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Analysis of the Safety Resilience Implementation in the Maritime Industry at Public and Private Companies (A Case Study in Indonesia)

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Abstract: (1) Background: The resilience concept shows performance improvement in four potential aspects consisting of the ability to respond, provide anticipatory action, control things that occur internally and externally, as well as the learning process of what is going right and what is going wrong. This study aims to analyze the safety resilience implementation in the Indonesian maritime sector. (2) Method: This is a descriptive study using semi-quantitative methods, using interview guides based on the Resilience Assessment Grid (RAG). The sampling technique is purposive sampling. (3) Results: The level of implementation of safety resilience at the public company was 75.1%, while the private company was 70.2%. The score for each safety resilience element in the public and private companies are as follows: the ability to respond (80%), learning ability (74.62%), monitoring ability (70.77%), and the ability to anticipate (66.92%). (4) Conclusion: The safety resilience implementation in Indonesian sea transportation shipping has not been optimal in implementing the safety resilience concept. The focus of implementing safety is still on preventing and controlling accidents. The other orientation of ability improvement in the safety resilience concept has not been implemented.

Keywords: maritime industry; safety resilience; resilience assessment grid

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1. Introduction

The concept of resilience has grown increasingly popular, accompanied by the number of sectors/domains that implement this. This resilient concept shows the flexibility, adaptability, and ingenuity of an organization in dealing with changing conditions [1]. Resilience-related literature already has a strong focus but has not been accompanied by empirical evidence of the implementation of this concept. Along with the development of industry 4.0, it also requires companies to develop by following the complexities that arise from the aspects of technology, digitization of work, work environment regulation, and business development. Organizations no longer focus on problems that will occur, but on conditions that are stagnant or already at a peak. The concept of resilience shows performance improvement in four potential aspects, namely the ability to respond, provide anticipatory action, monitor what is happening both internally and externally, as well as the learning process of what went right and what went wrong [2].

The flow of globalization causes an increase in the flow of people, goods, information, images, and money across distances and times, giving rise to new contexts in terms of governance, business, population, and safety aspects. New threats are emerging to infrastructures, such as energy, information networks, health, and the transportation system [3]. The maritime industry, as a sector related to shipping and trade at sea, also needs to use this concept to support its sustainability and maintain the organization's sustainability in facing threats in the long term. In sustainable development, the shipping industry is an important component because it supports the transportation of stuff and

the mobilization of people, effectively and efficiently. The shipping industry is exposed to the risk of disruption and threats, both from short-term and long-term events. Short-term events can include industrial accidents, financial crises, natural disasters, terrorism, and sabotage. Long-term events can be in the form of regulatory changes, climate change, and market changes.

In terms of accidents, the International Maritime Organization (IMO) reported that, globally, there were 631 cases of ship accidents from 1975 to 2020 [4]. In Indonesia, the Indonesian National Transportation Safety Committee reported that from 2003 to 2019 there were 134 ship accidents that occurred in Indonesian seas [5]. The accidents include drowning, collision, explosion, fire, overturning, onboard fatality, running aground, bumping, and tilting. In the public and private companies in this study, there were at least 10 accidents that occurred from 2011 to 2019. The problem faced can only be removed through adaptation, innovation and, in some cases, the complete transformation of the company [6].

The International Safety Management (ISM) Code for Guidelines for Safety Management Systems is a crucial instrument for introducing the concept of resilience in the maritime domain. The concept of resilience is seen as a complementary set of principles that can help to achieve and maintain work safety [7]. Notwithstanding all the improvements in safety standards and technological developments, maritime companies have realized that accidents still occur, and the system is not resilient to errors at different levels [8]. For this reason, systems and organizations need to increase their adaptive capacity [9]. Safety of Life at Sea (SOLAS) is an international convention that aims to set minimum standards for the construction, equipment, and operation of ships, which are compatible with their safety [10]. In addition, Indonesia is an archipelagic country where sea transportation has an important role to ensure the smooth mobility of the population between islands in Indonesia. It is hoped that the results of this study can provide an overview of the existing level of safety resilience in shipping companies in Indonesia, and that recommendations for improvement can be given to achieve a better level of safety resilience and can ensure the continuity of operations. The study can also provide input for improving the safety program in the field of sea transportation to prevent ship accidents. Based on this description, the objective of the study is to analyze the safety resilience implementation in the Indonesian shipping sea transportation based on four elements of safety resilience, namely the ability to respond, provide anticipatory action, monitor what is happening both internally and externally, as well as the learning process of what went right and what went wrong.

2. Materials and Methods

The design study used was descriptive with a semi-quantitative method. The study was conducted at one of the shipping service providers owned by the public company and one of the private shipping service providers in Indonesia. The study period is four months, from April to July 2020. The data was collected through document review (secondary data) and interviews with related parties to confirm the results of the analysis of secondary data regarding the implementation of the concept of safety resilience. The interview guide uses a set of questions based on the Resilience Assessment Grid (RAG) developed by Erik Hollnagel [11] in 2015, with adjustment of sentences and adding questions according to the research topic. This ability assessment is carried out by exploring the detailed elements of each quality of resilience, consisting of response, monitoring, anticipation, and learning, which is then described in the form of a Resilience Assessment Grid (RAG) as in Figure 1 [11].

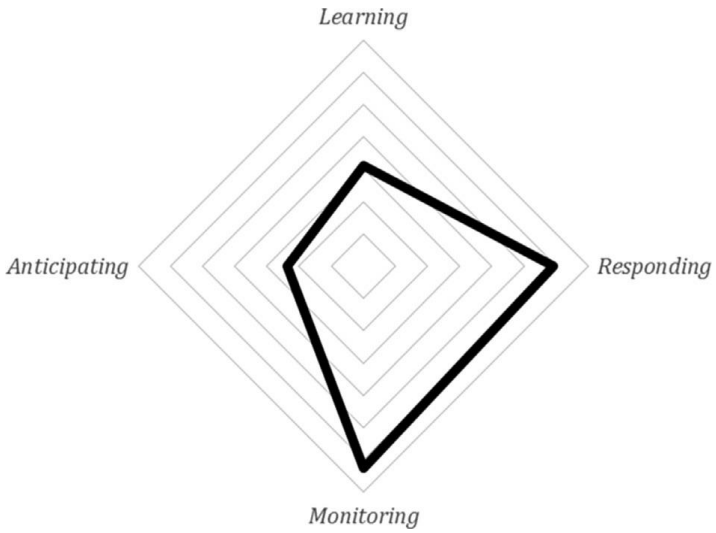

Figure 1. The RAG score for the four elements.

The research sample was taken by a purposive sampling technique, where the main informant was the Designated Person Ashore (DPA), and the triangulation informant was the Quality, Health, Safety, and Environment (QHSE) Officer. This research has been approved by the Ethical Committee of Research and Community Development, Faculty of Public Health, Universitas Indonesia, No. Ket-96/UN2.F10.DII/PPM.00.02/2020.

3. Results

3.1. Overview of the Company Reliability

3.1.1. Vessel Data at Public Company

The public company has ten vessels, including two bulk carriers, five container vessels, one tug charter to other companies, one barge, and one tugboat. The oldest fleet is a type of barge vessel that is 17 years old, while the youngest fleet is a type of motor vessel that is 4 years old. Each vessel will sail one round voyage every month with various routes, between 546 NM to 2146 NM, from Port of Loading to Port of Loading. The public company fleet shipping areas cover all of Indonesia. The number of crews that each ship has depends on the capacity of the ship. For example, eight people for ships with a capacity of 322 GT and twenty-three people for ships with a capacity of 30,648 GT.

3.1.2. Vessel Data at Private Company

The private company has five vessels, the details of which are one supply vessel, two SPOB (Self Propelled Oil Barge) vessels, and two tankers. The oldest fleet is a type of tanker vessel that is 24 years old, while the youngest fleet is a type of supply vessel that is 3 years old. The route taken by the ship varies, for the route traveled as far as 1 NM to 5 NM will sail 11 times per month, while some sail 25 to 30 times per month. Coverage of shipping areas in private companies is around the Java sea. Implementation of the maintenance vessel according to schedule, there are three out of five ships owned, one ship is in the process of maintenance docking, and one vessel is on standby for docking. The number of crew/human resources on board is eight to thirteen people, according to the ship's capacity.

3.1.3. Vessel Performance for Public Company and Private Company

Based on data from the vessels of the public company, it can be concluded that the vessel performance can be said to be following the capacity of the organization in meeting job demands and requests from customers. Based on information from respondents, safety performance is estimated to have a percentage of 75%, while from a business perspective, it is 80% due to paying attention to cost efficiency.

3.1.4. Implementation of Occupational Health and Safety (OHS) Management System at Public Company and Private

The public company has implemented an OHS Management System based on the Occupational Health and Safety Assessment Series (OHSAS) 18001:2007 and ISM Code 2010. The private company has carried out certification with International Organization for Standardization (ISO), integrated 45001:2018 and ISM Code 2018.

3.1.5. Resources in Public Company and Private Company

As of July 2020, the number of employees in the public company is 60 people, including the number of personnel. In Marine Safety Quality, or what is commonly called HSE, there are two people, namely DPA and HSE, who also function as fleet division staff. Meanwhile, in the private company, there are 35 people with three personnel in the division QHSE, one of whom also serves as DPA.

3.2. Overview of Magnitude of Risk

3.2.1. Frequency of Ship Collisions at Public Company and Private Company

Based on the results of initial interviews with the HSE team of the private company, since the company was founded there has never been a ship collision. Meanwhile, in the public company, there was one ship collision in 2020.

3.2.2. Investigation Report of the Public Company Ship Collision

Based on the document of the minutes of a ship collision incident in one of the fleets belonging to the public company, it was anchored in the waters of Merak, so the losses incurred were borne by the company that owns the crashing fleet. The analysis reported by the public company shows the leading cause of this ship collision incident was negligence in navigating so that it was unable to avoid an anchored ship. This collision incident resulted in the ship belonging to the public company experiencing deformation damage in the bow of the ship, losing time to operate, and delaying the scheduled cargo, thus incurring higher costs. The actions taken by the ship's crew and skipper after the accident occurred were, namely, checking the damage to the outside of the ship and the forepeak tank to see if there was a leak or not. After that, the water was drained in the forepeak tank for further inspection. Based on the results of the maintenance class carried out, the public company fleet was declared fit to sail.

3.2.3. Calculation Result of Percentage Safety Resilience

Calculation of the percentage of safety resilience using the Resilience Assessment Grid method, is performed by adding up the scores given for each aspect of the ability to respond, monitor, learn, and anticipate as listed in Table 1. The added score is then divided by the maximum value of each ability asked during the interview. Calculation formula:

$$Percentage\ of\ each\ Ability = \frac{Number\ of\ Question \times 5}{Maximum\ Score} \times 100\% \quad (1)$$

Table 1. Calculation for each aspect of ability.

Aspect of Response Ability	Score Rating		Aspect of Monitor Ability	Score Rating		Aspect of Learning Ability	Score Rating		Aspects of Anticipate Ability	Score Rating	
	Public Company	Private Company		Public Company	Private Company		Public Company	Private Company		Public Company	Private Company
List of Emergency Conditions	4	4	Technology	4	4	Evaluation of Genesis	4	4	Follow-up of emergency	4	3
Relevance	4	3	Notifications	5	4	Reporting	4	4	Periodic inspection	4	4
Threshold	4	3	Guarding system	5	5	Communication	4	4	Early Warning System	4	3
List of Responses	5	4	Leading/Lagging List Indicators	3	5	Selection criteria	4	3	Training	4	4
Response Speed	4	4	Relevance	3	3	Learning basics	4	3	Skills	3	4
Duration	5	4	Types of indicators	3	3	Classification	3	3	Frequency	4	3
Recovery	5	3	Validity	3	3	Formalization	4	3	Communication	4	4
Response Speed	4	4	Delay	3	4	Training	5	2	Strategies	2	4
Response Capability	5	4	Types of measurement	2	5	Learning methods	4	3	Model	2	3
Verification of Emergency Conditions	4	3	Frequency of measurement	3	4	Resources	3	3	Time Horizons	3	2
			Analysis/ Interpretation	3	3	Suspension/Delay	5	4	Deferral Acceptability of risk	3	3
			Stability	2	3	Learning objectives	4	4	Aetiology	3	3
			Organizational support	4	3	Implementation	5	4	Culture	4	3
Total Value	44	36	Total Value	43	49	Total Value	53	44	Total Value	44	43
Percentage (%)	88	72	Percentage (%)	66.2	75.4	Percentage (%)	81.5	67.7	Percentage (%)	68	66

4. Discussion

4.1. Analysis of Company Reliability and Magnitude of Risk at the Public Company

Based on Tables 2 and 3, the reliability aspect exceeds the level of risk faced, so it can be concluded that the public and private companies already have the main element of safety resilience.

Table 2. The reliability aspects assessment in the public and private companies.

No.	Aspect	Public Company		Private Company	
		Level	Reason	Level	Reason
1	Number of Vessels	High	Already have ten fleets	Medium	Already have five fleets
2	Adequacy of Resources	High	Even though several roles are concurrently held by one person, the tasks and functions can still run	Height	Roles, duties, and functions have been specifically assigned to each division
3	Vessel Construction Strength	High	Vessels are already certified "Ice Class"	Height	Vessels are not more than 25 years old, and only 3 years old
4	Performance Vessels	High	Active in conducting shipping operations	High	Active carrying out shipping operations
5	OHS Management System	Being	Certified OHSAS 18001: 2007 and ISM Code 2018	Being	ISO 45001: 2018 Certified and ISM Code 2018

Table 3. Magnitude of risk assessment in the public company.

No.	Aspects	Public Company		Private Company	
		Level of	Reason	Level of	Reason
1	Incidence of Ship Collision	Low	Only has occurred one time	Low	Never has the collision of ships
2	Shipping Routes	Low	Shipping around Indonesian waters	Low	Shipping around the Java Sea

4.2. Ability Analysis of Safety Resilience Elements of the Public Company

4.2.1. Response Ability

Based on Figures 2 and 3, it can be concluded that the response ability of the public company is rated well, with a total value of 88%. When viewed in terms of response to emergencies, the public company has been able to provide a quick response and effective follow-up to deal with it. In terms of the handling of shipwreck incidents in the Shipwreck Report and the news of events made by the skipper and DPA, there were no delays in reporting and handling was carried out immediately by both parties involved in the collision. The speed of response given was assessed as fast enough because the team on the ground immediately sent personnel on duty to conduct inspections and assist the crew and ensure the ship did not experience leaks. Besides, it is also stated that, for safety, there is no special budget because for the ship to be seaworthy, the company must ensure its safety.

Emergency response systems are already available on board, and responsibilities are set out in the emergency guidelines. A list of emergencies has also been listed along with a way of reporting for each emergency and a contact person to be contacted. Especially for ship collisions, entering the category of Red Alert, 2:60 min should be a response to the land. Communication facilities are also available in various methods, namely mobile, satellite phone, and email. There are also convenient means of communication, such as Medium Frequency High Frequency (MFHF) radio and Very High Frequency (VHF) radio, as regulated by the International Maritime Organization (IMO), where the crew can speak normally in the event of interference with the satellite phone.

Figure 2. Ability analysis of safety resilience elements of the public company.

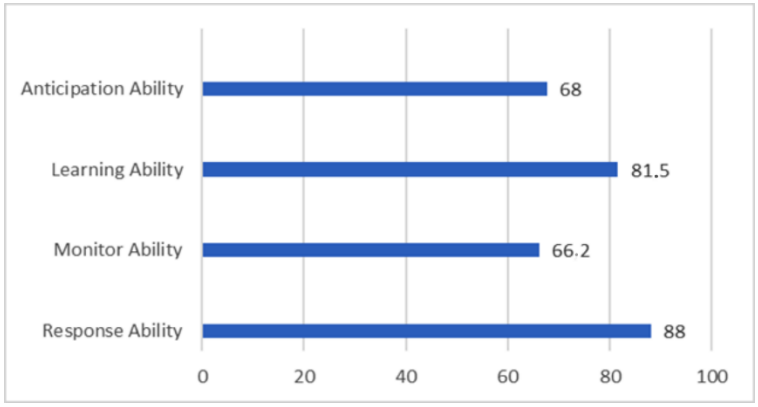

Figure 3. Average resilience safety level at the public company.

The emergency was declared complete when the situation was inspected, and the ship was assessed for operation by the sea. The statement of sea worthiness was issued by the harbormaster as the port authority. Emergency drill or emergency response simulation is routinely carried out by established procedures to ensure readiness for emergencies. The implementation of this drill will be evaluated and reported to top management.

4.2.2. Monitor Ability

Based on Figures 2 and 3, it can be concluded that the monitor ability of the public company is still considered necessary to be increased, with a total value of 66.2%. There are still many aspects that need to be improved to achieve optimal monitor abilities. The public company's fleet already has the latest technology for navigation systems, a full 24 h guard system by guards, and an adequate notification/communication system. However, the public company has still not conducted comprehensive monitoring in terms of the

management system, where there are no leading and lagging indicators carried out in full, and measurements are still scattered even though it has been implemented. Ideally, the entire fleet should report conditions that could potentially cause an accident (near miss) as part of IMO rules but, currently, the crew is judged reluctant to report near misses for fear of personal performance. The stability aspect is also judged to be insufficient because the results of the measurements performed only show a temporary effect. Ideally, the measurement or implementation of monitoring from the side of this management system should be carried out effectively to support the ability of response and anticipation. Periodic inspection at the public company consists of ship inspection, internal safety audit and internal security audit, and tabletop drill periodically as the implementation of organizational support.

4.2.3. Learning Ability

Based on Figures 2 and 3, it can be concluded that the learning ability of the public company is rated well, with a total value of 80.3%. The evaluation of emergencies is carried out through incident investigation. The public company sets the format of incident investigation in the procedure. The emergency reporting mechanism is also carried out by the Emergency Management Reaction Team. The public company formed a particular Whatsapp group for the captains of ships that serve, to receive information from each other to give precise instructions to their men in case of danger signs. The company's internal communication system is carried out by the circular letter method, distributed to all divisions, as stated in the communication procedure. Learning from incidents that occur on other ships or other companies will also be reported internally via blast email along with follow-up instructions. Basic organizational learning is from something that went wrong, or from a Safety-I perspective.

The training aspect is considered adequate, especially related to incident investigation training, National Examination Board in Occupational Safety and Health (NEBOSH), and Shipboard Safety Officer Training from the IMO training module, which must be followed by the skipper, chief officer, chief engineer, and first engineer. However, OHS training for all employees is still not implemented. The implementation of safety in the office has not been as strict as on board. The current resource aspect is considered adequate.

4.2.4. Anticipation Ability

Based on Figures 2 and 3, it can be concluded that the anticipation ability of the public company is considered to still need to be increased, with a total value of 60.3%. The public company acts on the follow-up of emergencies that occur by the established procedures. The calculation of losses and the budget required is also there because it is also to be submitted to insurance. However, budgeting for the implementation of OHS is also vital so that there is always a special allocation of funds that can be used to run the OHS program. Periodic inspections for safety equipment on board must also run, and outside parties also issue certificates for engine components. Early warning systems are also available at times, such as radios that are always on stand by and connected to the skipper, and a horn that can be sounded as a sign for guards in case of an emergency. Long-term reliable expertise is in incident investigation and accident analysis. To cover the shortcomings in the monitoring aspect, the public company must place special personnel responsible for the focus of carrying out monitoring and analysis of OHS data because it is still held by members of the Armada team.

Every year, there is always a risk analysis and opportunities that will appear in the future in management review activities. This management review will also discuss expectations regarding things that may happen in the future. There is currently no specific long-term model or planning for OHS expressed in explicit or implicit form. Work planning from the OHS side is only done once per year.

4.3. Ability Analysis of Safety Resilience Elements of the Private Company

4.3.1. Response Ability

Based on Figures 4 and 5, it can be concluded that the response ability of the private company is considered good, with a total value of 72%. The company already has an emergency response system that runs on ships and in offices, as stipulated in the ISM Code and harbormaster requirements. The obstacle that arose was that there was some person who had high initiative so that they acted out of command. A list of emergency conditions has also been identified in the procedure. The signs of an emergency can be seen from the safety device installed on the machine. Besides that, the AIS (Automatic Identification System) has been installed on board. This functions as a tracking system where the distance between ships can be seen and can be directly communicated to other ships that are approaching or to the entire crew when the ship is approaching an object.

Figure 4. Ability analysis of safety resilience elements of the private company.

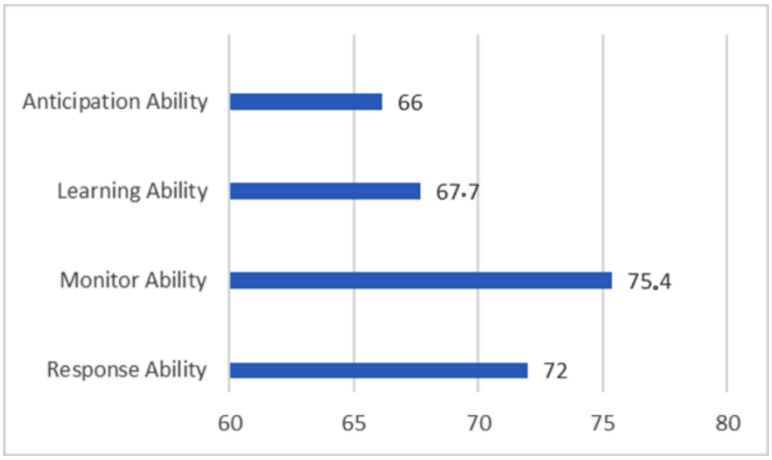

Figure 5. Average resilience safety level at the private company.

Specific action steps for each emergency are provided as a checklist in the Shore Emergency Response Plan. The duties and responsibilities of the crew when dealing with an emergency are already on the master list on each ship. Giving a response based on communication from the captain of the ship to the DPA, the DPA will coordinate with the Emergency Response Team for follow-up. An emergency condition is declared complete when the ship can function as before.

Human Resources on board follow regulations, Safe Manning, depending on the size of the ship. All crew members are involved in emergencies, as written in the master list. Besides that, there are links between several agencies that will assist in handling emergencies. Emergency drills are carried out to ensure preparedness for emergency conditions. However, there has never been a drill for ship collision conditions because there have never been any cases.

4.3.2. Monitor Ability

Based on Figures 4 and 5, it can be concluded that the responsiveness of the private company is considered good enough, with a total value of 75.4%. The public company has equipped the fleet with a navigation system that is quite sophisticated, as required in IMO. The communication system also uses satellite telephone or email. Besides that, because the shipping route is still in the Java Sea area, communication via Whatsapp can also be done. The guard system has been running where there are officers on duty who are always on standby in their positions.

Leading and lagging indicator aspects are determined by the company itself, which refers to the OHS program that has been made. The emergency drill, in this case, is part of the leading indicator. However, there are still weaknesses, namely, this indicator is centered in the QHSE division and involvement from operations is considered to be lacking. There has been no adjustment for each vessel where there should be differences in the characteristics of the ship, site, and operational area. However, currently, the leading and lagging indicators have not been running consistently because they were initiated from the charter program, not initiated by the companies themselves.

Every three months there is a vessel inspection to ensure the condition and performance of the ship are running optimally. Support from management for OHS is implemented in the form of management visits, QHSE inspections, from the Fleet Division team, as well as from clients. However, there is still a small proportion who are considered inadequate because of their mindset that underestimates safety.

4.3.3. Learning Ability

Based on Figures 4 and 5, it can be concluded that the learning ability of the private company still needs improvement, with a total value of 66.7%. Implementation of evaluation occurs in each monthly meeting or after the situation returns to normal, involving all personnel. The reporting and learning mechanism can also be in person or by email so that the communication aspect is considered sufficient. The private company has a mechanism observation card to record safe or unsafe actions. If there is an incident in another ship's fleet or another company, this will also be learned through the safety stand-down method, to discuss the incident and what to do. Currently, the private company tends to do learning based on a mistake.

The method used by the private company to describe the incident is carried out by making a report by the skipper to be sent to related parties depending on the incident. The process of data collection, analysis, and learning is currently considered inadequate because safety aspects are sometimes delegated to the QHSE division directly. OHS training and socialization is still not running optimally because of being currently plagued by a pandemic, where there are rotations of office people who partially work from home as well as limiting the number of visits to ships. There were no delays in reporting due to the current sophisticated and fast communication methods. Competence has also been adjusted to the needs and roles of each. To instill an OHS mindset, efforts are still being

made so that it is not only burdened by the QHSE Division to maintain the communication flow and so that it does not overlap.

4.3.4. Anticipation Ability

Based on Figures 4 and 5, it can be concluded that the anticipatory ability of the private company still needs improvement, with a total value of 66%. Emergency follow-up will be carried out according to procedures and budget calculations by the cost center. Periodic inspections of equipment safety on ships have been carried out regularly. The early warning system is carried out through direct monitoring of the ship's crew and the presence of safety devices, where if there are signs of unsafe conditions they must be reported to the skipper for follow-up. Expertise that can be relied on for the long-term is namely fire management, basic safety training, and handling of emergency conditions. Especially for the competence of the crew, it has also met the requirements of STCW 95.

Short-term planning (one year) is explicitly carried out in the annual program and also submitted during management reviews. There is no long-term planning for the OHS aspect. Risk analysis is outlined in the form of risk management, and an assessment is carried out. Mitigation is also continuously studied so that threats and opportunities that arise can be followed up. Awareness of risks or dangers in the aspect of OHS is currently not an organizational culture, and awareness still needs to be increased.

4.4. Level of Implementation of Safety Resilience for the Public and Private Companies

Based on the results of the RAG in Table 4, the average level of safety resilience in the public company is 75.1%. Elements of response and learning abilities have higher scores (88% and 81.5%) than monitoring and anticipation abilities (66.2% and 68%). These results can be analyzed as follows:

- Overall, the public company is still oriented to keep the operational process running. This can be seen from the high elements of learning and response ability. However, a more in-depth analysis shows that the existing learning process is a learning process from accident data that has occurred (failure stories) or the results of existing investigations. The learning process should be carried out comprehensively from success stories and failure stories, both from internal companies and other companies that are more advanced [2,12]. Meanwhile, a high response ability in the public company shows a response to similar risks or failures from the past, from the internal company and similar companies. The company is still focused on viewing risk as the cause of accidents. The company should comprehensively view risk as a cause of accidents and also as an opportunity to improve performance in the future [2,12].
- Low monitoring ability indicates that the monitoring element that functions to maintain the operating process is not optimal and needs to be improved properly. Meanwhile, the low anticipation ability shows that the company has not carried out an optimal improvement program. This happens because the improvement program through the anticipation element requires high costs and is carried out over a long period to increase the number of resources so that it is greater than the amount of existing risk.

Table 4. Results of RAG calculations in the public and private companies.

Companies	Response	Ability Monitor	Learning	Ability Anticipation Ability	Overall Average (%)
Public Company	88	66.2	81.5	68	75.1
Private Company	72	75.4	67.7	66	70.2
total	160.00	141.54	149.23	133.85	
%	80.00	70.77	74.62	66.92	

In the private company, the average level of safety resilience is 70.2%, where the elements of monitoring and response ability have higher values (75.4% and 72%) than learning and anticipation ability (67.7% and 66%). These results can be analyzed as follows:

- The high score of monitoring ability indicates that the monitoring element that functions to maintain the operation process is optimal. This is also indicated by the high score of the response ability. The high level of these two elements shows that the company has tried to prevent accidents from occurring so that the operation process can run well. The company is still focused on viewing risk as the cause of accidents. The company should comprehensively view risk as the cause of accidents and as an opportunity to improve performance in the future [2,12].
- The low score of learning ability occurs because there is no learning process from accidents that have never happened in the company. This learning process should be done through training and learning from other companies. Meanwhile, the results of the anticipatory ability analysis are the same as the public company, where the private company has not carried out an optimal improvement program either. This is because the improvement program through the anticipation element requires high costs and is carried out over a long period to increase the number of resources so that it is greater than the amount of existing risk.

Previous research on the road transport industry in Australia that conducted the Resilience Assessment Grid showed that ability to learn and respond had the highest score (83.3% and 77%, respectively) which indicates the company has these two abilities that are managed better than the ability to anticipate and monitor (52.9% and 41.3%, respectively), which score lower [13]. This shows the same result as Indonesian shipping sea transportation, where there are still elements of safety resilience that have not been optimally implemented. Meanwhile, to achieve a good level of safety resilience, the ability to learn, respond, monitor, and anticipate must be implemented and integrated optimally [2,14].

The other study in the Vessel Traffic Service (VTS) in Finland shows that the four safety resilience elements were used to identify activities that help to adapt to different operating conditions in daily work [15]. The study shows that VTS safety is experienced as a non-event by the participants in the survey. It showed when the VTS manages to cope with the contextual demands placed on the system and the ability to maintain control over the traffic movements. So, it can be said that in the study, "*Safety is that nothing happens, that the traffic moves without accidents and environmental emissions*". The orientation on carrying out operations that are targeted without accidents is not only the orientation of ship companies in this study. This orientation is also the target of operations for similar companies abroad, one of which is the Vessel Traffic Service (VTS) in Finland. However, to achieve a comprehensive implementation of safety resilience, this orientation needs to be improved by anticipating success in the long term.

4.5. The Position of the Public and Private Companies in the Safety Resilience Maturity Model

The public company has a percentage of 75.1%, while the private company is 70.2%. If poured into the safety resilience maturity model, the position of the two companies has led to the level of proactive, as shown in Figure 2.

In Figure 6, there is no significant difference between the level of implementation of safety resilience at the public company and private company. The status of the public company or private company does not affect the implementation of safety resilience in the maritime industry. It is in line with research conducted by Sheuwen Chuang et al. in 2020 in the Emergency Unit sector for private hospitals and government hospitals, where there is also no significant difference [15].

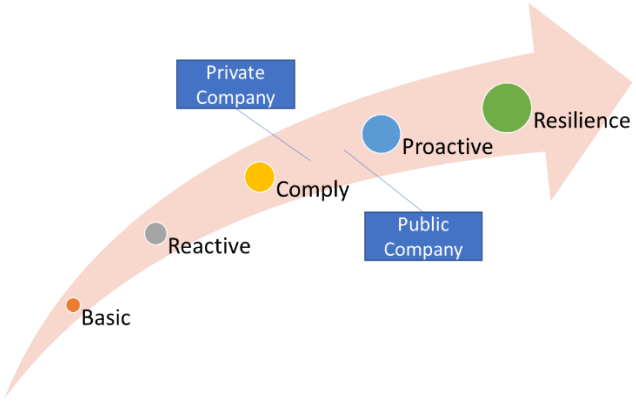

Figure 6. Position of the public and private companies in safety resilience maturity model for the maritime industry.

4.6. Supporting Factors and Inhibiting Factors for the Implementation of the Concept of Safety Resilience at the Public and Private Companies

4.6.1. Supporting Factors

Based on the calculation results in Table 4, the overall supporting factors of the implementation of the concept of safety resilience are the ability to respond (80%), followed by learning ability (74.62%), and monitoring ability (70.77%). Supporting factors at the public company are response skills and learning abilities. This could be due to the public company having experienced a ship collision incident, so the handling practices that had been anticipated through the procedures were deemed adequate. At the same time, the supporting factors at the private company are the ability to monitor and the ability to respond. This is because the private company has never had a ship collision incident, so the management system strengthens its monitoring abilities.

Strict regulations in the maritime sector also support implementation because these regulations are coercive, so companies must always comply with the requirements and regulations set by international regulators and the Indonesian government. This point is emphasized by researchers, where safety resilience must be able to improve performance and a management system that is formed to exceed the demands of compliance or compliance with regulations. The research conducted by GA Penolaza, et al. stated that response ability was also successfully implemented in construction projects [16].

4.6.2. Inhibiting Factors

Based on the results of the calculations in Table 4, the overall inhibiting factor of implementing the concept of safety resilience is the ability to anticipate (66.92%). This can be due to the aspects of safety in the two companies that do not have a strategic plan, such as the treatment of strategic planning made for the business. In the presentation given by Erik Hollnagel in the Resilience Health Care forum, it was stated that the condition of resilience could be achieved if the subject understands three things that must be possessed, namely knowledge of their abilities, targets to be aimed at, and how to achieve these targets. The mindset of safety, which still refers to "zero accident" or Safety-I, will not bring the two companies to safety resilience, so it is necessary to focus on building the ability to anticipate conditions that will be faced in the future. In particular, the mindset of safety must be changed from "Safety is zero accidents" to "Safety is the ability to succeed in dealing with various conditions, both suspected and unexpected" [12].

Organizations must find ways to build safety resilience between conditions of redundancy and use threats or disturbances that may arise as opportunities that can be exploited. As in research conducted by GA Penaloza et al., a focus on regulatory structuring can enlarge the scope for monitoring and response, but at the same time, limit efforts to learn and anticipate [17].

5. Conclusions

The results of the study show that the safety resilience implementation in Indonesian sea transportation shipping has not been optimal in implementing the safety resilience concept. This is indicated by the study results which show that the focus of implementing safety in shipping companies is still on preventing and controlling accidents. It does not include the other orientation of the safety resilience concept which aims to improve the company's ability through the ability of learning from success and failure stories, responding toward risk as potential harm, and also as an opportunity, monitoring not only internal factors but also external factors, and the anticipation for long term situations.

Both companies are still heading to a proactive level in the safety resilience maturity model. The basic learning of the two companies (public and private) is still from a negative aspect (Safety-I). The learning process should be carried out comprehensively from success stories and failure stories. Overall, the score results for safety resilience elements in the public and private companies are as follows: the ability to respond (80%), learning ability (74.62%), monitoring ability (70.77%), and the ability to anticipate (66.92%). Overall, the public company is still focused on keeping the operational process running. This can be seen from the high elements of learning ability and response. High response ability in the public company shows a response to similar risks or failures from the past, both from the internal company and similar companies. The company is still focused on viewing risk as the cause of accidents. Low monitoring ability indicates that the monitoring element that functions to maintain the operating process is not optimal and needs to be improved properly. Meanwhile, the low anticipation ability shows that the company has not carried out an optimal improvement program. Meanwhile, in private companies, a high monitoring ability value indicates that the monitoring element that functions to maintain the operational process is quite optimal. This is also indicated by the high score of the response ability. The high level of these two elements shows that the company has tried to prevent accidents so that the operation process can run well. The company is still focused on viewing risk as to the cause of accidents. The low value of learning ability occurs because there is no learning process from accidents that have never happened in the company. Meanwhile, the company's anticipatory ability has not carried out an optimal improvement program either. This is because the improvement program through the anticipation element requires high costs and is carried out over a long period. Based on these conclusions, some recommendations can be proposed as follows: (1) companies not only view risk as the cause of accidents but also as opportunities to improve performance in the future; (2) the learning process can be done through training and learning from other companies; (3) increase the anticipation program by making long-term plans to increase the number of resources so that it is greater than the amount of existing risk; and (4) periodically improve the monitoring program to produce data that can provide input for the response and anticipation program.

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References

1. Pęciłło, M. The concept of resilience in OSH management: A review of approaches. *Int. J. Occup. Saf. Ergon.* **2016**, *22*, 291–300. [CrossRef] [PubMed]
2. Hollnagel, E. Resilience engineering: A new understanding of safety. *J. Ergon. Soc. Korea* **2016**, *35*, 185–191. [CrossRef]
3. Wiig, S.; Fahlbruch, B. *Exploring Resilience: A Scientific Journey from Practice to Theory*; Springer Nature: Basingstoke, UK, 2019.
4. International Maritime Organization. Statistics. Available online: https://www.imo.org/en/OurWork/IIIS/Pages/Statistics.aspx (accessed on 20 December 2020).
5. National Transportation Safety Committe. Maritime Safety: Statistics. Available online: http://knkt.dephub.go.id/knkt/ntsc_maritime/maritime.htm (accessed on 18 December 2020).
6. Bhaskar, P.; Cahoon, S.; Chen, S.-L. Conceptualising a resilience based approach to shipping sustainability. *Rev. Integr. Bus. Econ. Res.* **2014**, *3*, 302.
7. Schröder-Hinrichs, J.-U.; Praetorius, G.; Graziano, A.; Kataria, A.; Baldauf, M. Introducing the concept of resilience into maritime safety. In Proceedings of the 6th Symposium on Resilience Engineering, Lisbon, Portugal, 22–25 June 2015; pp. 176–182.
8. Turan, O.; Kurt, R.E.; Arslan, V.; Silvagni, S.; Ducci, M.; Liston, P.; Schraagen, J.M.; Fang, I.; Papadakis, G. Can we learn from aviation: Safety enhancements in transport by achieving human orientated resilient shipping environment. *Transp. Res. Procedia* **2016**, *14*, 1669–1678. [CrossRef]
9. Herrera Rodriguez, M.; Agrell, P.J.; Manrique, C.; Trujillo, L. Maritime traffic disruptions in liner ship fleet deployment models: An application to the Suez and Panama canals. In Proceedings of the 28th European Conference On Operational Research (EURO 2016), Poznan, Poland, 3–6 July 2016.
10. International Maritime Organization. *International Convention for the Safety of Life at Sea*; International Maritime Organization: London, UK, 2004.
11. Hollnagel, E. Introduction to the Resilience Analysis Grid (RAG). 2015. Available online: https://www.erikhollnagel.com/onewebmedia/RAG%20Outline%20V2.pdf (accessed on 18 December 2020).
12. Hollnagel, E. *Safety-I and safety-II: The Past and Future of Safety Management*; CRC Press: Boca Raton, FL, USA, 2018.
13. Klockner, K.; Meredith, P. Measuring Resilience Potentials: A Pilot Program Using the Resilience Assessment Grid. *Safety* **2020**, *6*, 51. [CrossRef]
14. Patriarca, R.; Di Gravio, G.; Costantino, F.; Falegnami, A.; Bilotta, F. An analytic framework to assess organizational resilience. *Saf. Health Work* **2018**, *9*, 265–276. [CrossRef] [PubMed]
15. Chuang, S.; Ou, J.-C.; Ma, H.-P. Measurement of resilience potentials in emergency departments: Applications of a tailored resilience assessment grid. *Saf. Sci.* **2020**, *121*, 385–393. [CrossRef]
16. Saurin, T.A.; Costa, D.B.; Behm, M.; Emuze, F. Coping with the Complexity of Safety, Health, and Wellbeing in Construction. In Proceedings of the Joint CIB W099 and TG59 International Safety, Health, and People in Construction Conference, Salvador, Brazil, 1–3 August 2018.
17. Peñaloza, G.A.; Saurin, T.A.; Formoso, C.T. Monitoring complexity and resilience in construction projects: The contribution of safety performance measurement systems. *Appl. Ergon.* **2020**, *82*, 102978. [CrossRef] [PubMed]