while conducting the daily route work. However, I will try not to be distracted as I have a background as a seafarer, and I know when to step back.

What happens to the information in the project?
All data will be treated confidentially, and the identity of participants will remain anonymous in any form of study publication. Data will be held on storage facilities of the University of Strathclyde.

The University of Strathclyde is registered with the Information Commissioner's Office who implements the Data Protection Act 1998. All personal data on participants will be processed in accordance with the provisions of the Data Protection Act 1998.

Thank you for reading this information – please ask any questions if you are unsure about what is written here.

What happens next?
If you consent to participate in the study, you will be asked to sign a consent form to confirm this. If you do not want to be involved, we thank you for your attention.

The result will be a part of my PhD theses, may be published in a journal academic paper and in an oral presentation for the department's members.

Researcher contact details:
Full name: Saleh Ghonaim Occupation: PhD student at University of Strathclyde, Glasgow, UK Email: saleh.ghonaim@strath.ac.uk Mobile: +447482020531 Address: Department of Naval Architecture, Ocean & Marine Engineering, University of Strathclyde, Henry Dyer Building, 100 Montrose Street, Glasgow G4 0LZ, United Kingdom

Chief Investigator details:
Osman Turan o.turan@strath.ac.uk +44 (0)141 548 3211
University of Strathclyde, Henry Dyer Building, 100 Montrose Street, Glasgow G4 0LZ

This investigation was granted ethical approval by the University of Strathclyde Ethics Committee.

If you have any questions/concerns, during or after the investigation, or wish to contact an independent person to whom any questions may be directed, or further information may be sought from, please contact:

Secretary to the University Ethics Committee
Research & Knowledge Exchange Services
University of Strathclyde
Graham Hills Building
50 George Street
Glasgow
G1 1QE

Telephone: 0141 548 3707
Email: ethics@strath.ac.uk

Consent Form for [the shipping company's employees]

Name of department: Naval Architecture, Ocean and Marine Engineering

Title of the study: Enhancing shipping safety by managing human error through increased resilience

I confirm that I have read and understood the information sheet for the above project and the researcher had answered any queries to my satisfaction.

- I understand that my participation is voluntary and that I am free to withdraw from the project at any time, up to the point of completion, without having to give a reason and without any consequences. If I exercise my right to withdraw, and I don't want my data to be used, any data which have been collected from me will be destroyed.
- I understand that I can withdraw from the study any personal data (i.e. data which identify me personally) at any time.
- I understand that anonymised data (i.e. .data which do not identify me personally) cannot be withdrawn once they have been included in the study.
- I understand that any information recorded in the investigation will remain confidential, and no information that identifies me will be made publicly available.
- I consent to be a participant in the project
- I consent to be audio and/or video recorded as part of the project

(PRINT NAME)	
Signature of Participant:	Date:

Appendix E:

Question list

Dialogue content with the staff at the Faculty of Maritime Studies:

Introducing myself to the interviewees, and then let them introduce themselves with details such as; experience, the company worked for, ETC.

What did people on your ship consider to be an accident?

What did people on your ship consider to be an incident?

What did people on your ship consider to be a Near Miss?

How was the Near Miss reporting system procedure in your last company?

Did crewmembers usually conduct the reporting practice? If not, why?

How does the system work? Did you receive feedback?

What do you think about the new model that I proposed?

What kind of barriers could prevent the new model from happening?

How can we overcome these barriers?

Appendix F:

Question list for shore-based personnel at the shipping company:

What is your qualification?

Can you please talk about your experience as a …… and how many companies did you work for?

According to your knowledge and experience as a …… , what does crew member in this company considers being an accident, incident and Near Miss? What about you, do you share the same understanding?

Can you talk about the Near Miss reporting process that is followed in this company?

Do crewmembers usually have the initiative to conduct the Near Miss reporting practice? If not why?

How often or to what extent do the ships' personnel usually report events that could have led to an incident or accident?

Do crewmembers take corrective action for any unsafe act they see before reporting it? Is it sufficient enough to prevent any negative consequences? Why?

What do they think about the reporting process? Waste of time or very important, as it could prevent a major accident? How? What about your point of view on the reporting process?

How important is the Near Miss reporting in your work as …..?

Do you think that the on-board crew ships understand your role as …..? And the role of the DP?

After the crew members submitting a report, where does it go? How are the analysis team deal with it? Is the report meant to be internally, or it will be shared with others Near Miss reporting system?

Do crewmembers receive feedback on the quality of the reports, the recommendation for the corrective action or even an acknowledgement of the reception of the report?

How important do you consider anonymity and confidentiality in the reporting practice?

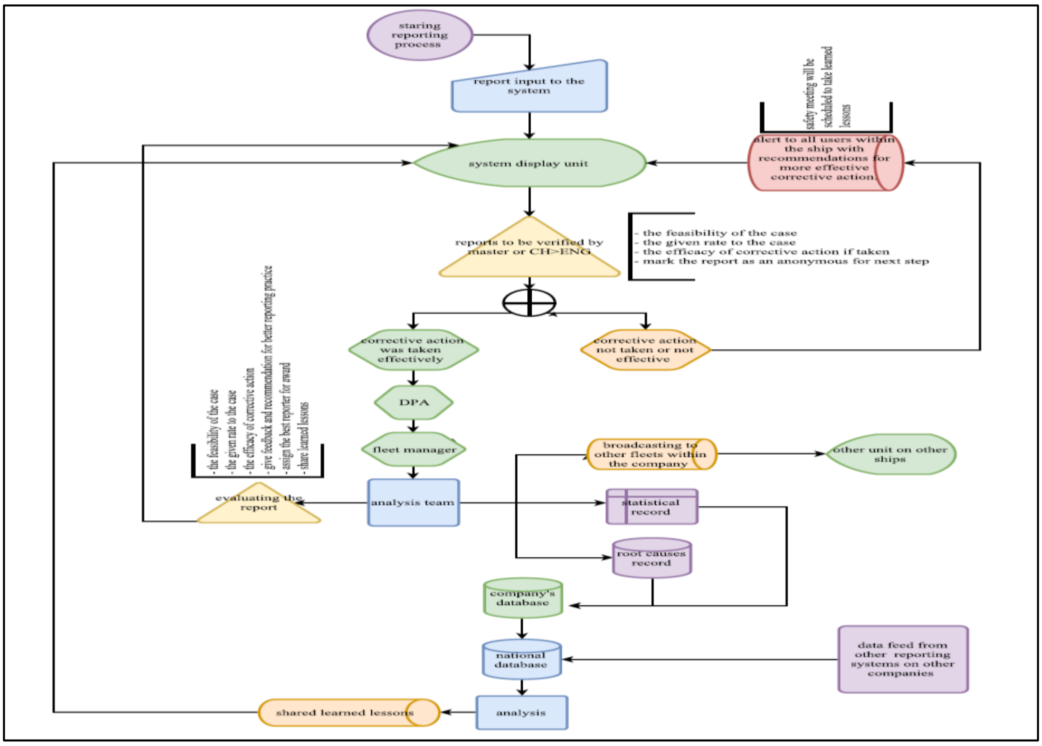
Do you think that the system could be better and improved? How?

Do you think that the company is dealing with all reports in a fair way?

Did the company encourage the crew member to report more Near Misses? How? In general, are you satisfied with the amount of received reports from ships' personnel?

What kind of barrier do you think needs to be overcome to get a better reporting practice?

Can you spend five minutes looking at the new proposed framework for Near Misses reporting?



Can you compare this flow work to the one have in your company?

What kind of barriers could prevent the new model from happening?

How can we overcome this barrier?

Can you look at the two new reporting form the paper version one and the electronic one on https://stratheng.eu.qualtrics.com/jfe/form/SV_3rRgeDvuVgLKWBn and tell me what do you think about it?

What kind of information is missing in this form?

Can you compare this reporting form to the one you have in your company?

Ship's Name		Ship's Location	☐At sea ☐On berth ☐Anchor area ☐Dry dock ☐N/A	Operation Type	☐Loading ☐Discharging ☐Loading and Discharging ☐Maintenance ☐Measuring toxic gases ☐Inerting ☐COW ☐Piloting ☐STS ☐SPM ☐Pollution control ☐Tank cleaning ☐Purging ☐Gas freeing	
Ship's Type	☐Chemical tanker ☐Oil Tanker ☐RORO ship (multi purposes) ☐Dry bulk	Cargo compartments status	☐Fully loaded ☐partly loaded ☐Ship is on ballast condition	Date of the Near Miss	Click or tap to enter a date.	☐Unsafe Act ☐Unsafe Condition
In case of another vessel was involved in the event, Give the name of the other vessel					Time of the Near Miss	
Type of the Near Miss	☐ Accident	☐ Incident	☐Near miss			
Near Miss Rate *(depending on how much it might cost*)*	☐Low	☐Medium	☐High	☐Very High		
Underlaying Root causes for the Near Miss (*tick more than one if applicable*)	☐Carelessness ☐Tools Deficiency ☐Equipment Failure ☐Failure to Comply with Procedure ☐Failure to use PPE ☐Housekeeping ☐Incorrect use of Equipment ☐Lack of maintenance ☐Lack of Competency ☐Failure to use LSA					
Potential Consequences of the Near Miss *(tick more than one if applicable)*	☐Damage to the Property ☐Damage to the Environment ☐Fire / Explosion ☐General Hazard to the Ship ☐Injury / Fatality ☐Navigational Hazard					
Near Miss Description						
Immediate Corrective Action						
Class for the Near Miss	☐ability, skills, knowledge of the people involved	☐personality (mental condition, emotional state)	☐physical condition (medical fitness, fatigue, use of alcohol or drugs)	☐activities prior to the accident/occurrence	☐assigned duties at the time of accident/occurrence	☐actual behaviour at time of accident/occurrence
	☐attitude	☐division of tasks and responsibilities	☐composition of the crew (competence/nationality)	☐workload (both overload and underload)/complexity of tasks	☐work hours/rest hours	☐procedures and standing orders communication (internal and external)
	☐on board management and supervision	☐organisation of on-board training and drills	☐teamwork	☐planning of work	☐level of automation	☐ergonomics of equipment and the working environment
	☐adequacy of living conditions	☐adequacy of food	☐opportunities for recreations	☐vibrations, heat, noise ship motion	☐design	☐state of maintenance (not maintained, badly maintained)
	☐equipment (availability, reliability)	☐cargo characteristics, including securing, handling and care	☐policy on recruitment	☐safety policy and philosophy	☐management commitment to safety	☐scheduling of leave periods
	☐general management	☐assignment of duties	☐ship-shore communication	☐weather and sea conditions	☐Port and transit conditions (VTS, pilots etc.)	☐traffic density
	☐ice conditions	☐regulations, survey and inspections				
Lessons Learned from the Near Miss						

*If the Unsafe act leads to potential damage of (250.000 US$ and more = Very High), (100.000 US$ and more = High), (10.000 US$ and more = medium) and (insignificant damage or estimated by less than 10.000 US$ = LOW).

Appendix G: the questionnaire distributed to the seafarers at the shipping company.

Near Misses practise and English language for seafarers.

Start of Block: Consent

The questionnaire which will be introduced in the next section is performed by me; Saleh Ghonaim a PhD student at the University of Strathclyde, NAOME department, and supervised by Professor Osman Turan the Departmental REF director.

Contact details:
Full name: Saleh Ghonaim Occupation: PhD student at University of Strathclyde, Glasgow, UK Email: saleh.ghonaim@strath.ac.uk Mobile: +447482020531 Address: Department of Naval Architecture, Ocean & Marine Engineering, University of Strathclyde, Henry Dyer Building, 100 Montrose Street, Glasgow G4 0LZ, United Kingdom

What is the purpose of this investigation?
This questionnaire aims to examine the feasibility of Near Misses reporting in the company by examining the communication level of success between seafarers and managers on the shore base office, English Language skills for seafarers from different region and the trust level among seafarers with their superiors. The questionnaire has designed to measure the efficacy of the reporting system as all of the aspects mentioned earlier are influencing the efficacy of the NMR directly. In addition to that, to know what the participants thin about the existing Near Miss reporting system.

Consent Form for [the shipping company's seafarers]

Name of department: Naval Architecture, Ocean and Marine Engineering

Title of the study: Enhancing shipping safety by managing human error through increased

resilience

I confirm that I have read and understood the information sheet for the above project and the researcher has answered any queries to my satisfaction.

- I understand that my participation is voluntary and that I am free to withdraw from the project at any time, up to the point of completion, without having to give a reason and without any consequences. If I exercise my right to withdraw, and I don't want my data to be used, any data which have been collected from me will be destroyed.

- I understand that I can withdraw from the study any personal data (i.e. data which identify me personally) at any time.
- I understand that anonymized data (i.e. .data which do not identify me personally) cannot be withdrawn once they have been included in the study.
- I understand that any information recorded in the investigation will remain confidential, and no information that identifies me will be made publicly available.
- I consent to be a participant in the project

Appendix H: the correlation matrix for KPIs

		FAC	NA	NMR	PSCI	IANC	EANC	SI	SIF	SM	SBD	LTIF	TRCF
FAC	Pearson Correlation	1	-.287	.667	.687	.199	-.787	.775	.557	.709	-.056	.067	.327
	Sig. (2-tailed)		.640	.219	.200	.748	.115	.123	.330	.180	.928	.915	.591
NA	Pearson Correlation	-.287	1	.083	.325	.332	.540	-.007	-.096	.112	.019	-.140	-.470
	Sig. (2-tailed)	.640		.895	.594	.585	.348	.991	.878	.858	.976	.822	.425
NMR	Pearson Correlation	.667	.083	1	.938*	.838	-.781	.985**	.745	.994**	.494	.681	.693
	Sig. (2-tailed)	.219	.895		.019	.076	.119	.002	.149	.001	.398	.205	.195
PSCI	Pearson Correlation	.687	.325	.938*	1	.785	-.613	.925*	.597	.965**	.263	.452	.401
	Sig. (2-tailed)	.200	.594	.019		.115	.271	.024	.287	.008	.669	.445	.503
IANC	Pearson Correlation	.199	.332	.838	.785	1	-.490	.732	.417	.823	.491	.837	.608
	Sig. (2-tailed)	.748	.585	.076	.115		.402	.159	.485	.087	.401	.077	.276
EANC	Pearson Correlation	-.787	.540	-.781	-.613	-.490	1	-.827	-.600	-.774	-.270	-.610	-.807
	Sig. (2-tailed)	.115	.348	.119	.271	.402		.084	.285	.125	.660	.275	.099
SI	Pearson Correlation	.775	-.007	.985**	.925*	.732	-.827	1	.790	.983**	.450	.588	.673
	Sig. (2-tailed)	.123	.991	.002	.024	.159	.084		.112	.003	.447	.297	.213
SIF	Pearson Correlation	.557	-.096	.745	.597	.417	-.600	.790	1	.692	.777	.436	.667
	Sig. (2-tailed)	.330	.878	.149	.287	.485	.285	.112		.195	.122	.463	.219
SM	Pearson Correlation	.709	.112	.994**	.965**	.823	-.774	.983**	.692	1	.396	.622	.624
	Sig. (2-tailed)	.180	.858	.001	.008	.087	.125	.003	.195		.509	.262	.260
SBD	Pearson Correlation	-.056	.019	.494	.263	.491	-.270	.450	.777	.396	1	.655	.707
	Sig. (2-tailed)	.928	.976	.398	.669	.401	.660	.447	.122	.509		.230	.181
LTIF	Pearson Correlation	.067	-.140	.681	.452	.837	-.610	.588	.436	.622	.655	1	.889*
	Sig. (2-tailed)	.915	.822	.205	.445	.077	.275	.297	.463	.262	.230		.043
TRCF	Pearson Correlation	.327	-.470	.693	.401	.608	-.807	.673	.667	.624	.707	.889*	1
	Sig. (2-tailed)	.591	.425	.195	.503	.276	.099	.213	.219	.260	.181	.043	

Appendix I: Correlation matrix domains VS KPIs

		FAC	NA	NMR	PSCI	IANC	EANC	SI	SIF	SM	SBD	LTIF	TRCF
domain1	Pearson Correlation	-.290	.607	.387	.341	.570	.152	.291	.509	.323	.802	.442	.270
	Sig. (2-tailed)	.636	.278	.520	.575	.316	.807	.635	.382	.595	.102	.456	.661
domain2	Pearson Correlation	.331	.453	.900*	.895*	.947*	-.458	.823	.591	.890*	.543	.687	.520
	Sig. (2-tailed)	.586	.444	.037	.040	.014	.438	.087	.294	.043	.344	.200	.369
domain3	Pearson Correlation	-.669	.113	-.239	-.412	-.045	.409	-.299	.222	-.338	.713	.195	.171
	Sig. (2-tailed)	.217	.857	.698	.491	.942	.495	.626	.720	.578	.176	.754	.783
domain4	Pearson Correlation	.482	.557	.837	.957*	.825	-.393	.787	.418	.872	.194	.409	.233
	Sig. (2-tailed)	.411	.329	.077	.011	.086	.512	.114	.484	.054	.755	.495	.706
domain5	Pearson Correlation	.282	.609	.774	.876	.899*	-.305	.684	.287	.800	.215	.515	.247
	Sig. (2-tailed)	.646	.276	.125	.051	.038	.618	.203	.639	.104	.729	.375	.689

Appendix J: Full list of Near Miss reports from the shipping company's reporting form

No	Near Miss description	rate	potential consequence	root causes	Personal / job factors	root causes comment	immediate corrective action	shipboard management review
1	the electric panel for the forward electric horn was not the original one and not matching the required specification	High	Health or illness		/ Inadequate planning		Cabinet provided with extra shield	On-board extra part was used
2	portable foam fire extinguisher fails to discharge during drill	High		Defective tool	Inadequate maintenance		the extinguisher was emptied and inspected	
3	burner electric motor has found burned out due to extreme local temperature	High	Machinery damage	Equipmen t failure		this was due to extreme environmental temperature	replace electrical motor with spare one	subject discussed
4	during routine inspection a burned plastic was found in the laundry room and blocked the dryer exhaust which led to damage to the dryer also the socket gets damaged	High	Fire	Incorrect use of equipment	Lack of knowledge / Excessive wear and tear	The split pin must be checked for proper prevention	Circuit isolated	Carrying out plugs' inspection
5	chart table's light has exploded on the officer face	High	Health or illness			never use the light until replacing it with proper one	the light was switched off. master and ETO called.	explosion of the light was due to a faulty light
6	during training two of the crew were not able to fit the immersion suits due to their huge body	High		Failure to use PPE	/ Inadequate purchasing	all the immersion suit is same size	noted to safety officer to order new sizes	this issue to be rise to MS
7	during concocting cargo hose, the o ring was observed damaged	High	Property damage	Lack of maintenan ce			The O ring was replaced immediately	
8	one of the crew used the air compressor to blow himself from dust	High	Health or illness	Lack of skills			He was instructed to not do this again	This will be discussed in the safety meeting
9	during making a repair for steam pipe in the purifier room, the temperature of fuel oil was found 78 degree instead of the designed temperature 90 degree	Low	Property damage	Lack of maintenan ce			The machine has been calibrated	
10	during navigational watch the cadet noticed the 3-vhf radio and one portable survival craft radio were run out of batteries	Low		Failure to comply proper procedure	lack of knowledge / Inadequate procedures and checklist	negligence of the OOW	radio was put back in the charger	this issue will be discussed in the safety meeting

No	Near Miss description	rate	potential consequence	root causes	Personal / job factors	root causes comment	immediate corrective action	shipboard management review
11	while lifting a pipe by using the engine room crane, the hook was found not lashed with rope and the crane was swinging	Low	Health or illness	Lack of skills				
12	plastic garbage was found not segregated	Low		Carelessness		All crew were informed about garbage segregation	All crew were informed about garbage segregation	All crew were informed about garbage segregation
13	bridge fire hose was used in cleaning process	Low		Incorrect use of equipment	Lack of knowledge		They were told to stop and carry on with the proper hose	To be discussed in the safety meeting
14	one of the mooring winches has no handle for the hydraulic brake system. in case of emergency it will be very hard to open or close the break	Low	Machinery damage	Defective tool		Missing handle to be fabricated	Using adjustable wrench to use the break	To be discussed in the safety meeting
15	fire extinguisher in the port safety locker was obstructed by few boxes this could lead to a delay in fighting fire in case of fire	Low	Fire	Housekeeping	/ Inadequate work practice	The job was assigned without giving instruction to the OS	Boxes were removed immediately	To be discussed in the safety meeting
16	While the taking over the watch I found the laminator machine switched on and very hot	Low	Fire	Carelessness	Abuse or misuse of equipment		The machine was switched off immediately	No further action
17	during fire drill on deck, one of the fires monitored valve was not able to be open by hand. also, the f - key was not in the area	Low	Fire	Poor work practice		all tools must be secured in place	pump man was informed to check securing of the key all the times	the crew was informed about the Near Miss in the safety meeting
18	fire alarm in the workshop in the engine room was noticed during the test to have some delay	Low	Fire	Defective tool	Lack of maintenance		The fire alarm was replaced by new one	
19	rags were found next to diesel generator which could lead to fire	Low	Fire	Housekeeping	Lack of knowledge / Inadequate procedures and checklist	It is important to remove the oily rage after finishing the task	Rags were removed	This was instructed to engine room staff
20	two of the portable foam extinguishers were not marked with the requirement	Low	Property damage	Weather condition		No regular maintenance	Replaced with new one	Replaced with new one

No	Near Miss description	rate	potential consequence	root causes	Personal / job factors	root causes comment	immediate corrective action	shipboard management review
21	The securing padlock key for the fire monitor on deck found not secured in case if the key fall it may cause spark	Low	Fire	Lack of skills	/ Inadequate supervision		The key was secured	This will be discussed in the safety meeting
22	the kettle in the crew mess room was boiling water continually and the steam was condensing on the celling near to the smoke detector	Low	Fire	Equipmen t failure			A replacement kettle was put in the miss room	Post to be posted saying do not leave the kettle unattended
23	during cargo operation he noticed 3 broken antenna walkie talkies were in use	Low		Equipmen t failure	Lack of knowledge	Crew did not realise potential danger	Antenna was replaced	To be discussed in the safety meeting
24	after removing rubber mate from sunken deck, it become very slippery	Low	Health or illness				Crew were advised to take extra caution	
25	two crew members were chipping in the manifold area without proper PPE (helmet)	Low	Health or illness	Failure to use PPE	/ lack of supervision		They were advised to wear the helmet	To be discussed in the safety meeting
26	two gratings at the area around the ladder at steering gear room was noted missing and left a big gap	Low	Health or illness	Pore working standard			The fitter was notified to fabricate new steps	The fitter was notified to fabricate new steps
27	while vessel was rolling, one of the crew was running down on the stairs and he lost balance.	Low		Carelessn ess			The oiler advised him to slow down	This issue was highlighted many times in the safety meeting
28	during picking up some provisions from service boat, one of the crew was standing under the crane	Low	Health or illness	Lack of skills	Lack of knowledge / Inadequate supervision	He was in rush to finish with the provision	The safety officer notified him immediately	This case to be discussed in the safety meeting
29	one of the crew was climbing the stairs on the engine room with both hands full of heavy objects	Low	Personal accident case	Lack of skills			Another crew helped him	New post to be posted next to the ladder to notify crew of the safety procedure while using the ladder
30	during routine inspection for watertight door they noticed all butterfly screw was over painted and could not unscrew. in case of emergency, escape route could be obstructed	Low	Property damage	Lack of skills	Inadequate supervision	Inadequate instructions / inadequate supervision	The extra paint was removed	The extra paint was removed

No	Near Miss description	rate	potential consequence	root causes	Personal / job factors	root causes comment	immediate corrective action	shipboard management review
31	one helmet was found in the stairs	Low	Personal accident case	Carelessness		Poor housekeeping	Helmet removed	To be discussed in the safety meeting
32	ventilation in the paint store was blocked by two cans of paint. this will delay the ventilation process	Low		Carelessness			Cans removed	
33	someone left a shackle on the stairway	Low	Personal accident case	Carelessness	Lack of skills		Immediately removed	To be discussed in the safety meeting
34	one of the engineers used hatch to go down for some task and he left the hatch open without any guard around it to prevent anyone from falling	Low	Personal accident case	Failure to comply proper procedure	Lack of skills / Inadequate work standard		The duty engineer was called to come and close the hatch	At no time hatch to be open
35	one of the oilers was using the stairs going down while he was carrying things in both hands	Low	Personal accident case	Failure to comply proper procedure	Lack of skills / Inadequate procedure and check lists		An oiler stopped him to help	This was discussed several times in the safety meeting
36	during the boarding of the agent and port authority, the clinometer of gangway was not fixed	Low	Personal accident case	Failure to comply proper procedure			Crew were instructed to fix clinometer	
37	while fixing the coupling of the air hose the worker find it difficult with gloves, so he decided to take it off. his fingers could be cut	Low	Personal accident case	Failure to use PPE	Lack of knowledge /		The crew was immediately stopped	Do not take short cut
38	one of the crew was applying rust remover on a rusty area without wearing eye protection	Low	Personal accident case	Failure to use PPE	Lack of knowledge /		The task was shut off immediately and the crew was instructed wear safety goggle	Safety instruction will be demonstrated in the safety meeting
39	the frame of the basketball was damaged	Low	Personal accident case	Housekeeping			Stopped playing	
40	trolley was found in the alleyway inside the accommodation with no securing while the ship is in open sea	Low	Health or illness	Incorrect use of equipment	Lack of skills / Inadequate work standard	Lack of training	Trolley removed immediately	Will be discussed in the safety meeting
41	during washing seaside gang way by high pressure water hose, one of the crew was not wearing safety harness.	Low	Personal accident case	Lack of skills	Lack of knowledge	Not being aware of the potential consequence	The AB passed the harness to the crew	This behaviour was observed in multi occasion

No	Near Miss description	rate	potential consequence	root causes	Personal / job factors	root causes comment	immediate corrective action	shipboard management review
42	while preparing for anchoring the sea was slightly high which resulted in the slipping of one of the crew. luckily, he did not get injured and he was able to keep his balance.	Low	Health or illness	Carelessness			The duty officer advised all of the crew in the area to hold any stationary object to not fall down	The duty officer advised all of the crew in the area to hold any stationary object to not fall down
43	while preparing one of the ballast tanks for inspection, the cover flange was open for ventilation and left unattended and without any mark	Low	Personal accident case	Inadequate work standard		Carelessness	The guard tape was installed immediately	Checklists need to be followed
44	during working on the provision crane, one of the crew was not wearing helmet which could resulted in serious injury or even death	Low	Personal accident case	Carelessness	Lack of knowledge		He was asked to go to the accommodation to get the helmet	This was discussed several times in the safety meeting
45	during his watch he saw one of the crew members working on the platform Infront of the bridge without harness	Low	None conformance	Carelessness		Work permit was prepared, and toolbox meting carried out	A harness was given to him to be fitted	Will be discussed in the safety meeting
46	the escape hatch in the elevator at the nav deck was blocked with padlock from outside. this was noticed during annual check	Low	None conformance	Carelessness			Hatch unlocked	Will be discussed
47	a barricade tape was missing at the area with no gratings	Low	Health or illness	Carelessness	/ lack of supervision		The AB remains at the area and called another crew to bring the barricade	Checklists needs to be followed
48	shekels and chain were secured badly at securing point	Low	Property damage	Lack of knowledge	Lack of skills / Inadequate work standard		The shekels and the chain were re secured again in the correct way	The shekels and the chain were re secured again in the correct way
49	during routine check on deck, a none secure bag full of rags were found near to the incinerator and the place was slightly oily due to leakage. this might cause slipping to any of the crew or even fire if the fire tringle was existing	Low	Fire	Carelessness	Lack of knowledge		The bag of the rags was removed	This will be discussed in the safety meeting

No	Near Miss description	rate	potential consequence	root causes	Personal / job factors	root causes comment	immediate corrective action	shipboard management review
50	during some tasks on the engine room, one of the crew was found without harness	Low	Personal accident case	Lack of knowledge	Carelessness / lack of supervision		The crew was asked to come down to wear the harness	Crew needs a clear instruction before conducting any task
51	weather tight door on the port side of the accommodation was open without securing the hook while some one was working behind the door	Low	Personal accident case	Incorrect use of equipment	Lack of knowledge	Crew member was on hurry to do his task	The door was shut immediately	Crew was advised to not do this again
52	chipping on deck without helmet	Low	Personal accident case	Poor work practice	Lack of knowledge		He was asked to bring the helmet	New crew needs to follow safety instruction carefully
53	one of the crew was noticed by the master while he was fitting the chain block to pad eye without support to step ladder	Low	Personal accident case	Incorrect use of equipment		Overconfidence	The master supported the ladder while he finishes the task	This case to be discussed in the safety meeting
54	one of the crew was going down through the stairs while he was carrying a big box which was obstructed him from seeing the way	Low	Personal accident case	Poor work practice		The crew wanted to go the job faster	He was stopped and someone helped him	Crew were instructed of the proper working practice
55	while working near to the main engine, the railing was found damaged. this could lead to serious injury or fatality	Low	None conformance	Lack of maintenance			The rails were fixed after notifying the fitter	The rails were fixed after notifying the fitter
56	during connecting a hose to the ship's manifold, they noticed one of the greeting sheets were partly corroded	Low	Property damage	Lack of maintenance			The corroded part has been replaced	
57	during the safety round, a VHF was found in the changing room unattended inside the looker. in case of emergency this could lead to communication break down	Low		Poor work practice			The crew were asked to check where is their VHF	
58	one of the steps in the ladder going to garbage area was broken	Low	Personal accident case	Excessive wear and tear			The step to be fixed in the correct place	More inspection to be carried out to check a similar case
59	the local manual activation buttons for water mist and incinerators protection glass was broken and the rest of the broken glass was left inside the frame of the button. then they cover it with duct tape which make it impossible for anyone to find out whether the button is activated or not	Low	Machinery damage	Incorrect use of equipment	Lack of skills / Inadequate supervision		The tape was removed, and the button was replaced	

No	Near Miss description	rate	potential consequence	root causes	Personal / job factors	root causes comment	immediate corrective action	shipboard management review
60	during routine round on the engine room, the grainer in the workshop was found in working mode unattended. this could lead to injury	Low	Machinery damage	Incorrect use of equipment	Lack of skills / Inadequate supervision	Doing multi tasks at ones	The grainer was shut off	New post needs to be posted to instruct the crew
61	some valves related to changing full mode were found shut down due to negligence	Low	Fire	Incorrect use of equipment	Lack of skills / Inadequate supervision	Instruction was not clear	The valve was turned on again	The valve was turned on again
62	the stationary room was full of a4 paper boxes and it was not organised. in case of Rolling the boxes will fall and block the door from inside	Low		Carelessn ess			Boxes removed	
63	one of the navigational shapes is not according to the requirement college annex I 6 b	Low	None conformance	Incorrect use of equipment		AB was instructed to fabricate one and the officer did not check after him	Shape was corrected	No further action required
64	no symbols were posted for emergency exit in the accommodation	Low		Carelessn ess		Oversight	The symbol was posted	
65	hospital weather tight door handle not in position	Low	None conformance	Housekee ping	Carelessness	Omission	The handle is back again in position	This issue to be discussed in the safety meeting
66	pressure gauge of sewage vacuum was fluctuating which make the pump in running condition continuously	Medium	Machinery damage	Housekee ping	Abuse or misuse of equipment	carelessness	the peel of the fruit was removed from the valve flap	all crew was briefed and advised to not repeat this action
67	rescue line in the engine room escape trunk was found in the bottom of the platform	Medium	Personal accident case	Housekee ping		proper securing for the line and regular check in the future	rescue line was placed back	topic was discussed in the safety meeting
68	some of the crew left their PPE in the alleyway, which give indication that someone in his cabin not in the master station in case of abandon ship.	Medium	Personal accident case	Housekee ping			everyone keeps his shoes inside his cabin	crew advised to keep their PPE inside their rooms
69	foam firefighting valve for the fixed system in the engine room found incorrectly set, the tank left with foam mixture more than 2% and it must be less	Medium	Fire	Incorrect use of equipment		oversight	the valve was adjusted as per last foam analysis certificate	valve set correctly

No	Near Miss description	rate	potential consequence	root causes	Personal / job factors	root causes comment	immediate corrective action	shipboard management review
70	changing room door was left open by a door stopper. in case of fire inside the room the fire will spread to our side	Medium	Fire	Equipment failure			Faulty door was disconnected, and door closed	
71	sampling hose in the gas meter was damaged	Medium	Fire	Equipment failure	Lack of maintenance		The hose was replaced	
72	during maintenance for system on the purifier room, isolation material for one of the steam valves was found totally damaged. this could leak hot steam to any person nearby.	Medium	Personal accident case	Equipment failure	Lack of maintenance		The leak was sealed	No further action required
73	chipping without safety goggles	Medium	Personal accident case	Poor work practice	Lack of knowledge		He was asked to bring the safety goggles	New crew needs to follow safety instruction carefully
74	during working on pneumatic tools, one of the air hoses was lacking due to storing it in sunny place and the hose loses its flexibility	Medium	Personal accident case	Equipment failure	Housekeeping		The hose gets replaced	No further action required
75	during working on the ER store, the air hoist access cover between the store and the workshop was not secured. it might fall if someone tried to remove it.	Medium	Property damage	Housekeeping		Oversight	The cover was secured	Crew are required to pay full attention
76	one of the crew was working on the light post without wearing safety harness and pulling heavy tools from Hight.	Medium	Personal accident case	Failure to use PPE	Carelessness	Work permit was prepared, and toolbox meting carried out	A harness was given to him to be fitted	Will be discussed in the safety meeting
77	not holding the handrails while carrying boxes	Medium						
78	during accommodation inspection he found some helmet and safety shoes in alleyway, which could obstruct crew in case of emergency	Medium		Carelessness	Lack of skills / Inadequate work standard	It was ordered to keep them inside the room	It was ordered to keep them inside the room	Possible hazard was explained to crew

No	Near Miss description	rate	potential consequence	root causes	Personal / job factors	root causes comment	immediate corrective action	shipboard management review
79	some of the rating in the engine room use their dirty gloves while going up and down on the stairs. that led to slippery handrails	Medium	Health or illness	Failure to comply proper procedure	Lack of knowledge / Inadequate leadership	Even proper housekeeping won't improve people who do not properly follow simple instructions	This matter was discussed several times and no improvement	Rating needs some training
80	during conducting me overhauls, some contracture was not wearing helmet	Medium	Personal accident case	Failure to use PPE	Carelessness		A helmet was given to him to be fitted	Will be discussed in the safety meeting
81	during routine inspection, the emergency escape hatch for the elevator was found secured from outside and cannot be open from inside	Medium						
82	while working on the midship crane lifting harmful material, some crew were not wearing safety goggles	Medium	Personal accident case	Failure to use PPE	Carelessness		A safety goggles was given to him to be fitted	Will be discussed in the safety meeting
83	during pump room inspection he noticed on of the ladder steps is not in correct level which could lead to personal injury	Medium	Personal accident case	Poor access		poor working practice	informed the pump man to highlight the hazard	to be discussed in the next safety meeting
84	fire alarm was sounded in the incinerator due to smoke coming from bottom of that area in the sludge which resulted from a leakage of waste through the air ventilation in the area. this event caused the incinerator to shut down.	Medium	Fire	Failure to comply proper procedure			The alarm was acknowledged, and the source of the smoke was checked	The alarm was acknowledged, and the source of the smoke was checked
85	he has noticed that the oil temperature remote indication for all purifiers in the CAM are giving wrong reading	Very High	Machinery damage	Equipmen t failure	Inadequate engineering design	the purifier board temperature channel is secured	replaced CPU for the purifier	
86	detection point for fire is not working. discovered during weekly check.	Very High	Machinery damage	Equipmen t failure	/ Excessive wear and tear		The old part was replaced	This Near Miss was not visible from outside, the inspection shows the fault

No	Near Miss description	rate	potential consequence	root causes	Personal / job factors	root causes comment	immediate corrective action	shipboard management review
87	some fire detection call point in the engine were not activated	Very High	Fire	Equipmen t failure		excessive wear and tear	replace a call point from ship stock	additional local inspection for all call point fire detections
88	deck fire doors do not close due to some glue was applied to the door	Very High	Fire	Incorrect use of equipment	Abuse or misuse		door freed up	officers and crew briefed and advised to not do this again
89	facing difficulty in connecting fire hose at the time of the drill	ery High		Incorrect use of equipment	/ Inadequate maintenance	The fire hose was damaged due to strong impact	The coupling was replaced immediately	
90	during safety tour on deck he found corn brooms were placed on deck. this broom is fire hazard	Very High	Fire	Housekee ping	/ Inadequate purchasing	After recent fire on one of the vessels, safety officer conducted this inspection	Remove from use	Will discussed in safety meeting
91	pump room firefighting system and general alarm were not working. and the air horn found totally damaged	Very High	None conformance	Defective tool	Improper motivation		spare horn was fitted in place	all crew was informed about this case
92	hot sparks were generating from some task in the workshop going to working place where a crew was holding something contains diesel	Very High	Fire	Carelessn ess	Lack of knowledge / Inadequate planning		The grinder was stopped	The ER staff was instructed to be careful next time
93	incinerator ash door interlock was found damaged due to heavy external impact during wall rebuilding work in that area	Very High		Incorrect use of equipment	lack of skills / Abuse or misuse of equipment		interlock was replaced	officers and crew were advised and brief about the case
94	during disconnecting cargo hose one of the crew was not wearing gloves	Very High	Personal accident case	Failure to use PPE	Carelessness		The crew asked to wear gloves	To be discussed in the safety meeting
95	during the preparation for arriving onset he noticed the pilot ladder rope was damaged	Very High	Personal accident case	Lack of maintenan ce			Crew were instructed to replace the damage ladder with new one	
96	during the elevator maintenance process, some accumulated oil was found on the shaft	Very High	Machinery damage	Failure to comply proper procedure	Abuse or misuse of equipment		The accumulated oil was cleaned	

No	Near Miss description	rate	potential consequence	root causes	Personal / job factors	root causes comment	immediate corrective action	shipboard management review
97	someone get hit by the toilet door while he was inside without locking the door	Very High	Personal accident case	Carelessn ess		Toilet door to be always locked	Crew was warned	Crew informed of the possible hazard
98	the shape hatch in the elevator at the nav deck was blocked with padlock from outside. this was noticed during annual check	Very High	None conformance	Failure to comply proper procedure	Inadequate instructions / Inadequate planning	Procedure for elevator escape hatch while in piracy area to be implemented	Padlock was forced off	Procedure for elevator escape hatch while in piracy area to be implemented
99	unsecured pipes were found on the deck	Very High	Health or illness	Housekee ping	Lack of knowledge / Inadequate leadership	Lack of responsibility	Pipes were secured	
100	one of the portable grinders does not have a safety guard. the user should have checked that before using it	Very High	Personal accident case	Defective tool		The new order must be according to the safety standard	The new order must be according to the safety standard	The new order must be according to the safety standard
101	during disconnecting cargo hose one of the crew member did not wear safety gloves	Very High	Machinery damage	Incorrect use of equipment	/ Inadequate tools	Tools with low safety feature cannot be used	This grinder should be checked before using	Tools with low safety feature cannot be used
102	one of the vessel's o2 analyser get damaged due to sea water flooding	Very High		Equipmen t failure		seawater carry over from the scrubber	dunnage unit isolated	officers informed
103	while the pilot and the loading master were coming onboard using the pilot ladder, the winch has stopped working. The pilot and the loading master remained stuck for 15 minutes	High	Personal accident case	Equipment failure	Lack of maintenance		The winch was fixed immediately	Winch must be checked in advance before the pilot arrival
104	while on the port operation, some of the deck crew were using their walkie-talkies and the antenna was covered with tape instead of the proper isolation material.	Low		Equipment failure	Lack of knowledge	Crew did not rely potential danger	The antenna was replaced	Will be discussed in the next safety meeting
105	while a crew was using a portable device on the ER workshop, I noticed the device does not have a safety instruction.	Low	Health or illness	Incorrect use of equipment	lack of skills	Abuse or misuse of equipment	The instructions were posted next to the device	The instructions were posted next to the device
106	a crew member in the ER was seen skipping a step in the stair while he was carrying things.	Low	Personal accident case	Failure to comply proper procedure			He was stopped immediately	In the next safety meeting this issue will be discussed

No	Near Miss description	rate	potential consequence	root causes	Personal / job factors	root causes comment	immediate corrective action	shipboard management review
107	a crew member in the ER was running down the stairs without caution	Low	Fire	Carelessness		Forgetfulness	Turned off	Notice of switching off was posted
108	during taking over the watch, the laminator machine was switched on and very hot.	Low	Fire	Carelessness	Abuse or misuse of equipment		The machine was switched off immediately	No further action
109	one of the engine crew was carrying a barrel of oil without covering it, the sea was rough	Low	Health or illness	Failure to comply proper procedure			He was stopped immediately	In the next safety meeting this issue will be discussed
110	while chipping near to manifold area, one of the crew did not wear proper PPE (safety goggles)	Low	Personal accident case	Failure to use PPE	Carelessness		goggles were given to him to be fitted	Will be discussed in the safety meeting
111	hospital weather tide door was left open.	Low	Fire	Failure to use PPE	Carelessness	Lack of skills	The door was closed	In the next safety meeting this issue will be discussed
112	while preparation for piracy procedure, one of the accommodations doors was left open	High		Failure to comply proper procedure	Lack of skills / Inadequate supervision	Instructions need to be clear then some follow up	The door was closed immediately	Instructions need to be clear then some follow up
113	while attending the weekly drill, one of the crew was running at the stairs without holding rails.	Low	Personal accident case	Poor work practice		The crew wanted to go the job faster	He was stopped and someone helped him	Crew were instructed of the proper working practice
114	the gas meter was not set correctly while measuring the CO2 level inside enclosed space	Low		Poor work practice	Lack of maintenance		A new gas meter was ordered	
115	one of the hatches covers in the ER room was not fixed in the right position.	Low	Property damage	Poor work practice	Carelessness	No clear instructions	The cover was removed and replaced again in the position	More supervision is required
116	during disconnecting cargo hose, a damaged O ring gasket on the cargo hose was observed.	Medium	Property damage	Lack of maintenance			The O ring was replaced immediately	
117	the OOW has slipped due to heavy weather while fixing position.	Low	Health or illness				Crew were advised to take extra caution	
118	while loading crude oil and connecting cargo hose. one of the crew from the port authority was not wearing gloves.	Low	Personal accident case	Failure to use PPE	Carelessness		gloves were given to him to be fitted	Will be discussed in the safety meeting

No	Near Miss description	rate	potential consequence	root causes	Personal / job factors	root causes comment	immediate corrective action	shipboard management review
119	while crew members were doing chipping on the x platform on one of the valves. one of the crew was doing on the top of the valve and the 2nd on the bottom of the valve without the helmet (PPE)	Medium	Personal accident case	Failure to use PPE	Carelessness		A helmet was given to him to be fitted	Will be discussed in the safety meeting
120	crew member was observed doing chipping without safety goggles.	Low	Personal accident case	Failure to use PPE	Carelessness		A goggle was given to him to be fitted	Will be discussed in the safety meeting
121	while working with the air compressor and connecting the air hose, the hose was leaking.	Low	Machinery damage	Housekeeping	Omission		The hose was replaced	The hoses need to be stored appropriately
122	while the vessel was at sea. the ladder goes to the big garbage observed wobbly. this could result in a fall	Low	Health or illness	Environmenta l damage			The fitter was notified to fabricate new steps	The fitter was notified to fabricate new steps
123	while carrying out inspection for FFLB, it was observed that circular guard rail on the vertical ladder leading to the platform for securing L/B to davit via shackle and chain was badly wasted at securing point to railing	Medium	Property damage	Poor work practice	Lack of skills/ lack of supervision	This kind of job need to be done under supervision	The shekels and chain were re secured	This kind of job need to be done under supervision
124	no barricade tape put around the area at emergency generator room entrance. where grating has been removed for maintenance	Low	Health or illness	Carelessness	/ lack of supervision		The crew remains at the area and called another crew to bring the barricade	Checklists needs to be followed
125	before going UMS in ER, it was noticed that workshop fire alarm still on delay. it was found the delay clock is seized	Medium	Fire	Lack of maintenance	Defective Tools	Lack of maintenance		The fire alarm was replaced by new one
126	at steering gear room platform, a big gap between two plates was found.	Low	Health or illness	Poor work practice			The fitter was notified to fabricate new steps	The fitter was notified to fabricate new steps
127	the ballast tank opening was left open with no Gard tape.	Low	Health or illness	Carelessness	/ Lack of supervision		The crew remains at the area and called another crew to bring the barricade	Checklists needs to be followed
128	I saw a crew member in the ER climbing the stairs without the support of the railing as he was carrying boxes.	Low	Personal accident case	Poor work practice		The crew wanted to go the job faster	He was stopped and someone helped him	Crew were instructed of the proper working practice

No	Near Miss description	rate	potential consequence	root causes	Personal / job factors	root causes comment	immediate corrective action	shipboard management review
129	during drill, the fire monitor on the main deck was not moving easily due to corrosion	Medium	Property damage	Lack of maintenance	Inadequate work standard / Inadequate supervisor	Fire monitors must be checked weekly	The corroded part has been chipped	Fire monitors must be checked weekly
130	while lifting the cargo hose by the crane, one of the cadets was supporting the hose and directing it to the manifold by his naked hand	Low	Health or illness	Lack of skills	Lack of knowledge / Inadequate supervision	He was in rush to finish	The CH/ENG notified him immediately	This case to be discussed in the safety meeting
131	while picking up provisions from service boat one of the crew was helping to store the provision before the second load of the provision was landed on the deck, he clouds be injured.	Low	Health or illness	Lack of skills	Lack of knowledge / Inadequate supervision	He was in rush to finish with the provision	The safety officer notified him immediately	This case to be discussed in the safety meeting
132	the lookout went to make a check on the deck and took the UHF with him, after a while the OOW tried to call him but no response. The UHF was out of battery.	Low		Incorrect use of equipment	Carelessness	The officer must check with the look out about the battery	Once he retuned the UHF was put in the charger	The officer must check with the look out about the battery
133	while the ship was rolling heavily due to the heavy weather. one of the crew was running down the stairs and fall.	Low	Personal accident case	Poor work practice		The crew wanted to go the job faster	He was stopped and someone helped him	Crew were instructed of the proper working practice
134	during testing sprinkler system in the grease locker (engine casing STB side) found one nozzle choke.	Low	Fire	Lack of maintenance	Inadequate working standard		The sprinkler was fixed	Inspection for all sprinkler to be conducted
135	while bunkering operation when one of the crew was using his phone on the 2nd floor of the accommodation.	High	Fire	Failure to comply proper procedure	Carelessness / Inadequate supervision	Omission	The crew was advised to go inside the accommodation	This will be discussed in the safety meeting
136	during the inspection of ship's portable UHF radio, it was discovered that one of the radios has damage rubber coating of the antenna. it makes equipment not intrinsically safe and leads to a fire hazard.	Medium	Machinery damage	Equipment failure	Lack of knowledge	Crew did not realise potential danger	Antenna was replaced	To be discussed in the safety meeting
137	during painting using spray equipment, one crew member was not wearing a mask.	Low	Personal accident case	Failure to use PPE	Lack of knowledge /		The task was shut off immediately and the crew was instructed wear safety goggle	Safety instruction will be demonstrated in the safety meeting

No	Near Miss description	rate	potential consequence	root causes	Personal / job factors	root causes comment	immediate corrective action	shipboard management review
138	I noticed a smell of tobacco in the 3rd floor of the accommodation, it turned to be the oiler who was smoking in his toilet.	Low	Fire	Failure to comply proper procedure	Carelessness	Omission	The safety officer was informed, and the crew was asked to not do this again	The next day an urgent safety meeting was carried out
139	after cleaning the accommodation side, two of the exhaust flaps for the ventilation were left closed.	Low	Property damage	Failure to comply proper procedure	Poor working practice		The flaps were reopened again	This the value of the supervision. The flaps were observed immediately
140	One of the pips within the COW system found with some leaking	High	Fire	Lack of maintenance	Inadequate procedures and checklists	The pump man should have discovered this earlier	A proper welding carried out in the leaking area	The pump man should have discovered this earlier
141	the level of the engine oil at the lifeboat was not at the right level.	Medium	Property damage	Lack of maintenance		The lifeboats maintenance must be conducted with high standard	The 3rd engineer was attended to refill the engine oil	The lifeboats maintenance must be conducted with high standard
142	while doing the daily deck work, I observed one of the crew lifting heavy object while wearing oily gloves. The object cloud fell from his hand.	Low	Personal accident case	Failure to use PPE	Carelessness		gloves were given to him to be fitted	Will be discussed in the safety meeting
143	while painting the rescue boat, one of the ropes that was attached to the boat from the seaside was almost damaged.	Medium	General hazard	Lack of maintenance			The rope gets replaced	Lifeboats along with its fitting and equipment must be in good condition all times
144	while using the crane in the ER the boiler was standing under the crane directly.	Low	Health or illness	Lack of skills	Lack of knowledge / Inadequate supervision	He was in rush to	The CH/ENG notified him immediately	This case to be discussed in the safety meeting
145	in heavy weather and the ship was rolling, the OS was carrying paint with both hands and going down the stairs.	Low	Personal accident case	Poor work practice		The crew wanted to go the job faster	He was stopped and someone helped him	Crew were instructed of the proper working practice

No	Near Miss description	rate	potential consequence	root causes	Personal / job factors	root causes comment	immediate corrective action	shipboard management review
146	one engine personnel were carrying a bucket of diesel. on his way to the lower ER deck, he noticed that the floor plates were removed and left without any sign or notice.	Low	Health or illness	Carelessness	/ lack of supervision		The crew remains at the area and called another crew to bring the barricade	Checklists needs to be followed
147	during the navigational watch, the traffic was very intense, the OOW forgot to fix the ship's position on the chart as he was busy.	High	General hazard	Failure to comply proper procedure	Lack of skills		The look out reminded the OOW to plot the position	All look out were advised to assist the OOW in busy navigational watch
148	during drill, the AB was wearing the fire suit and his assistance forgot to switch on the Oxygen valve. He was not able to breath at the first 5 second. Then the officer recognised the valve and switched on.	Low	Personal accident case	Failure to comply proper procedure	Carelessness	The safety office must follow up each step of the drill	The O2 slander was opened	The safety office must follow up each step of the drill
149	a hot plate was found in the cadet's room.	High	Fire	Failure to comply proper procedure	Carelessness	Lack of inspection	The hot plate was removed from the cabin	The following safety meeting was about fire hazard in the cabins
150	the deck cadet was working on the deck without wearing safety shoes.	Low	Health or illness	Failure to use PPE	/ Lack of supervision		They were advised to wear the safety shoes	To be discussed in the safety meeting
151	during anchoring operation, the AB was standing very close to the anchor chain.	Low	Personal accident case	Failure to comply proper procedure	Carelessness / Inadequate supervision	He was not aware of the consequence	the OOW asked him to keep clear	A brief must be conducted before teach task
152	one of the engine cadets has crossed the mooring lines while the ship was going alongside.	Low	Personal accident case	Failure to comply proper procedure	Carelessness / Inadequate supervision	He was not aware of the consequence	When crew are inside the accommodation, the safety officer explained to the cadet the consequence	When crew are inside the accommodation, the safety officer explained to the cadet the consequence
153	the CH/Officer was holding the tugboat line with both hand and the tug was pulling the ship.	Low	Personal accident case	Poor work practice	Lack of skills	This behaviour is not acceptable from any seafarers	The 3rd officer shouted on him to leave the line as the boat was pulling	A crew member in this position should not act like this. This indicates a low working experience

No	Near Miss description	rate	potential consequence	root causes	Personal / job factors	root causes comment	immediate corrective action	shipboard management review
154	rat guard was not fixed in position while the ship was at port	Low	General hazard	Lack of skills	Inadequate instructions / Inadequate procedure and chec		Once the rat guard noticed missing, the CH/Off placed them on each mooring line	Checklists needs to be followed
155	while conducting safety round at main deck, one of the containers' lashing was not fixed in a good way	Medium	General hazard	Lack of skills	/ Inadequate supervision	The lashing manning at the port must work under supervision	The CH/OFF asked two of the crew to fix the lashing points and to check all other containers lashing	The CH/OFF asked two of the crew to fix the lashing points and to check all other containers lashing
156	one of the crew did not wear harness while working in high area	Low	Personal accident case	Failure to use PPE	Carelessness	Work permit was prepared, and toolbox meting carried out	A harness was given to him to be fitted	Will be discussed in the safety meeting
157	while the ship was at berth, two of the crew members on deck were taking photos	Low		Failure to comply proper procedure			They were asked to stop using the phone while on deck	This issue eas discussed on the safety meeting
158	one crew member left midship door in open position without securing pin when vessel was rolling and entered store. rolling can cause sudden closing of door which can cause injury to crew members or damage to door.	Low	Personal accident case	Carelessness	Inadequate procedures and checklists		The was shut closed immediately	This will be discussed in the safety meeting
159	the OS was doing chipping work on the aft deck without wearing proper PPE.	Low	Health or illness	Failure to use PPE	Lack of skills	Not aware of the potential consequence	The OS was asked to wear the helmet as soon as possible	This act was highlighted several times in the safety meeting
160	safety equipment on the lifeboat was left without proper securing after checking the expiry date	Low	General hazard	Failure to comply proper procedure	Lack of skills / Inadequate procedure and checklists		The equipment was secured after noticing this issue	

No	Near Miss description	rate	potential consequence	root causes	Personal / job factors	root causes comment	immediate corrective action	shipboard management review
161	using wrong equipment for chipping while the ship is fully loaded (crude oil)	Very High	Fire	Incorrect use of equipment	Poor working practice	The crew was not aware of the different type of chipping equipment	The proper equipment passed to him and the potential consequence explained to the crew	The proper equipment passed to him and the potential consequence explained to the crew
162	some of the paper charts were corrected by applying a very poor practice. The size of the navigational symbols was very big. Some of the information on the chart was not able to read.	High		Poor work practice	Lack of knowledge		The 2nd officer re corrected the charts	The officers must know how to correct paper charts in a good way
163	the mess man was going down to the provision room using the stairs and not holding the rails.	Low	Personal accident case	Poor work practice		The crew wanted to go the job faster	He was stopped and someone helped him	Crew were instructed of the proper working practice
164	using the fire hose to clean the main deck.	Low	General hazard	Incorrect use of equipment	Lack of skills		The job was stopped immediately	This will be explained in the safety mmeting
165	while departing form Boustany, the master engaged with side talks with the pilot and they did not notice the crossing of a small boat. Then the OOW informed the master.	Very High	General hazard	Poor work practice	Carelessness	The team work on the bridge must be engaged with the safe navigation all the time	The OOW informed the master after being hesitated for a while	The OOW has done an excellent job
166	while the ship was rolling due to heavy weather, the mess man has forgot to secure the plates at officers' dining room. Many of the plates were fallen and broken.	Low		Housekeeping	Carelessness		The broken glass was removed	The galley team must be prepared for heavy weather
167	at safety round in the pump room, the Ch/Officer and the two cadets were going down using the long ladders. One of the cadets was climbing down without caution. He was stopped immediately and the explained what cloud happened to him	Low	Personal accident case	Carelessness	Lack of skills	Not being aware of the potential consequence	He was stopped immediately and the explained what cloud happened to him.	This will be discussed in the safety meeting

No	Near Miss description	rate	potential consequence	root causes	Personal / job factors	root causes comment	immediate corrective action	shipboard management review
168	radar range was set at 24 miles during rainy day, this cloud lead to appearance of fault targets	Low	General hazard	Lack of knowledge	/ Inadequate instruction		The range was set at a smaller rang	Please follow master order
169	water leaking happened in the toilet at the bridge.	Low		Lack of maintenance			The leaking was fixed	
170	the anchor, winch was not working, then the master decided to use the other anchor to let go.	Medium	Machinery damage	Lack of maintenance	/ Inadequate planning	This anchor was not used for long time	A fixing plan was arranged	A fixing plan was arranged
171	mooring rope storage was full of water as the water tide door was damaged as a result of a heavy weather	Medium	General hazard	Lack of maintenance	Poor working practice / Inadequate supervision	The water tide door must be fixed immediately	The ropes were put on the main deck to dry out	The door had to be fixed earlier
172	the air compressor was faulty during working in the ER. The CH/ENG has order new one	Low		Lack of maintenance			The CH/ENG has order new one	
173	one of the firefighting extinguishers in the anchor room was not working and expired for long time	Low	Fire	Inadequate inspection		No one is going their frequently	A new fire extinguisher with same specifications was placed	More inspections to be carried out in all places that no one go in
174	greasing a water tide door was extremely poor by the OS. This could damage the door.	Low		Lack of knowledge	Lack of skills / Inadequate supervision		The grassing process was re done again	OS must not work without super vision
175	while the ship was at berth, the gang way man did not keep recording each visitor in the visitor logbook.	Medium	General hazard	Poor work practice	Failure to comply with the proper procedure		The gang-way man asked to do a proper security check	Will be discussed in the safety meeting
176	the new deck cadet attended a deck watch without boilersmith.	Low	Personal accident case	Failure to use PPE	Carelessness		The cadet asked to wear the overall suit immediately	Will be discussed in the safety meeting
177	the LSA at the bridge was expired for more than three months	Medium	Personal accident case	Lack of maintenance	Inadequate checklist/ supervisor	carelessness	The OOW asked to order a new LSA package	Will be discussed in the safety meeting
178	during discharging the cargo tanks, the CH/Officer was trying to open one valve from the CCR, but the valve was not responding. The AB went to the pump room to check on the valve. He found the valve over painted.	Medium	Property damage	Lack of maintenance	Housekeeping	Poor work practice	The AB asked to remove the paint immediately	Crew were instructed of the proper working practice

No	Near Miss description	rate	potential consequence	root causes	Personal / job factors	root causes comment	immediate corrective action	shipboard management review
179	during the weekly inspection, one of the fire detection spots was not responding to the carbon monoxide	Low	Machinery damage	Failure to use PPE	Lack of maintenance		Immediate replacement to the sensor	More inspection to be conducting for all sensors
180	the electrical engineer was doing the routine inspection to the left as he found one of the chapels was slightly necked. He fixed the caplet immediately. And informed the Captain and the Ch/EN about it.	High	Machinery damage	Lack of maintenance	Inadequate maintenance		A routine check been placed for the lift	
181	after the midnight watch, the cadet went to have some snakes. He put the food and the metallic spoon in the microwave by mistake. After few seconds he stopped the microwave as the spark griped his attention	Low	Personal accident case	Poor work practice	Carelessness	No clear instructions	The clear instructions been posted next to the microwave	Will be discussed in the safety meeting
182	while cleaning the accommodation stairs, the OS left the fire door open using a door stopper	Low	Personal accident case	Poor work practice		The crew wanted to go the job faster	He was stopped and someone helped him	Crew were instructed of the proper working practice
183	the starboard side light of the ship was not clear due to some paint was applied by mistake in the previous day	High	Property damage	Lack of maintenance	Housekeeping	Poor work practice	To remove the paint immediately	Crew were instructed of the proper working practice
184	the OOW was conducting an inventory to the lifeboat's equipment. He found the food was expired.	Medium	Property damage	Lack of maintenance	Carelessness		The OOW asked to order a new food package for the lifeboat	Will be discussed in the safety meeting
185	while measuring the O2 level at one of the cargo tanks, the cadet was standing against the direction of the wind and the cadet has breathing the harmful gases intentionally.	Low	Health or illness	Failure to use PPE	Carelessness	Lack of skills	The cadet asked to wear the proper equipment	
186	cargo tank number 5 at the port side ventilation was blocked. The OOW has noticed the blockage before the loading.	High	Property damage	Lack of maintenance	Inadequate maintenance/ supervision		The crew asked to clear the ventilation	Will be discussed in the safety meeting
187	the 3rd engineer was measuring the oil level at one of the tanks by himself without asking for help from one of the ER crew.	Low	Personal accident case	Poor work practice		The engineer wanted to do the job faster	He was stopped and someone helped him	The engineer was instructed of the proper working practice

No	Near Miss description	rate	potential consequence	root causes	Personal / job factors	root causes comment	immediate corrective action	shipboard management review
188	the third officer was using headset phone during his watch. By the time when the master came to the bridge, the OOW removed the headset phone.	Medium	Personal accident case	Lack of skills	Carelessness	Lack of responsibility	OOW was warned	OOW informed of the possible hazard
189	some of the light that indicate the situation of the water tide doors was not working	Medium	Property damage	Equipment failure	Inadequate maintenance		The light been checked and replaced	No further action

Appendix K: Full list of the collected Near Miss reports from the newly designed reporting form

No	Near Miss description	Rate	Unsafe act or con	Potential Consequence	Root Causes	Root causes comment	Immediate Corrective Action	Lessons Learned	Classification of the Near Miss
1	not wearing helmet	L	Act	Injury or fatality	Carelessness	Carelessness	wear helmet	Be careful	ability, skills, knowledge of the people involved
2	today, while passing through a-deck alleyway to the duty mess room, a broken lid of the dustbin which had sharp screws protruding from the lid struck my hand lightly. luckily no injury occurred.	L	Act	Injury or fatality	Housekeeping	Wear and tear	The dustbin was removed from the place and the broken lid was fixed back.	All the broken/ damaged items which has sharp edges to be made good or removed from the place at the earliest as it may possess danger to the persons passing nearby.	ability, skills, knowledge of the people involved
3	wrong plating instruction	M	Act	General hazard to the ship4	Housekeeping	Omission	New i9nstruction	Good housekeeping	activities prior to the accident/occurrence
4	during daily round was found at port side of accommodation are located boxes with anti-piracy spike and free access to the fire plan holder was blocked.	L	Act	Injury or fatality	Failure to comply with procedure	Housekeeping / lack of knowledge	Bosun was informed about non-conformance about safety equipment	Crew members were refreshed knowledge about follow up all safety procedures and safety precaution for work and planning to	planning of work

No	Near Miss description	Rate	Unsafe act or con	Potential Consequence	Root Causes	Root causes comment	Immediate Corrective Action	Lessons Learned	Classification of the Near Miss
							procedures. Boxes were shifted to main deck and free access to fire plan restored.	work with fire equipment.	
5	During MOB drill one of the reporters did not informed the bridge. He just did the procedure in cooperation with the rest of the crew on the deck.	M	Act		Failure to comply with procedure				organisation of on-board training and drills
6	during fire drill (fire in the chemical locker), it was observed that one of the crew members entering the space did not carry the fire axe and flashlight along with the fireman's outfit.	M	Act	Injury or fatality	Failure to comply with procedure	Lack of knowledge of wearing the complete Fireman's outfit, which includes Flashlight and Fire Axe.	The crew member was corrected, and Flashlight provided before entering the space.	All crew members explained the importance of wearing proper PPE and Fireman's outfit in case of any fire. In a real scenario, such lapses might result in an injury. Matter to be discussed in a safety meeting.	organisation of on-board training and drills

No	Near Miss description	Rate	Unsafe act or con	Potential Consequence	Root Causes	Root causes comment	Immediate Corrective Action	Lessons Learned	Classification of the Near Miss
7	while isolating aft air conditioning compressor, the cap of condenser outlet valve was removed to enable closing of the valve. on removing the cap, found that the valve gland cover had unscrewed and was stuck inside the cap. with the cover removed, the gland packing blew out.	L	Act	Damage to the environment	Equipment failure	Opening and closing of the valve over the years has led to valve gland cover slowly unscrewing.	Valve opened hard up, so that valve was sealing on the opening seat. This caused the leak to stop and packing refitted and gland cover screwed back on.	To be aware that the valve has an opening seat as well as closing seat.	equipment (availability, reliability)
8	during engine round it was noticed by me that one of crew member was working without fasten the chin strap of his helmet.	M	Act	Injury or fatality	Failure to use PPE	failure to use proper ppe, improper motivation, inadequate procedure or checklist, carelessness	crew member was stopped from work and explained the correct use of proper PPE as per SMS	use of proper ppe must be done at all times	ability, skills, knowledge of the people involved
9	in engine control room which has a first aid kit was placed. and so, while doing some counter check of it, it was found out that one medicine namely silver sulfadiazine (burn cream) was not included on the list of inventories.	L	Condition	Injury or fatality	Failure to comply with procedure	Failure to comply with proper procedures // carelessness	Immediately informed 2E and 2nd Officer. First Aid kit stock replenished.	Training on the importance of following procedures and maintaining First Aid kits is required.	management commitment to safety

No	Near Miss description	Rate	Unsafe act or con	Potential Consequence	Root Causes	Root causes comment	Immediate Corrective Action	Lessons Learned	Classification of the Near Miss
10	two senior officers from the same department travel at same time with elevator although it is prohibited (large notice with warning was posted in the elevator).	M	Act	Damage to the environment	Carelessness	N/A	Warn them not to do it.	Seniors should be a good example of the work and 11behavior, not to violate the rules.	attitude
11	one crew member was mixing a paint without using appropriate face mask.	L	Act	Injury or fatality	Failure to use PPE	Carelessness / Lack of knowledge	Stop operating and request him to use the face mask.	Some of crew members required extra training and familiarization.	ability, skills, knowledge of the people involved
12	the laminating machine left switched on unattended and it is a source of heat nearby some papers.	L	Act	Injury or fatality	Carelessness	None	The laminator switched off. Warning poster "Don't leave unattended" exhibited to avoid any similar situation in the future.	Any electric equipment (chargers, heaters, microwaves, etc.) shouldn't working unattended.	ergonomics of equipment and the working environment

No	Near Miss description	Rate	Unsafe act or con	Potential Consequence	Root Causes	Root causes comment	Immediate Corrective Action	Lessons Learned	Classification of the Near Miss
13	it was notice that the bread baking machine in the galley had some black spots and electrical shot marks on it ,which could have led to contamination of the products made in it making them unhealthy to eat and more over the machine could have led to electrical short circuit because of which it was not safe to use .	L	Condition	General hazard to the ship	Housekeeping	NA	Baking machine immediately removed from use, Galley Staff and Chief Officer informed.	NA	equipment (availability, reliability)
14	during elevator maintenance one of the crew member assumed the maintenance was completed and tried to use the elevator even though the notice posted near the entrance stating, "elevator under maintenance".	M	Act	injury	Carelessness	The concerned crew member on seeing the elevator cart moving during maintenance assumed that the elevator maintenance was completed, and the notice was not removed.	The concerned crew member was briefed about the seriousness and the importance of Lock out / Tag out procedures which is to be followed and complied. And that the elevator was still being tested after completing the	Always lock out / Tag out procedures to be followed and complied. Any doubts - ask your superior.	equipment (availability, reliability)

No	Near Miss description	Rate	Unsafe act or con	Potential Consequence	Root Causes	Root causes comment	Immediate Corrective Action	Lessons Learned	Classification of the Near Miss
							necessary work.		
15	during p/room inspection it has been noticed that all cargo and ballast pumps bearings grease releasing valves and plugs are overpainted and most of them not moving. hence during greasing of the bearings, excessive grease and pressure cannot be removed from the bearing posing risk of overheating and damage to the bearing.	M	Condition	fire	Incorrect use of equipment	Poor work practice; Lack of knowledge; Inadequate leadership or supervision	Crew instructed to wire brush all valves and plugs for free operations.	Recently, I find frequently pumps bearings to be over greased as crew has no knowledge about proper greasing procedure.	ability, skills, knowledge of the people involved
16	cleaning chemical with no instructions in English or common language. unsafe to use due to possible incorrect strength mixing causing injury to personnel	L	Condition	Damage to the propriety	tools deficiency	Supplied by local chandler - outside of vessel control.	Removed from use and disposed of.	Stores to be checked on receipt	regulations, survey and inspections
17	the d/cadet was found using jet chisel but not using PPE as protective goggles.	M	Act	injury	Failure to use PPE	negligence	He was ordered to stop the job immediately and advised to wear proper PPE. Chief	Always take 5 before running in to any job. Engage the brain before the hands.	ability, skills, knowledge of the people involved

No	Near Miss description	Rate	Unsafe act or con	Potential Consequence	Root Causes	Root causes comment	Immediate Corrective Action	Lessons Learned	Classification of the Near Miss
							Officer informed.		
18	vessel at anchor in Jose - Venezuela. during disembarking of port authorities, noticed one of the visitors is using his mobile phone to take pictures on deck.	L	Act	Damage to the propriety	Carelessness	As per standard practices, all visitors were briefed during embarkation and informed not to use electronic devices on deck. Warning notice was posted at the gangway and was clearly visible. Visitor probably ignored the notice board.	Duty officer in charge immediately instructed mentioned visitor to stop taking pictures and switch off his phone.	All crew debriefed and instructed when escorting visitors from vessel, to remind them about importance of switching off all equipment prior leaving accommodation and not to use same on deck. Matter discussed among SMT during daily planning meeting, to be included in next SCM as well.	attitude
19	during inspection of crew recreation room, one metallic ash tray has been found broken (one lid missing). its mean ashtray has been not fully protected from cigarettes end.	M	Act	Injury or fatality	Carelessness	It was must be broken while carelessly handling the push button	Ash tray has been disposed. New one placed.	Any defective item to be reported immediately & should be replaced at once	attitude

No	Near Miss description	Rate	Unsafe act or con	Potential Consequence	Root Causes	Root causes comment	Immediate Corrective Action	Lessons Learned	Classification of the Near Miss
20	water fountain leaking and invisible water slick is on deck so someone can slip and get injured.	L	Condition	Injury or fatality	Equipment failure	Leak on the gasket.	Water to the fountain shut, area cleaned, fountain repaired an put back to service.	Every defect, no matter how minor, should be immediately reported and attended.	state of maintenance (not maintained, badly maintained)
21	while vessel was rolling ship, staff try to use port side provision crane to pick up the fabricated shelf from engine room.	L	Act	fire	Carelessness	carelessness and lack of situational awareness	immediately ask to stop the operation and inform safety officer. stop work authority	proper planning with due consideration to weather & ship's movement	composition of the crew (competence/nationality)
22	during regular deck rounds, observed security measures were not fully implemented on deck. anchor pipe was covered with securing plates, however, due to design of plates, same were not properly secured aligned open it from the side.	M	Act	fire	Incorrect use of equipment	Prior arrival at Jose - Venezuela anchorage, security briefing was done with complete crew, explained company procedures and plan how to implement security measures during port stay.	Informed chief officer to instruct deck team to put additional securing measures on plates and to rig razor wire around chain as additional protection.	Deck crew gathered and de-briefed on proper security measures to be implemented during Venezuela call. Near Miss to be mentioned during next SCM. Chief Officer to make regular security inspection during anchor stay to verify security measures are as per company standards.	ability, skills, knowledge of the people involved

No	Near Miss description	Rate	Unsafe act or con	Potential Consequence	Root Causes	Root causes comment	Immediate Corrective Action	Lessons Learned	Classification of the Near Miss
23	one of the fire hydrants on weather deck (deck #5) was blocked by wooden dunnage stowed on the deck and close to the hydrant. approaching and using the hydrant should be Difficult or impossible during emergency.	H	Act	Injury or fatality	Carelessness / lack of competency	Careless and poor working practice.	Chief Officer informed immediately , and wooden dunnage are removed and stowed on a safe place. Fire hydrant is clear and ready for using in emergency.	All safety equipment must be clear from any obstructions and ready for use all the time.	ability, skills, knowledge of the people involved
24	after bridge watch I went down to my cabin and found that ceiling in the alleyway near my cabin with two sharp edges was facing front /open area not to wall, the celling was removed for some maintenance purpose.	L	Act	Injury or fatality	Carelessness	crew working inside accommodation is wearing safety shoes however not on duty can easily get injured, root cause lack of complain225ce and slack attitude	I removed the metal celling and secured were the ceding been kept sharp edges facing the wall	always secured the items removed in a place which does cause an injury to s.	design
25	unannounced (at short notice) helicopter landed on deck while mooring operations were taking place.	M	Act	General hazard to the ship	Carelessness	Poor communication agent - vessel	Mooring operations were suspended. Crew was		

No	Near Miss description	Rate	Unsafe act or con	Potential Consequence	Root Causes	Root causes comment	Immediate Corrective Action	Lessons Learned	Classification of the Near Miss
							mobilized to receive helicopter		
26	crew member was going down the stairs in the accommodation with mobile phone in front of his eyes held by 2 hands.	M	Act	General hazard to the ship	Carelessness	Complacency.	Crew member was stopped and explained that it was dangerous practice with potential of falling on the stairs as not looking at the path.	While walking on stairways always look at the path.	ability, skills, knowledge of the people involved
27	during mooring operation at port of Yanbu. I noticed one crew member passing walk through nearby on the bitts area wherein the tug line makes fast while the tugboat still pulling /assisting the vessel for docking. Unsafe of the crew member involved.	L	Act	Injury or fatality	Carelessness	Carelessness and lack of knowledge	Unsafe action of the crew member IMMEDIATELY ADVICE/REMIND	TO BE DISCUSS NEXT SCM	ability, skills, knowledge of the people involved

No	Near Miss description	Rate	Unsafe act or con	Potential Consequence	Root Causes	Root causes comment	Immediate Corrective Action	Lessons Learned	Classification of the Near Miss
28	during fire, safety & security rounds after my morning watch it was observed few wet boiler suits on the top of working dryer machine. this is potential danger of the ignition fire in case water seeps in the dryer circuit or due to heat from dryer.	M	Act	General hazard to the ship	Carelessness	NA	Immediately removed from the top of dryer.	The instruction carried out with all crew members. Additional poster attached in laundry. Will discussed on the next SCM	ability, skills, knowledge of the people involved
29	air hose to blasting machine burst	M	Act	Injury or fatality	lack of competency	Ab failed to check the check the equipment in this case the air hose for integrity and age of the hose as 330 very high pressure was needed	Replace the hose	Always check the equipment before use and know the consequences of part failure	equipment (availability, reliability)
30	crew member was going down the stairs in the accommodation with mobile phone in front of his eyes held by 2 hands.	M	Act	Injury or fatality	Carelessness	Complacency, carelessness	Crew member was stopped and explained that it was dangerous practice with potential of falling on the stairs as not looking at the path.	Look at the path of your walk	ability, skills, knowledge of the people involved

No	Near Miss description	Rate	Unsafe act or con	Potential Consequence	Root Causes	Root causes comment	Immediate Corrective Action	Lessons Learned	Classification of the Near Miss
31	found trash / garbage bins obstructing access to electrical power supply distribution board on bridge. all electrical panel board / distribution board should keep in easily accessible condition. nothing should be kept in front of the electrical panels, which block the access in emergency conditions.	L	Act	fire	Carelessness	Poor access	Removed Garbage / trash Bins from the location. Found the suitable locations for Garbage / Trash Bins. Warning signs put in place to avoid such Near Miss in future.	Less space / work area caused this unidentified hazardous work practice onboard.	ability, skills, knowledge of the people involved
32	shipping by hammer	L	Act	Injury or fatality	Incorrect use of equipment	Lack of knowledge	Stopped the work and been reported	Provide knowledge and instructions	ability, skills, knowledge of the people involved
33	equipment not proper secured	L	Act	Injury or fatality	Carelessness	Poor knowledge	Equipment was secured	NA	ability, skills, knowledge of the people involved
34	working without proper PPE	L	Act	Failure to comply with procedures	Failure to use PPE	complacency	stopping the work	needs reminder every time	ability, skills, knowledge of the people involved

No	Near Miss description	Rate	Unsafe act or con	Potential Consequence	Root Causes	Root causes comment	Immediate Corrective Action	Lessons Learned	Classification of the Near Miss
35	two crewmembers were doing some paint work at the monkey island near to the radar danger zoon after taking permission from the OOW. After lunch time they came back to complete the painting. This time they did not informed the OOW that they are back to commence their work.	H	Act	in correct use of equipment	Carelessness	carelessness by crew member.	door secured on securing pin.	watertight doors to be secured by securing pin in open position.	procedures and standing orders communication (internal and external)
36	during safety rounds on deck, I found one shore rigger who is walking around near open deck without any personal gas meter.	M	Act	carelessness	Carelessness	carelessness/ lack of knowledge about dangerous gases during cargo operations	Immediately told the shore rigger to get inside.	Always be attentive and assess the situational awareness to minimize risks.	ability, skills, knowledge of the people involved
37	noticed one of the crew working on the forward mast without wearing helmet.	M	Act	Injury or fatality	Carelessness	He did not bring his Helmet with him to the Mast as the crew not b ed about his safety, rather he considered to work fast and finish the job.	Stop him and advised him to work with proper PPE.	Safety is First	ability, skills, knowledge of the people involved
38	found installed additional no explosion proof, standard hp sodium lamp projector on open dk-4 fwd. port side aft, plugged in to adjacent hand receptacle. this deck is designated for dg class 1 cargo stowage. installation of any no explosion proof projectors is strictly forbidden and does not	M	Condition	Injury or fatality		Failure to comply with vessel requirements for carrying DG	Projector dismantled from the post, HNA receptacle closed with blind cap.	Should be checked before Installation	

No	Near Miss description	Rate	Unsafe act or con	Potential Consequence	Root Causes	Root causes comment	Immediate Corrective Action	Lessons Learned	Classification of the Near Miss
	comply with any standard of safe practice.								
39	crossing of mooring lines	M	Act	Injury or fatality	Carelessness	carelessness and poor work practice	Stopped person doing it inform to go around area marked with tiger stripe	Newer use shortcuts	ability, skills, knowledge of the people involved
40	finger cut due to not using of gloves	M	Condition	Injury or fatality		Finger injury	Stop the person, guide him to use Proper PPE, advice to use PPE for job. Explained about the hazard.	Analyse hazards involved in each work, prior to start job.	ability, skills, knowledge of the people involved
41	the galley stove hood exhaust screen was not inserted in place after cleaning while cooking was in progress.	L	Act	Failure to comply with procedures	Failure to use PPE	Peron engaged in cleaning forget to put back hood screen.	Placed hood exhaust screen on duct.	Always Take 5 before performing job. Consult always Manufacturer instructions. Apply Risk Assessment, in written, if required by	planning of work

No	Near Miss description	Rate	Unsafe act or con	Potential Consequence	Root Causes	Root causes comment	Immediate Corrective Action	Lessons Learned	Classification of the Near Miss
								Company manuals. If not sure about job, ask your Supervisor or/and Senior Officer for clarification.	
42	carrying of cutter without securing properly	M	Act	Injury or fatality	Carelessness	Lack of attention	Advised to keep it away and secure it on a safe place.	Always pay attention of what you're inside your pocket	ability, skills, knowledge of the people involved
43	my room was locked, and the key was left with a crew how was on the deck observing the discharging process. so, I went to the deck with my slipper and pyjama to take my keys.	H	Act	Injury or fatality	Carelessness / Failure to use PPE	lack of knowledge and low level of understanding the safety culture.	I did not take any corrective action. but the boatswain has stopped me in when I was on my way back to the accommoda tion and explained to me this was wrong and advised me to write the report to not forget the importance of being	this might lead to injury or fatality as the deck was slippery. also, will reflect a bad reputation for the company if someone from the port authority saw that.	ability, skills, knowledge of the people involved

No	Near Miss description	Rate	Unsafe act or con	Potential Consequence	Root Causes	Root causes comment	Immediate Corrective Action	Lessons Learned	Classification of the Near Miss
							careful in the future.		
44	I was cleaning my room during the weekly check for crew's cabin. and I left a candle on my room and I went to my duty.	VH	Act	fire	Carelessness	lack of knowledge. and exaggerating of being clean.	during the inspection, the master saw that. he shut the candle down and conduct an urgent meeting. everything was explained to me as it could lead to a fire.	there is a safety type of candle that can shut itself down when it is finished. anyway, candles are not allowed on board.	ability, skills, knowledge of the people involved
45	while approaching a SPM for loading and waiting for the port authority to come on board via helicopter. one of the crew did not wear the fire suit.	M	Act	Injury or fatality		not enough fire suit on board.	he was instructed to go back to the accommoda tion.	all PPE must be checked in advance to be in different sizes and in good number.	ability, skills, knowledge of the people involved
46	while a was plotting a position on the paper chart. I draw the sample of the visual position instead of a gaps position.	M	Act	Injury or fatality	lack of competency	copying the sample was drawn in the previous watch. lack of knowledge.	the duty officer corrected my mistake and explained to me the	now I'm aware of the difference between al samples and when to use each one.	ability, skills, knowledge of the people involved

No	Near Miss description	Rate	Unsafe act or con	Potential Consequence	Root Causes	Root causes comment	Immediate Corrective Action	Lessons Learned	Classification of the Near Miss
							difference between the samples.		
47	one engine personnel were about to carry out fuel oil filter cleaning and carrying a bucket of diesel. on his way to the Leer ER deck where the cleaning area is located, he noticed that the floor plates were removed and left without any sign or notice. this could lead to an injury if the personnel fall into the opening and could lead damage for the machinery or even fire.	H	Act	Injury or fatality	lack of competency	lack of skill. poor working practice. lack of supervision.	tiger rope was placed around the removed floor plates as a warning sign.	do not leave any low-ranking crew without supervision.	ability, skills, knowledge of the people involved
48	The boiler has noticed a spot of oil spell in the ER.	M	Act	Injury or fatality	Carelessness / Housekeeping	failure to comply with the procedure. lack of skills. he was in hurry to finish all the tasks before 1700 hrs.	I stopped him and instructed him to carry one by one or ask for help from a crew. the consequenc es were explained to him as well.	always keep an eye on the low ranking as they think I'm able to do multi-tasks at a time.	regulations, survey and inspections

No	Near Miss description	Rate	Unsafe act or con	Potential Consequence	Root Causes	Root causes comment	Immediate Corrective Action	Lessons Learned	Classification of the Near Miss
49	one of the crew was observed standing under the crane while picking up some stuff from the surface boat.	H	Act	Lack of competency	Carelessness / Failure to comply with procedure / lack of competency	lack of skills. lack of situation awareness.	asked him to keep clear of the dangers area.	some of the new crew wats to proof themselves by doing any things even if it was dangerous. so, they need special observation all the times.	ability, skills, knowledge of the people involved
50	during a routine inspection, the rescue boat forward painter was in bad condition. this could lead to breaking while in use.	M	Condition	Injury or fatality	lack of competency	poor practice of conducting maintenance.	the CH.OFF was informed and the painter was renewed.	painters need extra inspections from time to time. no one knows when the emergency will happen.	regulations, survey and inspections
51	during watch on deck, I observed one of the crew lifting the ventilation with greasy gloves. this might slip the vent on his hand.	L	Act	housekeeping	Carelessness / lack of competency	overconfidence.	I told him to take new gloves.	to be very careful while doing any job	ability, skills, knowledge of the people involved
52	during the afternoon routine inspection round in the ER the 4th engineer was noted replenishing the oil in topping air compressor. due to age sight glass is not transparent and it is not possible to clearly determine the exact oil level in the compressor. the compressor is protected by automation from running with L oil level only. but H level of oil can also be dangerous.	M	Condition	Injury or fatality	Lack of maintenance / lack of competency	lack and not proper of maintenance and lack skills	4th engineer stopped. sight glass was replaced.	this need to be discussed clearly with all members in the ER to be careful.	equipment (availability, reliability)

No	Near Miss description	Rate	Unsafe act or con	Potential Consequence	Root Causes	Root causes comment	Immediate Corrective Action	Lessons Learned	Classification of the Near Miss
53	during the round check, the crude oil wash line was leaking.	H	Condition	Injury or fatality	tools deficiency / Equipment failure	lack of maintenance.	the CH.OFF was informed the line was drained and depressurised. rubber expansion joint replaced with new one.	to replace the joint expansion rubber frequently before the leak happens.	state of maintenance (not maintained, badly maintained)
54	noticed few exhaust flaps around the accommodation closed	L	Act	Injury or fatality	Carelessness	lack of skills and poor inspection.	informed responsible person and flap opened. once again flaps need to be opened and to be closed only in port and cargo operation.	crew need reminder all the time. never left without supervision.	ability, skills, knowledge of the people involved
55	while cabins inspection, one of the crew was smoking on bed	H	Act	Damage to the property	Carelessness / Housekeeping	carelessness. poor housekeeping.	the ashtray was replaced. the crew member was informed of the consequences.	the crew was learned to be extra careful next time.	attitude

No	Near Miss description	Rate	Unsafe act or con	Potential Consequence	Root Causes	Root causes comment	Immediate Corrective Action	Lessons Learned	Classification of the Near Miss
56	during painting using spray equipment, one crew member was noted working without the chemical respirator. he wears a dust mask.	H	Act	Injury or fatality	Housekeeping	lack of skills and competency.	job stopped and asked to wear the correct PPE. with an explanation of the difference.	each PPE and its purpose must be clear to all crew.	planning of work
57	The 4th engineer was about to transfer desal oil from tank to tank without following the working procedure. The CH/E saved the situation immediately.	L	Act	Lack of competency	Equipment failure / tools deficiency	lack of maintenance for tools and excessive load on tools	the antenna was replaced.	the UHF need to be checked before each use	planning of work
58	while bunkering operation when I was taking tank sounding, I saw bunker supervisor beside me using his phone while the bunker sounding pipe was open, and the fumes was coming up	M	Act	Injury or fatality	Carelessness	lack of knowledge and carelessness.	he was stopped immediately.	people from outside the ship has lower level of safety so be careful.	attitude
59	during testing sprinkler system in the grease locker (engine casing stab side) found one nozzle choke.	H	Condition	Failure to use PPE	Carelessness / tools deficiency	lack of maintenance	nozzle removed cleaned and tested AND IT WAS OPERATIONAL.	check regularly.	regulations, survey and inspections
60	while the ship was rolling heavily due to the heavy weather. one of the crew was running down the stairs and he lost his balance. he missed one of the steps and almost fall	L	Act	Lack of competency	Carelessness	carelessness.	he was told to walk slower and pay more attention while the	while the ship is in heavy weather everything needs to be secured even crew needs to be careful.	ability, skills, knowledge of the people involved

No	Near Miss description	Rate	Unsafe act or con	Potential Consequence	Root Causes	Root causes comment	Immediate Corrective Action	Lessons Learned	Classification of the Near Miss
							ship is rolling.		
61	The OOW had adjusted the echo sounder setting at the last minute of approaching shallow water.	L	Act	fire	Carelessness	carelessness.	an immediate investigation carried out to find to whom it belongs, and the consequences was explained.	some of the crew are not aware of being a seafarer that mean 24 hrs continues and responsible for the safety of the ship.	procedures and standing orders communication (internal and external)
62	One of the crew has mixed the garbage.	M	Act	Tools deficiency	Carelessness	carelessness lack of situation awareness	he was instructed to move away.	this occurrence is happening all the time. the crew needs continue supervision.	regulations, survey and inspections
63	while connecting the cargo hose at the manifold one of the grating noted corroded.	L	Condition	Injury or fatality	lack of competency	lack of maintenance.	the Ch. OFF was informed, and a replacement has taken place.	grating need to be checked more frequently.	state of maintenance (not maintained, badly maintained)

No	Near Miss description	Rate	Unsafe act or con	Potential Consequence	Root Causes	Root causes comment	Immediate Corrective Action	Lessons Learned	Classification of the Near Miss
64	during fire drill. the fire monitor valve was hard to open by hand and the f key was not in its position as a standby for use.	L	Condition	Navigational hazard	Carelessness	lack of inspection	F key was secured back to be ready in the future	in case of a real fire the fire monitor will not be usable	state of maintenance (not maintained, badly maintained)
65	At night the deck cadet was cooking at the galley without informing the Chief cook.	L	Act	Damage to the environment	Carelessness	lack of situation awareness	he was stopped and I helped him	never compromise your life to do job	attitude
66	while preparing to enter a ballast tank one of the crew members has removed one of the cover flanges of the tank and leave the hole uncovered and without notice or safety barrier.	L	Act	Lack of maintenance		lack of skills not conducting the check list	a barrier was located and a sign	such a simple act could kill someone.	planning of work
67	at steering gear room platform, near the stairway from mezzanine decks, a big gap between two plates was found	L	Condition	fire	tools deficiency / lack of competency	lack of inspection	one of the plates was relocated to narrow the gap	maintain regular inspection to all places within the ship.	state of maintenance (not maintained, badly maintained)
68	before going ums in ER, it was noticed that workshop fire alarm still on delay. it was found the delay clock is seized	L	Condition	fire	tools deficiency	lack of maintenance	ETO was immediately informed and he cleaned the unit.	do not ignore any tools without inspection	state of maintenance (not maintained, badly maintained)

No	Near Miss description	Rate	Unsafe act or con	Potential Consequence	Root Causes	Root causes comment	Immediate Corrective Action	Lessons Learned	Classification of the Near Miss
69	no barricade tape put around the area at emergency generator room entrance. where grating has been removed for maintenance	L	Act	Injury or fatality	Carelessness	lack of skills, carelessness	the tape was put in place	before removing any late or grating, the tape needs to be prepared.	planning of work
70	OOW did not make a double check after plotting position by the look out.	L	Act	Injury or fatality	lack of competency	lack of inspection and maintenance	a rope was tied between the circular guard rail and railing flat bar temporarily. to reinforce guard rail. the crew member was informed of the hazard while the lifeboat drill was being carried out.	regular inspection for some critical thing needs to carry out	composition of the crew (competence/nationality)
71	while the vessel was at sea. the ladder goes to the big garbage observed wobbly. this could result in a fall	L	Condition	Tools deficiency	tools deficiency	this was not seen for a long time.	this was informed to boatswain to repair the ladder	before stepping on a ladder make sure it is solid enough	
72	during working with the pneumatic tool was found that air hose near connection has a crack and air leak. the air hose crack	M	Condition	Injury or fatality	tools deficiency	excessive workload	the work was stopped, and the rubber	each equipment must be checked before starting the job	equipment (availability, reliability)

No	Near Miss description	Rate	Unsafe act or con	Potential Consequence	Root Causes	Root causes comment	Immediate Corrective Action	Lessons Learned	Classification of the Near Miss
	appeared due to rubber over dry and lose its flexibility.						was replaced		
73	The junior cadet left alone in the navigational watch as the OOW was fully drunk and could not wake up.	M	Act	Navigational hazard	Carelessness	lack of skills and awareness of the possible outcome	the work was stopped	this case has happened more often, and they never learned the lessons.	teamwork
74	while crew members were doing chipping on the x platform on one of the valves. one of the crew was doing on the top of the valve and the 2nd on the bottom of the valve without the helmet (PPE)	L	Act	Tools deficiency	Carelessness	the lack of knowing what might happen.	he was instructed to put on his helmet	working on deck needs to continue observation. the crew usually violate the rules.	ability, skills, knowledge of the people involved
75	after the discharging. and disconnecting the cargo hose. one of the crew from the port authority was not wearing gloves.	VH	Act	Tools deficiency	Carelessness / Failure to use PPE	failure to comply with procedure of keeping PPE all the time while on deck	he was pushed back	briefing for crew before such a job to make sure they are safe enough.	ability, skills, knowledge of the people involved
76	The master gave the pilot the command while approaching the port.	L	Act	Navigational hazard	Housekeeping	negligence of removing the rubber earlier.	Ch. Off was informed for further action	to be very careful when stepping on a very shiny and clean surface.	teamwork

No	Near Miss description	Rate	Unsafe act or con	Potential Consequence	Root Causes	Root causes comment	Immediate Corrective Action	Lessons Learned	Classification of the Near Miss
77	during off cargo hose, a damaged o ring gasket on the cargo hose was observed.	H	Condition	Failure to use PPE	lack of competency	lack of maintenance	loading master and pilot and Ch. OFF was informed. a replacement has taken place.	this need to be checked in advance	equipment (availability, reliability)
78	during working in the ER store, it was noticed that the access cover between the workshop and the centre store for the air hoist is not secured and might fall while a person wants to remove it.	M	Act	Injury or fatality	Housekeeping	bad practice of housekeeping	a rope was fixed to the cover to prevent it from falling in case of removal.	housekeeping must be under supervision.	state of maintenance (not maintained, badly maintained)
79	it was observed that while taking atmosphere check to an enclosed space via the gas meter, that the sampling hose was damaged.	M	Condition	Navigational hazard	tools deficiency	excessive workload	the sampling hose was replaced	make calibration for the gas meter all the times.	equipment (availability, reliability)
80	While sailing nearby coast at night. The OOW received a phone call and dismissed the lookout.	M	Act	Lack of maintenance	Carelessness	overconfidence	he was stopped and directed to hold the rail to avoid falling		teamwork
81	while doing ME to overhaul the contractors were instructed about safety and the emergency stop of the cranes. during overhauling me	M	Act	Injury or fatality	Carelessness	lack of skills and knowing the purpose of the PPE	the safety instruction was told again, and they	keep an extra eye on the people from outside the ship	ability, skills, knowledge of the people involved

No	Near Miss description	Rate	Unsafe act or con	Potential Consequence	Root Causes	Root causes comment	Immediate Corrective Action	Lessons Learned	Classification of the Near Miss
	to was noticed that contractors were not wearing helmet						instructed to wear the helmet		
82	hospital weather tide door handle was not in position. it was taken out as anti-piracy procedure	L	Act	Tools deficiency	Carelessness / Failure to use PPE	lack of skills and carelessness	handle brought back	each tool has its own special benefit	
83	while chipping crew did not wear proper PPE	L	Act	Navigational hazard		lack of skills and failing to comply with safety procedure of wearing PPE	he was stopped and asked to wear the safety helmet	not everyone has the same level of safety culture. especially new seafarers	ability, skills, knowledge of the people involved
84	one of the engine crew was working with a wire brush. after he finished, he blows himself using the compressor to take the dust out.	H	Act	Injury or fatality	Failure to use PPE	lack of knowledge	he was stopped and I explained this might harm his body and get him an infection.	to be filled by the shore base personnel	ability, skills, knowledge of the people involved
85	during taking over the watch, the logbook was not updated with the voyage details for the last watch	L	Act	carelessness	Carelessness / Incorrect use of equipment	the previous officer was so sleepy and has fatigue, so he forgets to switch off the machine	it was unlogged	after departure, any port crew will face fatigue, so they need to sleep well to overcome the fatigue	procedures and standing orders communication (internal and external)

No	Near Miss description	Rate	Unsafe act or con	Potential Consequence	Root Causes	Root causes comment	Immediate Corrective Action	Lessons Learned	Classification of the Near Miss
86	The helmsman was not acknowledging the master order.	L	Act	Injury or fatality	Carelessness	not being aware of what might happen	the oiler went to him to help him immediately .	even if the person was very stable. you never know when the ship will role.	attitude
87	while a crew was using welding tools in the ER, he did not secure the working area from catching fire material.	VH	Act	Incorrect use of equipment		lack of skills.	the job was stopped, and the guard was placed correctly.	overconfidence might result in skipping some important step for any task.	planning of work
88	The deck cadet changed the radar setting without informing the duty officer while passing Malaga straight.	L	Act	Lack of competency	Incorrect use of equipment	lack of knowledge	the antenna was replaced	the crew did their best to keep the device in working condition. but they did it wrong	procedures and standing orders communication (internal and external)

No	Near Miss description	Rate	Unsafe act or con	Potential Consequence	Root Causes	Root causes comment	Immediate Corrective Action	Lessons Learned	Classification of the Near Miss
89	by the time the two pilots embarked the VLCC, the dry bulb temperature came close to that of the wet bulb, and nobody saw it coming. normally, wet/dry bulb temperatures are recorded regularly on the ship's logbook, but in this case, it seemed to be the task with least importance, given the current situation. this causes sudden appearance of Very High dense fog, which was unexpected by the bridge team during SPM approach. there was a lot of panic on the bridge, and suddenly the ship had to report to the VTS centre, and ships in the vicinity, and work with fog signals. with too much work and communication procedure that had to be followed in a short time, the ship came close to collide with a maintenance boat, but it was evaded on the last minute	L	Act	Lack of competency	Carelessness	Regular tasks become very boring, and hence get lost within the new not-so-often task, hence their significance is overlooked	communicating with the maintenance boat, and arrange irregular manoeuvrability (one that is not based on COLREGs)	Keep people onboard for carrying out regular boring work, because small details may cause huge damage	procedures and standing orders communication (internal and external)

Appendix K: the experts' opinion toward the collected and reported cases through the existing reporting form and the newly designed reporting form.

Expert: MH, Seafarer/academic (retired 2nd officer/professor assistant) (11-15 years) (load 3)							
No	Rate is Accurate	Potential Consequence is accurate	Root causes is accurate	Corrective action is accurate	Lessons Learned is accurate	Class is accurate	Percentage of the accuracy of the case
1							
2							
3		√	√	√			17.3%
4		√	√	√			17.3%
5							
6							
7	√	√	√	√			23.07%
8	√	√	√	√			23.07%
9							
10							
11		√		√			11.54%
12							
13	√	√	√	√			
14							
15		√	√	√			17.07%
16							
17		√	√	√			17.03%
18	√	√	√	√			23.07%
19	√	√	√	√			23.07%
20	√	√	√	√			23.07%
21	√	√	√	√			23.07%
22		√	√	√			17.30%
23	√	√	√	√			23.07%
24							
25	√	√	√	√			23.07%
26		√	√	√			17.3%
27							
28	√			√			11.53%
29		√	√	√			17.3%
30							
31		√	√	√			17.3%
32	√	√	√	√			23.07%
33				√			5.76%
34	√	√	√	√			23.07%
35			√	√			11.53%
36	√	√	√	√			23.07%
37		√	√	√			17.3%
38		√	√	√			17.3%
39	√	√		√			17.3%
40	√	√	√	√			23.07%

41	√	√		√			17.3%
42	√	√	√	√			23.07%
43							
44							
45							
46		√		√			11.53%
47	√	√	√	√			23.07%
48			√	√			11.53%
49							
50							
51							
52							
53	√	√					11.53%
54		√	√	√			17.30%
55		√		√			11.53%
56							
57							
58		√	√	√			17.3%
59				√			5.76%
60							
61	√	√	√	√			23.07%
62							0%
63	√	√	√	√			23.07%
64	√	√	√	√			23.07%
65							
66							
67							
68							
69							
70	√	√		√			17.30%
71	√		√				11.53%
72							
73	√	√	√	√			23.07%
74		√	√	√			17.3%
75							
76							
77		√	√	√			17.3%
78				√			5.76%
79			√	√			11.53%
80							
81							0.0%
82							
83							
84	√	√		√			17.3%
85	√						5.76%
86	√	√	√	√			23.07%
87	√			√			11.53%
88	√	√	√	√			23.07%
89	√			√			11.53%
90	√	√		√			17.3%
91							
92							
93	√	√	√	√			23.07%

94		√	√	√			17.3%
95	√	√	√	√			23.07%
96							
97							
98							
99				√			5.76%
100							
101				√			5.76%
102	√	√	√	√			23.07%
103							
104			√				5.76%
105	√	√	√	√			23.07%
106	√	√		√			17.3%
107							
108	√	√	√	√			23.07%
109							
110	√	√	√				17.3%
111		√	√	√			17.3%
112	√	√		√			17.3%
113							
114							
115	√		√				11.53%
116	√						5.76%
117			√				5.76%
118		√		√			11.53%
119				√			5.76%
120	√		√	√			17.3%
121		√	√	√			17.3%
122		√	√	√			17.3%
123	√		√	√			17.3%
124		√	√	√			17.3%
125		√	√	√			17.3%
126	√	√	√	√			23.07%
127	√	√	√	√			23.07%
128							
129		√	√	√			17.3%
130	√	√	√	√			23.07%
131	√		√	√			17.3%
132	√		√	√			17.3%
133	√	√	√	√			23.07%
134	√	√	√	√			23.07%
135	√		√	√			17.3%
136	√	√	√	√			23.07%
137	√	√	√	√			23.07%
138	√	√	√	√			23.07%
139							
140							
141		√	√	√			17.3%
142	√	√	√	√			23.07%
143	√	√	√	√			23.07%
144							
145							
146							

147							
148	√			√			11.53%
149	√		√				11.53%
150		√		√			11.53%
151							
152							
153							
154	√	√	√	√			23.07%
155	√		√	√			17.3%
156							
1	√	√	√	√		√	19.21%
2	√	√	√	√	√	√	23.07%
3	√	√	√	√		√	19.21%
4	√	√	√	√	√	√	23.07%
5	√	√	√	√	√	√	23.07%
6							
7	√	√	√	√	√	√	23.07%
8							
9	√			√	√	√	15.37%
10	√	√	√	√	√	√	23.07%
11	√	√	√	√	√	√	23.07%
12	√	√	√	√	√	√	23.07%
13	√	√		√	√	√	19.21%
14							
15	√	√	√	√	√	√	23.07%
16	√			√	√	√	15.37%
17	√		√	√	√	√	19.21%
18							
19				√	√	√	11.53%
20	√	√	√	√	√	√	23.07%
21	√		√	√	√	√	19.21%
22							
23			√	√	√	√	15.37%
24	√	√	√	√		√	19.21%
25	√	√	√	√	√	√	23.07%
26							
27	√	√	√	√	√	√	23.07%
28	√	√	√	√	√	√	23.07%
29	√		√	√	√	√	19.21%
30	√	√	√	√		√	19.21%
31	√	√	√	√	√	√	23.07%
32	√		√	√	√	√	19.21%
33	√		√	√	√	√	19.21%
34	√	√	√	√	√	√	23.07%
35	√	√	√	√	√	√	23.07%
36	√	√		√	√	√	19.21%
37	√	√	√	√	√	√	23.07%
38	√	√	√	√	√	√	23.07%
39	√	√	√	√	√	√	23.07%
40	√		√	√	√	√	19.21%
41	√	√	√	√	√	√	23.07%
42	√	√	√	√	√	√	23.07%
43			√	√	√		11.53%

44							
45	√	√	√	√	√	√	23.07%
46	√	√	√	√	√	√	23.07%
47							
48	√	√	√	√	√	√	23.07%
49	√		√	√	√	√	19.21%
50		√		√	√	√	15.37%
51		√	√	√	√	√	19.21%
52	√		√	√	√	√	19.21%
53							
54	√		√	√	√	√	19.21%
55	√			√	√	√	15.37%
56	√		√		√	√	15.37%
57							
58							
59	√	√	√	√	√	√	23.07%
60							
61							
62	√	√	√	√	√	√	23.07%
63	√		√	√	√	√	19.21%
64	√	√	√	√	√	√	23.07%
65	√	√	√	√	√	√	23.07%
66	√	√	√	√	√	√	23.07%
67			√	√	√	√	15.37%
68		√		√	√	√	15.37%
69							
70							
71							
72	√	√	√	√	√	√	23.07%
73		√	√	√	√	√	19.21%
74	√	√	√	√	√	√	23.07%
75	√		√	√	√	√	19.21%
76	√	√		√	√	√	19.21%
77	√	√	√	√	√	√	23.07%
78	√	√		√	√	√	19.21%

Expert: OA, Seafarer (Acting Captain) (15-20 years) (load 4)							
No	Rate is Accurate	Potential Consequence is accurate	Root causes is accurate	Corrective action is accurate	Lessons Learned is accurate	Class is accurate	Percentage of the accuracy of the case
1							
2	√	√		√			23.07%
3							
4			√	√			15.38%
5							
6							
7	√	√	√	√			30.76%
8	√	√	√	√			30.76%
9							
10							
11		√	√	√			23.07%
12							
13	√	√	√	√			30.76%
14							
15	√		√	√			23.07%
16							
17		√	√	√			23.07%
18	√	√	√	√			30.76%
19	√		√	√			23.07%
20	√	√	√	√			30.76%
21	√	√	√	√			30.76%
22		√	√	√			23.07%
23	√	√	√	√			30.76%
24							
25	√	√	√	√			30.76%
26		√	√	√			23.07%
27							
28	√			√			15.38%
29		√	√	√			23.07%
30							
31		√		√			15.38%
32		√	√	√			23.07%
33			√	√			15.38%
34	√			√			15.38%
35				√			7.69%
36	√	√	√	√			30.76%
37		√	√	√			23.07%
38		√	√	√			23.07%
39	√	√		√			23.07%
40	√	√	√	√			30.76%
41	√	√		√			23.07%
42	√	√	√	√			30.76%
43							
44							
45							
46				√			7.69%
47	√	√	√	√			30.76%

48				√			7.69%
49							
50							
51							
52							
53		√	√	√			23.07%
54							
55	√	√		√			23.07%
56							
57							
58		√	√	√			23.07%
59				√			5.69%
60				√			5.69%
61	√	√	√	√			30.76%
62	√						7.69%
63	√	√	√	√			30.76%
64	√	√	√	√			30.76%
65							
66							
67							
68							
69	√	√		√			23.07%
70		√		√			15.38%
71		√	√	√			23.07%
72							
73	√	√	√	√			30.76%
74		√	√	√			23.07%
75							
76							
77		√	√	√			23.07%
78		√		√			15.38%
79			√	√			15.38%
80							
81				√			7.69%
82							
83							
84	√	√	√	√			30.76%
85	√		√				15.38%
86	√	√	√	√			30.76%
87	√		√	√			23.07%
88	√	√	√	√			30.76%
89	√	√		√			23.07%
90	√	√	√	√			30.76%
91							
92							
93	√	√	√	√			30.76%
94	√	√	√	√			30.76%
95	√	√	√	√			30.76%
96							
97							
98	√		√	√			23.07%
99	√			√			15.38%
100							

101	√			√			15.38%
102	√	√	√	√			30.76%
103							
104	√		√	√			23.07%
105	√			√			15.38%
106	√	√		√			23.07%
107							
108	√	√	√	√			30.76%
109							
110	√	√	√	√			30.76%
111	√	√	√	√			30.76%
112	√		√	√			23.07%
113							
114							
115	√	√					15.38%
116							
117	√		√	√			23.07%
118				√			7.69%
119				√			5.76%
120	√	√	√	√			30.76%
121	√	√	√	√			30.76%
122		√	√	√			23.0%
123	√		√				15.38%
124	√	√	√	√			30.76%
125	√	√	√	√			30.76%
126		√	√	√			23.07%
127		√	√	√			23.07%
128							
129		√	√	√			23.07%
130	√	√	√	√			30.76%
131	√		√	√			23.07%
132	√	√	√	√			30.76%
133	√	√	√	√			30.76%
134	√	√		√			23.07%
135	√	√	√	√			30.76%
136	√	√	√	√			30.76%
137	√	√	√	√			30.76%
138	√	√	√	√			30.76%
139							
140							
141		√	√	√			23.07%
142	√	√	√	√			30.76%
143	√	√	√	√			30.76%
144	√			√			15.38%
145							
146							
147							
148	√			√			15.38%
149							
150		√		√			15.38%
151							
152	√	√					15.38%
153							

154	√	√	√	√			30.76%
155				√			7.69%
156							
1	√	√	√	√		√	25.63%
2	√	√	√	√	√	√	30.76%
3	√			√		√	15.38%
4	√		√	√	√	√	25.63%
5	√	√	√	√	√	√	30.76%
6							
7	√	√	√	√	√	√	30.76%
8							
9	√			√	√		15.38%
10	√	√	√	√	√	√	30.76%
11	√		√	√	√	√	25.63%
12	√	√	√	√	√	√	30.76%
13	√	√	√	√	√	√	30.76%
14							
15		√	√	√	√	√	25.63%
16	√	√		√	√	√	30.76%
17	√		√	√	√	√	25.63%
18							
19	√			√	√	√	20.50%
20	√	√	√	√	√	√	30.76%
21	√		√	√	√	√	25.63%
22							
23	√		√	√	√	√	25.63%
24	√	√		√		√	20.50%
25	√	√	√	√	√	√	30.76%
26							
27	√	√	√	√	√	√	30.76%
28	√	√	√	√	√	√	30.76%
29	√		√	√	√	√	25.63%
30	√	√	√	√		√	25.63%
31	√	√	√	√	√	√	30.76%
32	√		√	√	√	√	25.63%
33	√			√	√	√	20.50%
34	√	√	√	√	√	√	30.76%
35	√	√	√	√	√	√	30.76%
36	√			√	√	√	25.63%
37	√	√	√	√	√	√	30.76%
38		√	√	√	√	√	25.63%
39	√	√	√	√	√	√	30.76%
40	√		√	√	√	√	25.63%
41		√	√	√	√	√	25.63%
42							
43		√	√	√	√		25.63%
44	√		√	√	√	√	25.63%
45	√	√	√	√	√	√	30.76%
46	√		√	√	√	√	25.63%
47							
48	√		√	√	√	√	25.63%
49	√		√	√	√	√	25.63%
50	√	√		√	√	√	25.63%

51			√			√	10.25%
52				√	√	√	15.38%
53							
54	√	√	√	√	√	√	30.76%
55	√	√		√	√	√	30.76%
56	√		√	√	√	√	25.63%
57							
58							
59	√	√	√	√	√	√	30.76%
60							
61							
62	√	√	√	√	√	√	30.76%
63	√	√	√	√	√	√	30.76%
64							
65	√	√	√	√	√	√	30.76%
66	√	√	√	√	√	√	30.76%
67			√	√	√	√	20.50%
68	√	√		√	√	√	25.63%
69							
70	√	√		√	√	√	25.63%
71							
72	√	√		√	√	√	25.63%
73							
74	√	√	√	√	√	√	30.76%
75	√	√	√	√	√	√	30.76%
76	√	√	√	√	√	√	30.76%
77	√	√	√	√	√	√	30.76%
78	√	√	√	√	√	√	30.76%

Expert: MG, Academic (Acting Researcher) (11-15 years) (load 1)							
No	Rate is Accurate	Potential Consequence is accurate	Root causes is accurate	Corrective action is accurate	Lessons Learned is accurate	Class is accurate	Percentage of the accuracy of the case
1		√	√	√			5.26%
2		√	√	√			5.26%
3	√	√	√	√			7.69%
4		√	√	√			5.26%
5							
6	√	√	√				5.26%
7	√	√	√	√			7.69%
8	√	√	√	√			7.69%
9							
10							
11	√	√	√	√			7.69%
12	√	√	√	√			7.69%
13	√	√	√	√			7.69%
14	√	√	√	√			7.69%
15	√	√	√	√			7.69%
16	√	√	√	√			7.69%
17	√	√	√	√			7.69%
18	√	√	√	√			7.69%
19		√	√	√			5.26%
20							
21							
22	√	√	√	√			7.69%
23	√	√	√	√			7.69%
24	√	√	√	√			7.69%
25	√	√	√	√			7.69%
26	√	√	√	√			7.69%
27							
28							
29	√	√	√	√			7.69%
30							
31							
32	√	√	√	√			7.69%
33	√	√	√	√			7.69%
34							
35							
36							
37	√	√	√	√			7.69%
38	√	√	√	√			7.69%
39	√	√	√				5.26%
40	√	√	√	√			7.69%
41	√	√	√	√			7.69%
42	√	√	√	√			7.69%
43		√	√	√			5.26%
44		√	√	√			5.26%
45		√	√	√			5.26%
46		√	√	√			5.26%
47		√	√	√			5.26%

48							
49							
50							
51	√	√	√	√			7.69%
52		√	√	√			5.26%
53		√	√	√			5.26%
54		√	√	√			5.26%
55		√	√	√			5.26%
56	√	√	√	√			7.69%
57	√	√	√	√			7.69%
58		√	√	√			5.26%
59		√	√	√			5.26%
60		√	√	√			5.26%
61		√	√	√			5.26%
62		√	√	√			5.26%
63		√	√	√			5.26%
64		√	√	√			5.26%
65							
66		√	√	√			5.26%
67		√	√	√			5.26%
68		√	√	√			5.26%
69		√	√	√			5.26%
70		√	√	√			5.26%
71		√	√	√			5.26%
72	√	√	√	√			7.69%
73		√	√	√			5.26%
74		√	√	√			5.26%
75		√	√	√			5.26%
76		√	√	√			5.26%
77							
78		√	√	√			5.26%
79		√	√	√			5.26%
80		√	√	√			5.26%
81			√	√			3.84%
82							
83							
84							
85	√	√	√	√			7.69%
86	√	√	√	√			7.69%
87	√	√	√	√			7.69%
88	√	√	√	√			7.69%
89							
90	√	√	√	√			7.69%
91	√	√	√	√			7.69%
92		√	√	√			5.26%
93	√	√	√	√			7.69%
94		√	√	√			5.26%
95	√	√	√	√			7.69%
96							
97							
98	√	√	√	√			7.69%
99							
100							

101	√	√	√	√			7.69%
102	√	√	√	√			7.69%
103	√	√	√	√			7.69%
104	√	√	√	√			7.69%
105							
106							
107	√	√	√	√			7.69%
108		√	√	√			5.26%
109		√	√	√			5.26%
110	√	√	√	√			7.69%
111		√	√	√			5.26%
112							
113	√	√	√	√			7.69%
114							
115	√	√	√	√			7.69%
116	√						1.42%
117	√	√	√	√			7.69%
118	√	√	√	√			7.69%
119							
120	√	√	√	√			7.69%
121		√	√	√			5.26%
122	√	√	√	√			7.69%
123	√	√	√	√			7.69%
124							
125	√	√	√	√			7.69%
126	√	√	√	√			7.69%
127							
128	√	√	√	√			7.69%
129	√	√	√	√			7.69%
130	√	√	√	√			7.69%
131	√	√	√	√			7.69%
132	√	√	√	√			7.69%
133	√	√	√	√			7.69%
134	√	√	√	√			7.69%
135							
136	√	√	√	√			7.69%
137	√	√	√	√			7.69%
138	√	√	√	√			7.69%
139	√	√	√	√			7.69%
140	√	√	√	√			7.69%
141	√	√	√	√			7.69%
142	√	√	√	√			7.69%
143	√	√	√	√			7.69%
144		√	√	√			5.26%
145	√	√	√	√			7.69%
146		√	√	√			5.26%
147	√	√	√	√			7.69%
148	√	√	√	√			7.69%
149							
150	√	√	√	√			7.69%
151	√	√	√	√			7.69%
152	√	√	√	√			7.69%
153	√	√	√	√			7.69%

154	√	√	√	√			7.69%
155		√	√	√			5.26%
156	√	√	√	√			7.69%
1	√	√	√	√	√	√	7.69%
2	√	√	√	√	√	√	7.69%
3	√	√	√	√	√	√	7.69%
4	√	√	√	√	√	√	7.69%
5	√	√	√	√	√	√	7.69%
6	√	√	√	√	√	√	7.69%
7		√	√	√	√	√	6.40%
8	√	√	√	√	√	√	7.69%
9	√	√	√	√	√	√	7.69%
10	√	√	√	√	√	√	7.69%
11	√	√	√	√	√	√	7.69%
12		√	√	√	√	√	6.40%
13	√	√	√	√	√	√	7.69%
14	√	√	√	√	√	√	7.69%
15	√	√	√	√	√	√	7.69%
16	√	√	√	√	√	√	7.69%
17	√	√	√	√	√	√	7.69%
18	√	√	√	√	√	√	7.69%
19	√	√	√	√	√	√	7.69%
20	√	√	√	√	√	√	7.69%
21	√	√	√	√	√	√	7.69%
22	√	√	√	√	√	√	7.69%
23	√	√	√	√	√	√	7.69%
24	√	√	√	√	√	√	7.69%
25	√	√	√	√	√	√	7.69%
26	√	√	√	√	√	√	7.69%
27	√	√	√	√	√	√	7.69%
28	√	√	√	√	√	√	7.69%
29		√	√	√	√	√	6.40%
30	√	√	√	√	√	√	7.69%
31	√	√	√	√	√	√	7.69%
32	√	√	√	√	√	√	7.69%
33	√	√	√	√	√	√	7.69%
34		√	√	√	√	√	6.40%
35		√	√	√	√	√	6.40%
36	√	√	√	√	√	√	7.69%
37	√	√	√	√	√	√	7.69%
38		√	√	√	√	√	6.40%
39	√	√	√	√	√	√	7.69%
40	√	√	√	√	√	√	7.69%
41		√	√	√	√	√	6.40%
42	√	√	√	√	√	√	7.69%
43		√	√	√	√	√	6.40%
44	√		√	√	√	√	6.40%
45	√	√	√	√	√	√	7.69%
46	√	√	√	√	√	√	7.69%
47	√	√	√	√	√	√	7.69%
48	√	√	√	√	√	√	7.69%
49	√	√	√	√	√	√	7.69%
50		√	√	√	√	√	6.40%

51	√	√				√	3.84%
52	√	√	√	√	√	√	7.69%
53		√	√	√	√	√	6.40%
54	√	√	√	√	√	√	7.69%
55		√	√	√	√	√	6.40%
56	√		√		√	√	5.12%
57	√			√	√	√	5.12%
58	√			√	√	√	5.12%
59			√			√	2.56%
60	√	√	√	√	√	√	7.69%
61	√	√	√	√	√	√	7.69%
62							
63			√			√	2.56%
64							
65		√	√			√	3.84%
66	√	√	√	√	√	√	7.69%
67	√	√	√	√	√	√	7.69%
68	√	√	√	√	√	√	7.69%
69	√			√	√	√	5.12%
70	√	√	√	√	√	√	7.69%
71	√	√	√	√	√	√	7.69%
72	√	√	√	√	√		6.40%
73	√	√	√	√	√	√	7.69%
74		√	√			√	3.84%
75						√	1.28%
76	√	√		√	√	√	6.40%
77		√	√				2.56%
78	√	√	√	√	√	√	7.69%

Expert: NA, Seafarer (Acting 2nd officer) (6-10 years) (load 2)							
No	Rate is Accurate	Potential Consequence is accurate	Root causes is accurate	Corrective action is accurate	Lessons Learned is accurate	Class is accurate	Percentage of the accuracy of the case
1							
2		√		√			11.53%
3		√	√	√			11.53%
4		√	√	√			11.53%
5							
6							
7	√	√	√	√			15.38%
8	√	√	√	√			15.38%
9							
10							
11		√		√			11.54%
12							
13	√	√	√	√			
14							
15		√	√	√			17.07%
16							
17		√	√	√			17.03%
18	√	√	√	√			15.38%
19	√	√	√	√			15.38%
20	√	√	√	√			15.38%
21	√	√	√	√			15.38%
22		√	√	√			11.53%
23	√	√	√	√			15.38%
24							
25	√	√	√	√			15.38%
26		√	√	√			11.53%
27							
28	√			√			7.69%
29		√	√	√			11.53%
30							
31		√	√	√			11.53%
32	√	√	√	√			15.38%
33				√			3.84%
34	√	√	√	√			15.38%
35			√	√			7.69%
36	√	√	√	√			15.38%
37		√	√	√			11.53%
38		√	√	√			11.53%
39	√	√		√			11.53%
40	√	√	√	√			15.38%
41	√	√		√			11.53%
42	√	√	√	√			15.38%
43							
44							
45							
46		√		√			7.69%
47	√	√	√	√			15.38%

48			√	√			7.69%
49							
50							
51							
52							
53	√	√					7.69%
54		√	√	√			11.53%
55		√		√			7.69%
56							
57							
58		√	√	√			11.53%
59				√			3.84%
60							
61	√	√	√	√			15.38%
62							0%
63	√	√	√	√			15.38%
64	√	√	√	√			15.38%
65							
66							
67							
68							
69							
70	√	√		√			11.53%
71	√		√				7.69%
72							
73	√	√	√	√			15.38%
74		√	√	√			11.53%
75							
76							
77		√	√	√			11.53%
78				√			3.84%
79			√	√			7.69%
80							
81							0.0%
82							
83							
84	√	√		√			11.53%
85	√						3.84%
86	√	√	√	√			15.38%
87	√			√			7.69%
88	√	√	√	√			15.38%
89	√			√			7.69%
90	√	√		√			11.53%
91							
92							
93	√	√	√	√			15.38%
94		√	√	√			11.53%
95	√	√	√	√			15.38%
96							
97							
98							
99				√			3.84%
100							

101				√			3.84%
102	√	√	√	√			15.38%
103							
104			√				3.84%
105	√	√	√	√			15.38%
106	√	√		√			11.53%
107							
108	√	√	√	√			15.38%
109							
110	√	√	√				11.53%
111		√	√	√			11.53%
112	√	√		√			11.53%
113							
114							
115	√		√				7.69%
116	√						3.84%
117			√				3.84%
118		√		√			7.69%
119				√			3.84%
120	√		√	√			11.53%
121		√	√	√			11.53%
122		√	√	√			11.53%
123	√		√	√			11.53%
124		√	√	√			11.53%
125		√	√	√			11.53%
126	√	√	√	√			15.38%
127	√	√	√	√			15.38%
128							
129		√	√	√			11.53%
130	√	√	√	√			15.38%
131	√		√	√			11.53%
132	√		√	√			11.53%
133	√	√	√	√			15.38%
134	√	√	√	√			15.38%
135	√		√	√			11.53%
136	√	√	√	√			15.38%
137	√	√	√	√			15.38%
138	√	√	√	√			15.38%
139							
140							
141		√	√	√			11.53%
142	√	√	√	√			15.38%
143	√	√	√	√			15.38%
144							
145							
146							
147							
148	√	√		√			11.53%
149	√		√				7.69%
150		√		√			7.69%
151							
152							
153							

154	√	√	√	√			15.38%
155	√		√	√			11.53%
156							
1	√	√	√	√		√	12.80%%
2	√	√	√	√	√	√	15.38%
3	√	√	√	√		√	12.80%%
4	√	√	√	√	√	√	15.38%
5	√	√	√	√	√	√	15.38%
6							
7	√	√	√	√	√	√	15.38%
8							
9	√			√	√	√	10.24%
10	√	√	√	√	√	√	15.38%
11	√	√	√	√	√	√	15.38%
12	√	√	√	√	√	√	15.38%
13	√	√		√	√	√	12.80%%
14							
15	√	√	√	√	√	√	15.38%
16	√			√	√	√	10.24%
17	√		√	√	√	√	12.80%%
18							
19				√	√	√	5.12%
20	√	√	√	√	√	√	15.38%
21	√		√	√	√	√	12.80%%
22							
23			√	√	√	√	10.24%
24	√	√	√	√		√	12.80%%
25	√	√	√	√	√	√	15.38%
26							
27	√	√	√	√	√	√	15.38%
28	√	√	√	√	√	√	15.38%
29	√		√	√	√	√	12.80%%
30	√	√	√	√		√	12.80%%
31	√	√	√	√	√	√	15.38%
32	√		√	√	√	√	12.80%%
33	√		√	√	√	√	12.80%%
34	√	√	√	√	√	√	15.38%
35	√	√	√	√	√	√	15.38%
36	√	√		√	√	√	12.80%%
37	√	√	√	√	√	√	15.38%
38	√	√	√	√	√	√	15.38%
39	√	√	√	√	√	√	15.38%
40	√		√	√	√	√	12.80%%
41	√	√	√	√	√	√	15.38%
42	√	√	√	√	√	√	15.38%
43			√	√	√		5.12%
44							
45	√	√	√	√	√	√	15.38%
46	√	√	√	√	√	√	15.38%
47							
48	√	√	√	√	√	√	15.38%
49	√		√	√	√	√	12.80%%
50		√		√	√	√	10.24%

51		√	√	√	√	√	12.80%%
52	√		√	√	√	√	12.80%%
53							
54	√		√	√	√	√	12.80%%
55	√			√	√	√	10.24%
56	√		√		√	√	10.24%
57							
58							
59	√	√	√	√	√	√	15.38%
60							
61							
62	√	√	√	√	√	√	15.38%
63	√		√	√	√	√	12.80%%
64	√	√	√	√	√	√	15.38%
65	√	√	√	√	√	√	15.38%
66	√	√	√	√	√	√	15.38%
67			√	√	√	√	10.24%
68		√		√	√	√	10.24%
69							
70							
71							
72	√	√	√	√	√	√	15.38%
73		√	√	√	√	√	12.80%%
74	√	√	√	√	√	√	15.38%
75	√		√	√	√	√	12.80%%
76	√	√		√	√	√	12.80%%
77	√	√	√	√	√	√	15.38%
78	√	√		√	√	√	12.80%%

Expert: HA, Seafarer (Acting Chief Officer) (11-15 years) (load 3)							
No	Rate is Accurate	Potential Consequence is accurate	Root causes is accurate	Corrective action is accurate	Lessons Learned is accurate	Class is accurate	Percentage of the accuracy of the case
1							
2	√	√		√			17.30%
3							
4			√	√			11.53%
5							
6							
7	√	√	√	√			23.07%
8	√	√	√	√			23.07%
9							
10							
11		√	√	√			17.30%
12							
13	√	√	√	√			23.07%
14							
15	√		√	√			17.30%
16							
17		√	√	√			17.30%
18	√	√	√	√			23.07%
19	√		√	√			17.30%
20	√	√	√	√			23.07%
21	√	√	√	√			23.07%
22		√	√	√			17.30%
23	√	√	√	√			23.07%
24							
25	√	√	√	√			23.07%
26		√	√	√			17.30%
27							
28	√			√			11.53%
29		√	√	√			17.30%
30							
31		√		√			11.53%
32		√	√	√			17.30%
33			√	√			11.53%
34	√			√			11.53%
35				√			5.76%
36	√	√	√	√			23.07%
37		√	√	√			17.30%
38		√	√	√			17.30%
39	√	√		√			17.30%
40	√	√	√	√			23.07%
41	√	√		√			17.30%
42	√	√	√	√			23.07%
43							
44							
45							
46				√			5.76%
47	√	√	√	√			23.07%

48				√			5.76%
49							
50							
51							
52							
53		√	√	√			17.30%
54							
55	√	√		√			17.30%
56							
57							
58		√	√	√			17.30%
59				√			5.69%
60				√			5.69%
61	√	√	√	√			23.07%
62	√						5.76%
63	√	√	√	√			23.07%
64	√	√	√	√			23.07%
65							
66							
67							
68							
69	√	√		√			17.30%
70		√		√			11.53%
71		√	√	√			17.30%
72							
73	√	√	√	√			23.07%
74		√	√	√			17.30%
75							
76							
77		√	√	√			17.30%
78		√		√			11.53%
79			√	√			11.53%
80							
81				√			5.76%
82							
83							
84	√	√	√	√			23.07%
85	√		√				11.53%
86	√	√	√	√			23.07%
87	√		√	√			17.30%
88	√	√	√	√			23.07%
89	√	√		√			17.30%
90	√	√	√	√			23.07%
91							
92							
93	√	√	√	√			23.07%
94	√	√	√	√			23.07%
95	√	√	√	√			23.07%
96							
97							
98	√		√	√			17.30%
99	√			√			11.53%
100							

101	√			√			11.53%
102	√	√	√	√			23.07%
103							
104	√		√	√			17.30%
105	√			√			11.53%
106	√	√		√			17.30%
107							
108	√	√	√	√			23.07%
109							
110	√	√	√	√			23.07%
111	√	√	√	√			23.07%
112	√		√	√			17.30%
113							
114							
115	√	√					11.53%
116							
117	√		√	√			17.30%
118				√			5.76%
119				√			5.76%
120	√	√	√	√			23.07%
121	√	√	√	√			23.07%
122		√	√	√			23.0%
123	√		√				11.53%
124	√	√	√	√			23.07%
125	√	√	√	√			23.07%
126		√	√	√			17.30%
127		√	√	√			17.30%
128							
129		√	√	√			17.30%
130	√	√	√	√			23.07%
131	√		√	√			17.30%
132	√	√	√	√			23.07%
133	√	√	√	√			23.07%
134	√	√		√			17.30%
135	√	√	√	√			23.07%
136	√	√	√	√			23.07%
137	√	√	√	√			23.07%
138	√	√	√	√			23.07%
139							
140							
141		√	√	√			17.30%
142	√	√	√	√			23.07%
143	√	√	√	√			23.07%
144	√			√			11.53%
145							
146							
147							
148	√			√			11.53%
149							
150		√		√			11.53%
151							
152	√	√					11.53%
153							

154	√	√	√	√			23.07%
155				√			5.76%
156							
1	√	√	√	√		√	19.21%
2	√	√	√	√	√	√	23.07%
3	√			√		√	11.53%
4	√		√	√	√	√	19.21%
5	√	√	√	√	√	√	23.07%
6							
7	√	√	√	√	√	√	23.07%
8							
9	√			√	√		11.53%
10	√	√	√	√	√	√	23.07%
11	√		√	√	√	√	19.21%
12	√	√	√	√	√	√	23.07%
13	√	√	√	√	√	√	23.07%
14							
15		√	√	√	√	√	19.21%
16	√	√		√	√	√	23.07%
17	√		√	√	√	√	19.21%
18							
19	√			√	√	√	15.37%
20	√	√	√	√	√	√	23.07%
21	√		√	√	√	√	19.21%
22							
23	√		√	√	√	√	19.21%
24	√	√		√		√	15.37%
25	√	√	√	√	√	√	23.07%
26							
27	√	√	√	√	√	√	23.07%
28	√	√	√	√	√	√	23.07%
29	√		√	√	√	√	19.21%
30	√	√	√	√		√	19.21%
31	√	√	√	√	√	√	23.07%
32	√		√	√	√	√	19.21%
33	√			√	√	√	15.37%
34	√	√	√	√	√	√	23.07%
35	√	√	√	√	√	√	23.07%
36	√			√	√	√	19.21%
37	√	√	√	√	√	√	23.07%
38		√	√	√	√	√	19.21%
39	√	√	√	√	√	√	23.07%
40	√		√	√	√	√	19.21%
41		√	√	√	√	√	19.21%
42							
43		√	√	√	√		19.21%
44	√		√	√	√	√	19.21%
45	√	√	√	√	√	√	23.07%
46	√		√	√	√	√	19.21%
47							
48	√		√	√	√	√	19.21%
49	√		√	√	√	√	19.21%
50	√	√		√	√	√	19.21%

51			√			√	7.69%
52				√	√	√	11.53%
53							
54	√	√	√	√	√	√	23.07%
55	√	√		√	√	√	23.07%
56	√		√	√	√	√	19.21%
57							
58							
59	√	√	√	√	√	√	23.07%
60							
61							
62	√	√	√	√	√	√	23.07%
63	√	√	√	√	√	√	23.07%
64							
65	√	√	√	√	√	√	23.07%
66	√	√	√	√	√	√	23.07%
67			√	√	√	√	15.37%
68	√	√		√	√	√	19.21%
69							
70	√	√		√	√	√	19.21%
71							
72	√	√		√	√	√	19.21%
73							
74	√	√	√	√	√	√	23.07%
75	√	√	√	√	√	√	23.07%
76	√	√	√	√	√	√	23.07%
77	√	√	√	√	√	√	23.07%
78	√	√	√	√	√	√	23.07%