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Analyze the Implementation of Bridge Resource Management to Avoid Dangerous Situations on Vessel

Abstract: Possible factors leading to sea transportation accidents in Indonesia are divided into three, namely nature, technical, and human error. Human factor is the biggest contributor to the number of accidents at sea. One can be caused by the lack of implementation of bridge resource management on board, especially on the platform. This study aimed to identify the application of bridge resource management on board ships and provide recommendations for solving the problem of inhibiting factors of its application. The research was carried out during a 12-month shipboard training at one of the tanker ships based in Indonesia. This study used a qualitative descriptive method. Data are obtained through observation and questionnaires with related parties as primary data, and documentation and literature review as secondary data. The results showed that the application of bridge resource management still has many deviations that make its application not optimal. This is caused by factors from human resources, and other external factors such as lack of utilization of navigation equipment. Improving the quality of human resources in using navigation equipment will ensure that the Bridge Resource Management runs well on board.

Keywords: bridge resource management, human resources, accident, quantitative, applicability

INTRODUCTION

The safety of transportation modes in Indonesia is currently still low, especially sea transportation and awareness of transportation safety is still low among the Indonesian people (Victoria et al., 2022). Generally, the causes of sea transportation accidents in Indonesia are divided into three factors, namely natural, technical, and human. The human factor is the biggest contributor to the number of accidents at sea (Chauvin et al., 2013). Based on the literature reviews that have been read and reviewed by the authors, the research conducted by the authors has similarities to the variables that the authors will discuss in future research. One of the journal titles is Effects of A Classroom-based Bridge Resource Management Training on Knowledge, Attitudes, Behavior and Performance of Junior Naval Officers by Stefan Rottger, Saskia Vetter, Jens T. Kowalski. This study assessed the effectiveness of Bridge Resource Management based on management training classes (BRM) for naval officers in which the general principles of human behaviour and performance in teams and under pressure are conveyed.

The study presented in this article is the first to assess the impact of Bridge Resource Management training on reactions, knowledge, attitudes, behaviour and performance (Röttger & Krey, 2021). Data from the National Transportation Safety

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Committee from 2007 to April 2019 mentioned that there were at least 139 ship accidents with the most causal factors contributed by human factors. One example of the lack of implementation of Bridge Resource Management in Indonesia is the case of a Passenger Ship in the Duroa Strait, Maluku on December 22, 2016. Based on data from the National Transportation Safety Committee, the incident occurred when the ship was sailing around the Dunoa Strait. Chief Officer who was on duty at that time ordered the helmsman to change the steering which was originally Auto Pilot to Hand Steering Gear, at 14:58 turned circle every five degrees from 129 (E) to 090 (E). Chief Officer had warned the Captain and Duty Officer "Do not go left" because they saw the beacon on the right. At 2:50 p.m. the ship suddenly shook and the engine stopped. From the results of measuring the depth of seawater, the ship was confirmed to run aground. Based on IMO resolution A.893(21) on Guidelines for Voyage Planning requires navigational officer to plan each voyage, identify routes including taking into account all existing navigational hazards, and ensure sufficient space for ships to be safe in their voyages. The results of the accident analysis by the investigation and research team consisting of the Investigation Team Leader (ITL) and members of the National Transportation Safety Committee indicates that the ship made a turning circle too early so that the ship went off track. Then the ship run to a shallow area without correction until the ship run aground The main cause of the accident is positioning only through GPS and the lack of monitoring of ship movements that violate the guidelines in the bridge team management guide 4.

In this study, the author made observations for 12 months on tanker vessel which is owned by one of the shipping companies in Indonesia. During the onboard observation, it is found that officers and crew have not maximized the implementation of Bridge Resource Management (BRM) on board. The Bridge Navigational Watch Alarm System (BNWAS) is underutilized and the sense of responsibility and discipline of officers and duty crews need to be further enhanced. Based on Ship Operating Procedures (SOP) Part 2-Platform and Navigation Procedures. 2.7.5. Cooperation in Bridge Team Management, there should always be input and information between the members of the bridge team, to avoid the mistakes of one person. Any changes in ship condition must be notified and recorded in the Deck Operations Log. The navigational officer can assign each team member to perform navigational watchkeeping duties properly and must do double-check with each other. The purpose of this study is to find out the extent of the application of BRM on board. This research is expected to be an insight into the importance of implementing Bridge Resource Management on board ships related to the many ship accidents involving human factors and can learn what factors are inhibiting. This research is expected to be a recommendation for the parties concerned, especially the crew to increase awareness of the implementation of BRM to support shipping safety.

METHODS

The research method used in this study is descriptive qualitative, where the data obtained will be described by utilizing existing data. The researcher conducted the research while carrying out shipboard training for 11 months and 28 days on a tanker vessel, owned by one of the shipping companies in Indonesia. The researcher used primary data in the form of a mixed-type questionnaire with 5 closed questions. The object of research, in this case, is the ship's crew, especially deck officers who are closely related to the application of Bridge Resource Management. There were 7 respondents for the questionnaire.

Table 1. Respondents of Questionnaire

| | |
|---|----------------|
| 1 | Captain |
| 2 | Chief Officer |
| 3 | Second Officer |
| 4 | Second Officer |
| 5 | Third Officer |
| 6 | Fourth Officer |

The secondary data that the author took was in the form of observations and documents related to the implementation of Bridge Resource Management as well as ship regulations and SOPs related to the application of BRM on board.

RESULT AND DISCUSSION

Questionnaire results

The questionnaire with 5 questions with 5 alternative answers is presented with the following diagram.

1. Bridge resource management *training* has been implemented

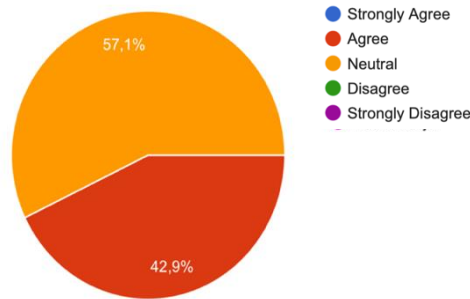


Figure 1. Questionnaire Results 1

2. Bridge resource management is well implemented according to procedures on board.

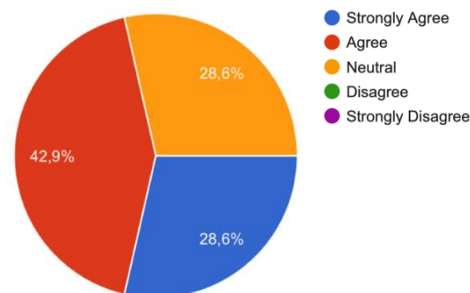


Figure 2. Questionnaire Results 2

3. Observation (look out) is one of the success factors of bridge resource management.

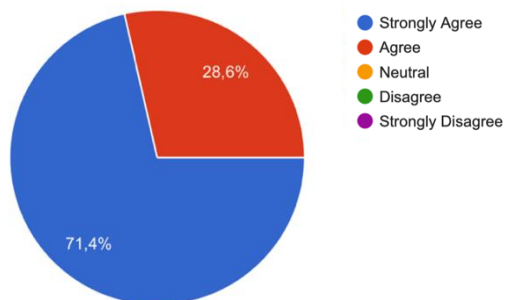


Figure 3. Questionnaire Results 3

4. Cooperation between crew members is a success factor for bridge resource management.

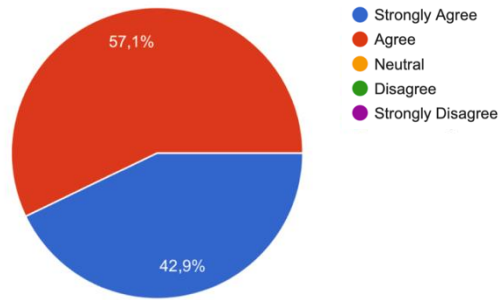


Figure 4. Questionnaire Results 4

5. Fatigue is an inhibiting factor for bridge resource management.

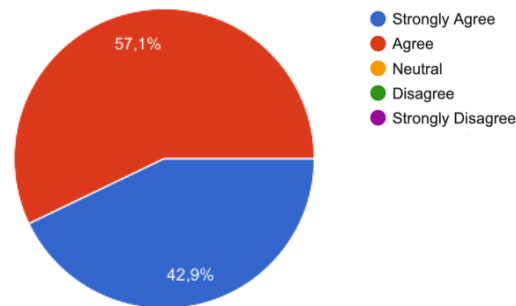


Figure 5. Questionnaire Results 5

Results of Documentation and Observation

1. Communication between ships and shore



Figure 6. Communication Between Shore

Communication between ships can minimize the risk of ship accidents due to collisions. Upon receiving clear information, decisions or actions can be made properly between the two ships. Based on the author's observations, communication on board is carried out following the applicable rules. Communication is carried out if there is any doubt when the officer will make a decision dealing with a crossing situation with another ship.

2. Use of steering wheel

The use of the rudder on board must always be under the supervision of the duty officer, be it to change the bow or change it to manual or automatic mode. During the researcher's observation, when the duty officer orders the helmsman to change the course of the ship, the duty officer must supervise every move made so that there is no mistake in changing course.



Figure 7. Using of Steering

3. Bridge Watch Monitoring System (BNWAS)

The Bridge Watch Monitoring System (BNWAS) used on the researcher's ship uses a button system that must be pressed every 5-10 minutes. If within that time the duty officer does not press the button, the alarm will sound as a warning sign.



Figure 8. Bridge Watch Monitoring System

4. Familiarization of the crew.

Based on Ship Operating Procedures (SOP/POK) Part 9: Ship Familiarization and Crew Training, all newly joined crew members are given proper ship familiarization and a ship safety tour before being assigned to their duties. Safety and familiarization and this safety tour will be provided by the Safety Officer or his Representative using the form POK - 216A. For familiarization with platform equipment and other equipment use the form POK- 216B.

5. Teamwork.

According to Ship Operating Procedures (SOP/POK) Part 10: Watchkeeping Arrangements, the Master must follow the duty list for the deck department as shown in Table 2 below. The Captain arranges the task list according to the availability of human resources on board the ship. The Master must ensure that at all times, the minimum safe manning is observed. When in port, the Master must ensure that the crew are available to handle emergencies.

Table 2. Watchkeeping Schedule

| Watchkeeping | 04:00-08:00 / 16:00-20:00 | 08:00-12:00 / 20:00-24:00 | 12:00-16:00 / 24:00-04:00 | 06:00-12:00 18:00-24:00 | 24:00-06:00 12:00-18:00 | Workday |
|-----------------------------------|---|--------------------------------|------------------------------|-----------------------------|----------------------------|--|
| Additional Time For Officers & AB | 08:30-10:30 | 13:00-15:00 | 16:00-18:00 | NA | NA | NA |
| At Sea / Port | Chief / Fourth Officer, AB | Third Officer atau Captain, AB | Second Officer, AB | Third Officer, AB | Second Officer, AB | Bostwain + 1 AB Pumpman+1 AB + 1 OS |
| At Port during Cargo Operation | Captain - All of Crew According to the watchkeeping Schedule Chief Officer- Supervise Cargo Operations | | | Third / Fourth Officer + AB | Second Officer + AB | Bostwain + 1 AB Pumpman + 1 AB + 1 OS |
| Restricted Visibility / TSS | Captain, OOW, AB & OS | | | | | N.A |

6. Rest hour arrangement

The Standards of Training, Certification and Watchkeeping for Seafarers (STCW) stipulates that crew, including the Captain, are required to take a minimum period of rest to be fit for Duty.

- a. Minimum 77 hours of rest in a 7-day period;
- b. Minimum of 10 hours of rest in a 24-hour period; and
- c. The 10-hour rest period must not be divided into more than 2 periods, one of which must be at least 6 consecutive hours, with an interval between periods of no more than 14 hours.

This rest hour arrangement aims to prevent the crew from the danger of fatigue. As we know, fatigue is one of the factors that can make work not optimal and may lead to dangerous situations.

7. Make the right decision

Decision-making seems to be an individual matter, however, the Captain as the final authority on the ship plays a very important role in making the right decision regarding every problem that occurs, especially when underway. Before making any decision, it is important to gather relevant information.

Wrong decisions can lead to undesirable situations on board. It is therefore important to conduct regular meetings, interact with officers and crew members and take opinions that can help produce a final choice from several available options and thereby make wiser decisions, especially when often not all crew on board gather all the information in a short time or evaluate the surroundings. The Captain being the most experienced person on board the ship is considered the sole decision maker.

Table 3. Application of BRM

| No | Application of BRM on board MT. Pelagos One | Following the rules / not yet according to the rules | Regulation (SOP on ships, STCW, and P2TL, <i>Bridge Standing Order</i>) |
|----|---|---|--|
| 1 | Events on voyage 007/L/2021 on June 14, 2021, at 21.00 When the ship was underway to Tg. Priok, Third Officer who was on duty that time received an email notification that the ship was deviated towards Tuban. Third Officer immediately notified the Captain. Soon afterward, the captain appointed Second Officer to change the passage plan to Balongan. | Following STCW amendments 2010 parts A-II, on knowledge and understanding of expertise, operational procedures of the ship POK-246. | STCW amendments 2010 parts A-II, on knowledge and understanding of expertise, Column 4, decisions or actions that generate challenges and appropriate responses. and Operating procedure of POK - 246 vessel on Deviation report. <ol style="list-style-type: none"> 1. Notify the Captain of deviation news. 2. Fill out the POK deviation report - 246. 3. Record the position of the vessel at the start of the deviation. 4. Recording the time of the position of the ship makes deviations. 5. Fill in the destination port and renew the ETA. |
| 2 | The incident on voyage 007/D1/2021 on June 26, 2021, at 21.30 when the ship entered Dumai and was about to anchor. Guided by Pilot and Captain, the Forward team moved toward the bow for anchor preparation. But no officers were accompanying the Bostwain, Ordinary Seaman, and Cadets. In this case, Fourth Officer did not listen to the Captain's directions well. So that the anchor berthing process is carried out without any officer in charge at the bow. | Incompatible with STCW amendments 2010 parts A-II, on points of allocation, assignment, and prioritization of resources. POK ship operational procedure part 10 on duty arrangements 10.1.2 | STCW amendments 2010 parts A-II, on points of allocation, assignment, and prioritization of resources. In the 4th column, Resources are allocated and assigned as needed in the correct priority to perform the required tasks. 10.1.2 guard duty procedure when docked <ol style="list-style-type: none"> 1. The task of the station in the bow was handed over to the 1/4 converts, Bosun, and Sailors. 2. On the bridge, namely the Captain, the Duty Officer, and the Helmsman on duty. |
| 3 | The incident on voyage 009/D1/2021 on July 25, 2021, at 15.30 when the ship was underway to Cilacap, the ship's position was in the Bali Strait. When Second Officer and the Helmsman on duty were doing watchkeeping, the Second Officer gave the order to change the bow of the ship to 190 but the helmsman lost focus and changed his bow to 200. | Not following the bridge standing order, STCW amendments 2010 parts A-II, on knowledge and understanding of expertise, | STCW amendments 2010 parts A-II, on knowledge and understanding expertise, column 4 on Team members share an accurate understanding of the current and predicted state of the vessel, navigation paths, and external environment. <ol style="list-style-type: none"> 1. The Helmsman is familiar with the ship's steering controls and the notion of the helmet's order. 2. The Officer on duty uses a different helm order. |

| No | Application of BRM on board MT. Pelagos One | Following the rules / not yet according to the rules | Regulation (SOP on ships, STCW, and P2TL, Bridge Standing Order) |
|----|--|---|---|
| | | | <p>The Helmsman must repeat the helmet's order as soon as possible.</p> <p>3. The Officer on duty checks that the helm order is executed correctly.</p> |
| 4 | <p>Events on voyage 009/L1/2021 July 24, 2021, at 06:00. When the ship had loaded cargo in Tuban at 06.00. the fourth Officer who was on duty at that time could not prepare the Bridge for the ship's departure process due to the handling of cargo documents. The Chief Officer and Third Officer prepared to release the mooring and Second Officer was ordered by the Captain to prepare for the departure of the ship on the Bridge.</p> | <p>Following the operational procedures of the ship section 10.1.3 on cargo operations. STCW amendments 2010 parts A-II, on knowledge and understanding of expertise,</p> | <p>STCW amendments 2010 parts A-II, on knowledge and understanding of expertise, Column 4, decisions or actions that generate challenges and appropriate responses.</p> <p>1. Ullaging activities are carried out by Duty Officers, Pumpmen, and Helmsmen.</p> <p>2. Cargo documents are carried out by Fourth Officer and Chief Officer.</p> <p>3. The watchkeeping period is adjusted by the Captain depending on the situation during the cargo operation.</p> |
| 5 | <p>The incident on voyage 009/D2/2021 on July 30, 2021, at the time of changing the watchkeeping 00.00 - 04.00 to 04.00 - 08.00, Second Officer ordered the Helmsman to wake up the crew 15 minutes before the watchkeeping. However, until 04.15, Fourth Officer had not come to the Bridge to hand over watchkeeping. So the Helmsman reawakened the Fourth Officer who was still asleep in his Cabin.</p> | <p>Not following the company's procedures section 10.1.1 on watchkeeping duty and bridge standing order, Colreg rule 5 on observation</p> | <p>1. Every Duty Officer and crew on duty must submit watchkeeping hours properly.</p> <p>2. Filling in POK 107 and 108 regarding the handover of watchkeeping duty at sea.</p> <p>3. Duty Officers are prohibited from handing over the duty to Officers who neglect to perform their duties.</p> <p>4. Based on Colreg rule 5 on observation on pin one it is explained that maintaining a state in line with alertness through vision and hearing, as well as by all other available means, concerning significant changes in the operating environment.</p> |

Based on the results of the author's data analysis above, several events were found related to the implementation of Bridge Resource Management. Several incidents were not following the ship's operating procedures and the STCW Manila 2010 amendments. It is of concern that the implementation of BRM on board has not been maximized. Activities such as familiarization have been carried out in this case by Third Officer and Chief Officer onboard each crew who just boarded the ship. This is so that the crew can

get used to or can adapt to their new ship. But this is not enough because there are several other inhibiting factors.

There are inhibiting factors of implementing Bridge Resource Management. Humans are an important factor in the application of Bridge Resource Management. If the team members themselves are not able to implement well, then the implementation will be lacking. The ability of each individual to make quick and appropriate decisions is needed especially if the ship is in a crowded channel or strait. The Captain and Officer on duty must always be aware of the surrounding situation to avoid the ship from the danger of collision.

Based on the results of the questionnaire that the researcher did. As many as 57.6% of respondents agreed that fatigue is an inhibiting factor in implementing Bridge Resource Management. This happens because of the erratic working hours on board, especially when the ship is manoeuvring followed by the loading and unloading process, which makes each team member need extra energy. Although there is a set schedule, this cannot be done. It is a reference for team members to get enough rest, because in fact on the field there are always unexpected things that reduce rest hours. Moreover, the means of supporting entertainment on board so that the crew feels comfortable are still lacking provided by the company.

This is evidenced by the researcher's observation that Duty Officers or Helmsmen on duty often experience delays when performing guard service on the bridge. This reflects that a sense of responsibility and discipline is lacking and can be fatal if this is not addressed. Based on the bridge standing order that has been regulated in the ship's operational procedures, at each change of watchkeeping duty, previous members are required to convey information about what happened during the previous watchkeeping hours, as well as convey what was around the ship at the time of the change of watchkeeping. The Duty Officer is also required to fill in the ship operational procedure (SOP/POK) number 107 regarding the change of watchkeeping duty while at sea, complete the watchkeeping log book, and report the mileage to the engine room.

The use of the Bridge Watch Monitoring System (BNWAS) as an auxiliary means so that the Duty Officers on the platform can always be vigilant is not used optimally and is almost not used. From the researcher's observations on board, this tool is rarely activated by Duty Officers. It is only occasionally checked by the Second Officer for the needs of weekly checking of navigation equipment. The rest is never used as its function. Even though in its application this tool is very useful to keep ensuring that members of the watchkeeping duty are always vigilant when on duty.

Efforts are being made to improve the implementation of Bridge Resource Management. Deviant activities must be eliminated. Everything done on board must be decided based on the results of a quick and precise analysis. Deviant activities such as the lack of maximum use of the Bridge Watch Monitoring System (BNWAS) as an alarm to ensure that watchkeeping duty takes place safely can minimize the occurrence of accidents due to human factors.

Reduce the use of mobile phones while underway. The use of telephones and similar communication devices can make focus distracted. Mobile phones can distract members of the watchkeeping on the bridge and may make the ship deviate from the predetermined route. This can make the risk of collision or other dangers come.

Development of Bridge Resource Management training. Bridge Resource Management training has been carried out by officers on board but in its application, there is still a sense of responsibility and discipline violated by officers on board. Based on a journal made by Jessica Sondell Matilda Lyman (2020) in *The Effect a Bridge Resource Management Course has upon the Attitude towards Non-Technical Skills*, the officers' attitudes towards non-technical abilities do not increase significantly after attending BRM training. However, this does not indicate that BRM courses are not required. The development of guidelines and principles for the implementation of BRM must be

improved to create a sense of responsibility and discipline in achieving safety and security on board.

Create meetings or discussions between crew members. Meetings or discussions such as safety meetings can be used as a means of evaluation between crew on board. The meeting discussed about the performance that has been done by each crew. The Captain as a leader on board can evaluate and advise the best for every problem that arises. The crew can also submit complaints and suggestions so that the working atmosphere on the ship becomes more open and they can understand each other's situation. This is useful for the creation of a conducive atmosphere on board and will certainly increase cooperation between individuals.

Improve rest hours and support entertainment on board. The Standards of Training, Certification, and Watchkeeping for Seafarer (STCW) stipulates that each member of the ship has a minimum of 77 hours of rest in a period of 7 days. In 1 day at least 10 hours of rest in one period and the rest period of 10 hours should not be divided into more than 2 periods, one of which must be at least 6 consecutive hours, with intervals between periods of not more than 14 hours. This arrangement of rest hours aims to avoid the crew from the danger of fatigue as it is one of the factors that can make work not optimal and can be dangerous.

In addition to rest hours, the repair of entertainment facilities also needs to be considered, especially on ships where the researcher conducts the shipboard training. Ships very rarely dock or ports because most ports in Indonesia cannot be berthed by ships with deep drafts so the intensity of the crew to go ashore is very rare, especially with the COVID-19 pandemic which makes the crew prohibited from disembarking from the ship. So, it is appropriate for the company to add entertainment facilities so that the crew on the ship does not feel bored.

CONCLUSION

Implementation of Bridge Resource Management in MT. Pelagos One is understood by every member on board. Based on the results of the questionnaire, 42.9% agreed that the implementation of BRM was following the procedures on board. However, in its application, there were still many team members who did not pay attention to the implementation procedures. The inhibiting factor of implementing Bridge Resource Management is the lack of ability of crews in its application due to fatigue factors led by erratic working hours, lack of sense of responsibility and discipline, and the use of Bridge Watch Monitoring System (BNWAS) which is less than optimal

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