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The Impact of Behavioral-Based Safety among the Seafarers

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Abstract: ***Part of an effective safety culture, "based on behavioral safety" (BBS) is a continuous idea that use rewards to encourage change in unsafe individual behavior and improve management of that risk. BBS has a tremendous influence on ship safety. The need to safeguard seamen, infrastructure, the atmosphere, and employees from increasingly severe crashes occurring security, health, environment, or other threats is becoming more apparent to vessel management. The marine business is unique because it is labor- and investment and utilizes a variety of technologies. This systematic literature study (L.R.) explores the relationship between supervisor safety conduct & regulations or other contributing variables in order to develop a modeling of seafarer performance levels.***

From the viewpoints of influencing variables, marine vessels, review of literature, organisation, organization size, and demographic features of seafarers, the demographics of the study and the urgent challenges of crew safety climate are outlined. Improved knowledge, skill, attitude, behaviour, and morale among seafarers are all essential components of accident prevention. Consequently, an L.R. study on safety management attempts to determine whether BBS implementation is required to enhance a vessel's overall safety culture. Numerous firms have devoted significant resources to safety enhancements, often by addressing hardware issues and creating an SMS that includes frequent safety checks for line supervisors. Accident rates typically decline significantly as a result of these efforts over time. Unsafe working conditions bring on numerous workplace accidents. Seafarers must know that identifying, analyzing, and concentrating on such risky behaviour is the only way to reduce accidents further. In light of the preceding, an effort is made to investigate safety management to determine the necessity of implementing BBS to enhance the vessel's overall safety culture. The traditional command-and-control approach to workplace safety is not the same as behavioural safety.

Keywords: Behavioral base safety, Ship, vessels, seafarers, Maritime.

I. INTRODUCTION

The shipping industry has a high risk of fatalities due to organizational accidents and marine catastrophes (Hansen, Nielsen, & Frydenberg, 2002). To increase maritime safety, shipping corporations have attempted to make mission design, technologies, or safety devices more productive and efficient. (IMO 2004). Several companies began implementing behavior strategies with a focus on safety in the early 1980s, and behavioral psychology was a driving force. These endeavors used the early theories from behavioral psychologists (Sarah Sulzer-Azar off, Judy Komaki, & Bill Hopkins) in continuously monitor and enhance safety/injury prevention-critical behaviors. Due to their nature, humans are prone to making errors; thus, it is unreasonable to demand flawless performance from them (Shappell & Wiegmann, 1997). Cases in point include the Costa Concordia, Exxon Valdez, Prestige, & Sea Diamond. They are all mishaps that include the human element in some manner.

The human aspect is involved about 80% of something like the causes of marine accidents, while technical explanations and other variables account for the remaining 20%. In the Classical Protection Approach, the reduction of road accident is always the primary objective. This occurs in a number of ways, including via safety policies, training, meetings, slogans, awards, committees and councillors, restrictions, or disciplining. When discussing marine safety, we are referring to incidents (fire, explosion, grounding, collision).

Although safety laws have been in place for quite some time, recent developments in technology have contributed significantly to further decreasing accident rates. In spite of this, the bulk of marine mishaps are still attributed to human elements, such as poor abilities or enough proficiency in vital areas. Throughout the past century, it has been repeatedly claimed that human failure is just the leading cause of the vast majority of maritime sector mortality. From the sinking to a sinking of such Costa Concordia, mariners have a tendency to react in perilous circumstances using the same "incorrect" theoretical representation (DNV 2015).

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Applied behaviour analysis is where BBS got its start. Earlier researchers managed their exposures to occupational dangers by behavioral techniques (Rhoton, 1980;1978, Sulzer-Azar off). Early in the mid-1980s, researchers started demonstrating the usefulness of these strategies in lowering occupational diseases and accidents (Hopkins et al., 2000; Sulzer-Azar off & Austin, 2000. BBS initiatives' long-term effectiveness has been demonstrated by subsequent research. Hagge and others2017), as well as (Myers et al.2010), offered details on BBS procedures dating back 14 years. Five years after BBS was first implemented, Krause & Sloat (1999) discovered that safety was continuously improved in 73 businesses. BBS were shown to be as effective as equipment and more so than the treatments often implemented by safety committees, according to the studies.(Guastello, 1993).

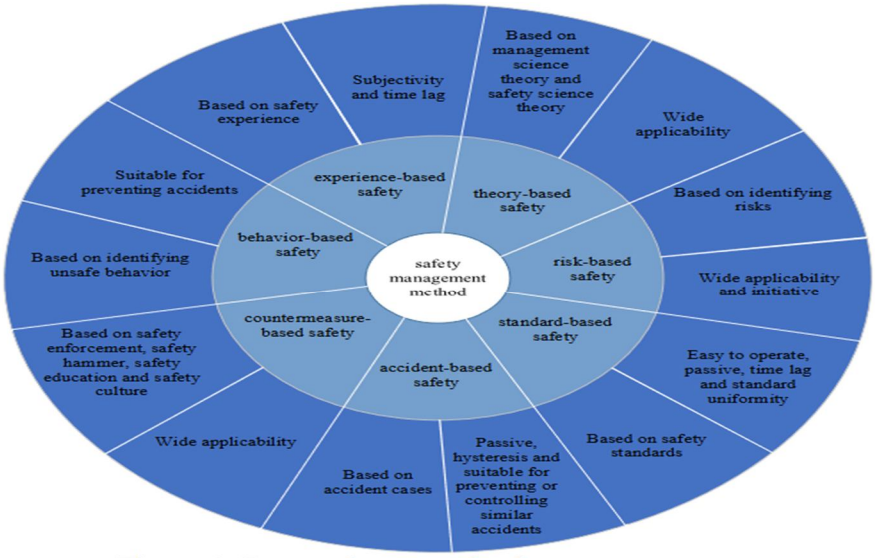


Figure 1. Research areas of safety management.

Behavioral treatments may reduce injuries by addressing several causes, while technical safeguards are more successful at removing a single hazard. Based on a continual trickle of case reports (Hagge et al., 2017; Myers and others, 2010), Management appears to be the most empirically validated strategy for limiting damages in organisational settings. The safety performance of managed vessels is directly related to the industry's survival and growth, which is highly technical and competitive.

A. A Psychological View of Behavioral-Based Safety (BBS)

The methods used in BBS are based on those used by psychologists and have only been used for about 30 years in occupational safety applications. Psychologists have identified one such comprehensive behaviour modification program.

From a psychological point of view, design safety engineers do not design with the idea that every person is different based on behavioural vectors like stress, functional disorders, social norms, etc. Psychologists think that the likelihood of human error can be reduced if these aspects were evaluated during the design of any process.

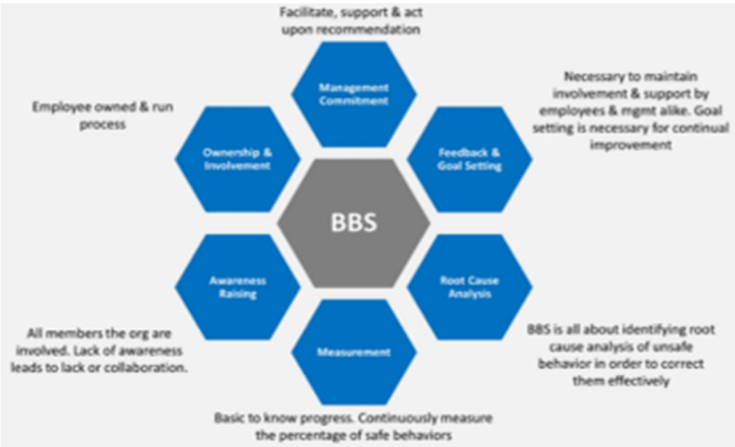


Fig 2: BBS Cycle

Even though the preceding is true in retrospect, one could make a counterargument by analyzing human error and conclude that when safety-critical systems were designed, The user's "freedom to choose" can encourage them to engage in "at-risk" behaviours that can result in injuries. Human error is a topic of interest to both perspectives; however, human error has not received sufficient research at the level of design engineering.

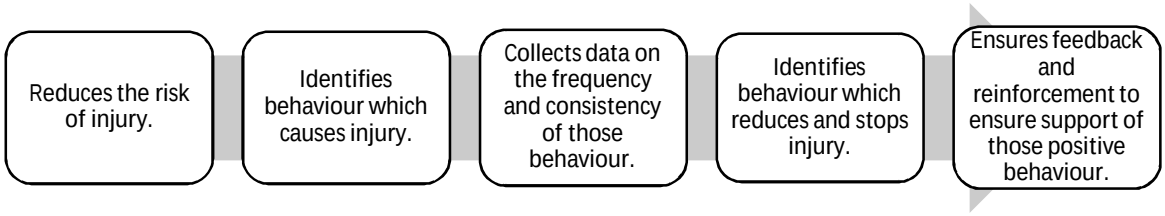
Other psychologists hold the following view regarding reducing or eliminating human errors caused by "at risk" behaviour: It's best to use more than one method.

1) Training and development,
2) inclusion in leadership, management, and supervisory roles,
3) distraction management,
4) and situational awareness is just a few examples.

While BBS's fundamental principles are similar to behaviour modification in psychology, its implementation in the workplace necessitates ongoing upkeep, participation, and support from all employment levels rather than focusing on particular interest groups.

B. What is Behavioral Safety?

Based on behavioral safe, often known as behavior-based safety, is the use of behavioral psychology to increase workplace health and safety. It is also known as "Organisation Protection." Establishing a procedure that clearly specifies a set of behaviors inside of an organization is essential for behaviour security.



Generally, as parts of a behavioral process, seafarers monitor and offer feedback about safety precautions within respective work locations. Recognition, problem-solving, and ongoing improvement are based on the data provided by these observations. Modern programs for behavioral safety depend primarily upon the total quality management (TQM) & organizational design. They need workers to perform assessments in particular work zones and collaborate in teams to assess the data and develop action plans to improve safety procedures. Most of the time, a Team is in charge of planning and implementing behavioural safety. A small group of seafarers from the workplace typically make up this team, which typically includes a representative from the department or stream in charge of security and the supervisory (management) level. In the implementation process, this team completes typically five steps

1) Design the process of observation and coaching
2) Determine how it data will be applied
3) Plan acknowledgement and remuneration for assisting the enterprise
4) Planify the teaching and launch procedure
5) Formulate a maintenance strategy for the procedure

C. Behaviour and Accident Prevention Model

In 2011, a Bureau of Labor Statistics (BLS) recorded around 2.8 million requiring hospitalization accidents in the workplace & 4,609 workplace deaths. H. Heinrich conducted exhaustive study on an insurance sector database in 1931. Consequently, he estimated that around 90 percent of safety problems are caused by "unsafe activities." If more study confirmed that this figure is accurate, eliminating human error might substantially decrease the number of workplace incidents that occur annually.

Social contact is often the most important instrument used by certified trainers to evaluate safety-related programs during injury investigations, preventative maintenance, and maintenance. Utilizing BBS in the workplace gives the chance to reduce accidents. Because of individual contribution to the event is diminished, the danger of harm must always exist whenever an interpersonal communication occurs, but the probability of an injury owing to human mistake really does have the opportunity be less significant.

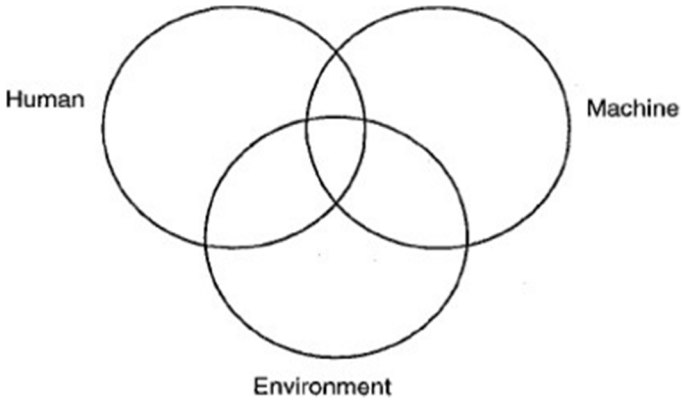


Fig 2: Prevention ModelSource:(earnest 1985)

This model's human component is not necessarily concerned with the person hurt throughout the procedure. Injured workers, witness, device installers, operator, maintenance staff, managers, and architects are all significantly threatened by human mistake and unsafe behavior. It is vital, while deciding the scope of these persons' duties, to examine their length of stay, degree of education, policy stances held within the company, and pre- and post-incident investigations. The environmental factor is examined at the ip layer and in the local work environment. To accurately evaluate the immediate context in which the job was performed, it is necessary to acquire an exact description of the testimony of those who were there and during the occurrence. Additionally, it might be useful to collect information well about workplace in order to determine usual working circumstances.

Numerous aspects are considered during the examination of the machine component. In addition, it is vital to verify that the equipment was used according to the manufacturers ' instructions now at time the incident occurred. In addition, it is vital to evaluate how the human pilot fits into design of something like the technology as well as what is known about operating that particular piece of gear.

D. The Steps for the BBS Intervention Process

1) *Step 1: A design Team is Created:* Establishing a designer before launching a BBS program is the most efficient method. Every member of the committee should be familiar with BBS and have consented to participate, and the designer should include of both managers & front sailors. This group will develop the BBS systems, but all mariners will participate in its implementation.
2) *Step 2: The following actions are chosen as targets based on safety occurrences, near-miss reports, security audits, or interpretive Analysis:* To begin, the design team decides which activities and locations to prioritize. The unit may use information already available at the site, such as safety audit findings, safety statistics, knowledge from training sessions, or unstructured interviews with sea employees (preferably from the past five years). It could provide a wealth of information for improvement opportunities. The team investigates whether anything was done to prevent the serious injuries; if this is not immediately apparent, the group employs strategies such as discussing how enhanced situational awareness could have influenced the scenario. On the basis of this investigation, the team will compile a list of essential safe behaviors.
3) *Step 3: Development of Critical Checklist:* The list consists of the safe behaviors specified in the previous stage. The list may be shortened based on the significance of safety, its frequency, its information quality, or its connection with other things on the list. A single page of paper ought to suffice to make the summary (one side). On the reverse of the checklist, you should provide standards for anything and everything getting assessed; avoid allowing anyone to be understood subjective. The easiest approach to determine whether the list is useful is to observe a crew at task see if those that can fulfill all the criteria on the checklists. Before it will be considered suitable for usage, the list likely need further revisions.
4) *Step 4: To Quantify using Some kind of Methodology:* As an inquiry progresses, the computerized measurement system effectively keeps a running tally of safe and unsafe actions. Caution is advised: Even if assessment is a precursor, we still need to reinforce the studied behavior with a consequence. Appropriate use of scale by a leader may foster an atmosphere in which employees actively seek evaluations of their performance. This is possible when consequences are enforced depending on the assessed behavior change. When seafarers get precise, good outcomes feedback, then see an advantage, aspire higher, and wish to be calculated.

5) *Step 5: Observations of Behavior are Undertaken Out:* Recognize who would also deliver the message. According to the data, the most beneficial system involves all seafarers in the observation process. The encouragement of seafarers to observe one another will benefit all seafarers because behavioural observations improve the safety behaviours of both the observer and the observed. The team and all seafarers must agree upon the frequency of the words. Will they take place inside or across departments? Will an individual person, a specific job, or the whole work environment be observed? Have you considered using contract workers? If that's the case, start recruiting experts as during design process.
6) *Step 6. Delivery of Feedback:* The method requires thorough training for mariners. The observation should offer a summarization of important positive safety behavior seen, starts with a brief description from one and two areas needing improvement. Unless this poses a risk, feedback should be provided immediately following the observation. This algorithm may be used to both positive and undesirable responses. Explain what you've seen, weigh the pros and cons of various scenarios, and pay attention to what's going on. It is important to offer both the observer's specific input and the site's aggregate opinion. At safety training, the leader should go through the results of the observations (in a broad sense, not individually) and offer visual feedback. A graph is the most straightforward and efficient approach. We can see how we're doing and set goals with visual feedback. Leaders shouldn't react negatively to low graph numbers but positively to improvements. They should instead foster objective problem-solving.
7) *Step 7 Utilize the Facts:* You now have crucial information to aid you in comprehending process changes. Include a study regarding in ongoing discussions. Ensure that all workers are notified of any adjustments based on information or are aware that their involvement was the reason for this as a group; individual identities are not recorded.
8) *Step 8. Set Increase in Performance Targets:* On the basis of existing statistics, the objectives should be feasible, and sailors should really be encouraged to take part. Ensuring how each crewman is aware of the activities or processes they must modify to meet the short-term goals (see the goal-setting section of this guide). Remember to concentrate upon that training program as opposed to the results; The program's integrity will be jeopardized if results management is attempted. Please focus on the actions that result in these outcomes rather than the results themselves (for instance, increasing the use of safety goggles from 80% to 100%).

Observing a person's behaviour presents an opportunity to offer both encouraging and critical feedback. Structured on watching a certain behavior or group of behaviors, a reviews atmosphere is a setting in which everybody here is learning.

➢ *The Benefits That A Well-Developed System Of Observation*

- Evaluation of the safety program's efficacy;
- Societal Implications of Safety Issues;
- A starting point for establishing improvement objectives;
- Rehearse watching and talking safe conduct

➢ *The Advantages of Behavioral Observations Include:*

- Enhanced observer and observee safety procedures;
- Increased awareness of the situation;
- Provides feedback on how well safety procedures work;
- Serves as a foundation for setting improvement goals;
- Provides a platform for positive behaviour recognition (McSween, 2003)

E. Concept of BBS in the Workplace

BBS is a proactive method for altering the safe behaviour levels of a workgroup before incidents occur. The goal of BBS is to change a person's mindset, habits, and actions to avoid "at-risk" behaviours.

It isn't easy to pinpoint the precise beginning of the BBS field as it exists today. However, activity peaked at the beginning of the 1970s. Since its introduction and use in the middle of the 1970s, BBS has undergone significant development. In the 1930s, Heinrich wrote a paper about the results of evaluating accidents. He discovered that around 90% of fatalities was due to human mistake. What is now known as BBS was founded on this conclusion? Since "cultural" BBS models typically result in the desired outcomes, they should be welcomed by all: Seafarers and management collaborate for the betterment of the system for safety management.

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A decent BBS programme will contain the following characteristics:

- Mutual aim
- Specification of exactly what is anticipated Requirements of the desired conduct
- Observer data collecting
- Recommendations to observed personnel
- Review

Different names are used to explain behavior:

- A person's moral character
- The individual's behavior & attitudes
- A person's observed activity

BBS is a proactive method for altering the safe behaviour levels of a workgroup before incidents occur. The goal of BBS is to change a person's mindset, habits, and actions to avoid "at-risk" behaviours. Because it makes systems and procedures real, behaviour is essential. Behavioural interventions can benefit both safety and business in other ways if used correctly. The capacity of even the experienced personnel to follow to rules, procedures, compliance standards, and best safe work procedures is tested in the ever-changing and dynamic world of BBS Management.

In additional towards the Piper Alpha catastrophe, the accidents of Glenborough, Kegworth, & Moorgate reveal that human error was a substantial contributor to the tragedy. According to studies, safety incidents increase alongside safe behaviors. Techniques for evaluating an industry's safety culture indicate organizational strengths and shortcomings that are not necessarily clearly related to specific behaviors. Because of this, it may be challenging to identify specific behaviours that should be encouraged or adopted to enhance a positive safety culture. Human behaviour concerns everyone who works to reduce accidents and increase safety.

The use of Behavior-Based Safety has led to unprecedented level of performance in the following places:

- Decreases in severe injuries
- Reductions in the emission of hazardous substances
- Decreased regulatory infractions
- Decrement in occurrences of destruction of property
- Enhanced security readiness
- Increases in timely completion of important tests and inspections

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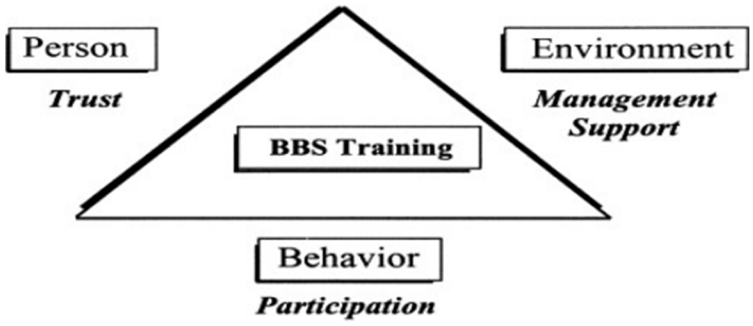

Fig 4: Behavioral base safety modelSource: (EARNEST 1985)

Surveys and focus groups were used to gauge participants' perceptions of BBS in the workplace, which served as the foundation for the BBS above model. The middle training section of this model is crucial to a successful BBS program because it connects all BBS components. Most employees in this meta-analysis believed that when their knowledge of BBS was improved, Their willingness to participate in the program increased.

1) Phase 1 – Observation
2) Phase 2 - Documentation and Measurement
3) Phase 3 – Feedback

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F. Management and Leadership BBS Roles and Responsibilities

Even though BBS developers are typically pushed by ship personnel, management and upper-level officers nevertheless play a crucial role in marketing, modeling, and sustaining the program. A BBS program will fail without strong safety leaders, and the expected benefits may not be realized.

1) Different Potential BBS Leadership Behaviours

a) Their conduct serves as an example for those who subordinate to them.

b) Their sentiments are evident in what people say officially and informally, such as in the cafeteria and at the beginning of a shift across from senior managers, leaving a lasting impression.

c) The supervisors' actions and thoughts have the most impact, not what employees claim they are doing think.

d) They act on behalf of these other crew members when time or energy is limited. For example, if a member of the media is exhausted, their behavior is contingent as to what the manager says and considers as appropriate of their bunch of journalists.

e) The directed leader communicates to subordinates what's been expected of them, timetables work to be completed, and provides detailed instructions how to do tasks.

f) The successful manager is kind and attentive to subordinate' requirements.

g) Before making a decision, a participatory leader speaks with workers and considers their input. This sort of leader is compatible with BBS applications and procedures. This sort of leader actively participates there in programme.

The safety procedure relies heavily on leaders. By instead inspecting a performance, leadership should consist of attending to them all and asking questions such as, "Are there any aspects of your work that you do not regard as necessary? The leader is responsible for listening to and gaining insight from workers. Allowing others to instruct you is amongst the most effective methods to develop connections (Uhl, 2012).To help their subordinates achieve their work objectives, influential leaders remove obstacles and obstacles from the way of travel.

G. Factors that Influence Maritime Shipping

The maritime shipping industry's safe operations can be considered a complicated sociotechnical system that determines the industry's long-term viability. Different affecting factors that impact "things go well" & "things go poorly" are given as safety precautions in various papers. These factors can be categorized based on numerous principles.

The variables that add to somewhere safe can be classified as individual discernment, hierarchical limit, and natural circumstances. However, the emergence of cutting-edge technology like as intelligent machines, mechanization, neural networks, and comprehensive data analysis, which were used to solve marine maritime security problems, is creating substantial alterations in the behaviors of crew members and companies. Consequently, we added the method elements to the customary variables framework in the current review.

II. CONCEPTUAL FRAMEWORK

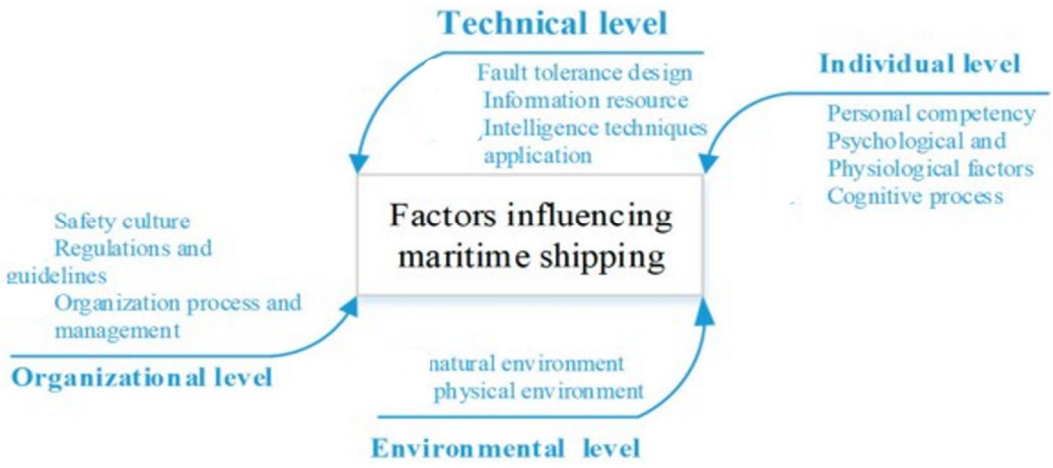

Fig 5: Impacting factors that influence the safety of maritime shipping
Source: (Qiao et al. 2021)

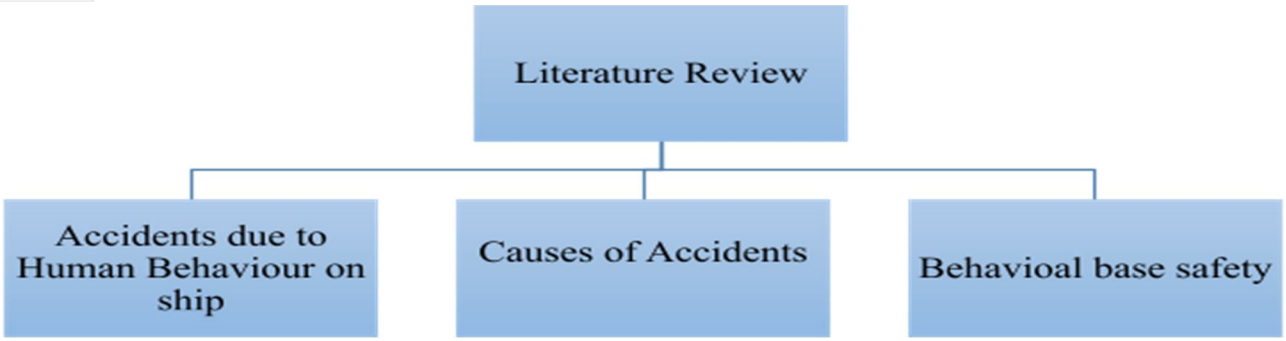

Fig 6: Conceptual Framework

III. RELATIONSHIP

A. Related Ship Accidents

According to Axel hörteborn et al. (2021), the demand for global trade has increased the need for maritime transportation. This has considerably increased maritime volume and ship dimensions over the previous several decades, hence increasing the chance of accidents. Current naval risk management methods are based on obsolete theories that do take for all current facts. Low ratings of safety were reported by mariners, pointing to a mismatch between safety culture ideals and indeed the actual safety atmosphere. Senior and junior officers' perceptions of safety differ significantly from those of managers or officers employed directly by ship owners. Instead of relying on regulations, a shift in perspective regarding how seafarers view protection could provide more effective solutions and even reduce incidents on board. As a result, Yogendra Bhattacharya et al. (2015) recommend shifting the focus to the human element of seafarers and their perceptions of safety.

When personnel have sufficient resources and time, or when procedures are consistent with seafarers' professional values, system safety laws in maritime transportation is most effective in decreasing personal injuries. There are several more factors that might lead to ship accidents like groundings. We find that safety-critical tasks, including navigation, are significantly impacted by the unintended consequences of regulation (proceduralization).

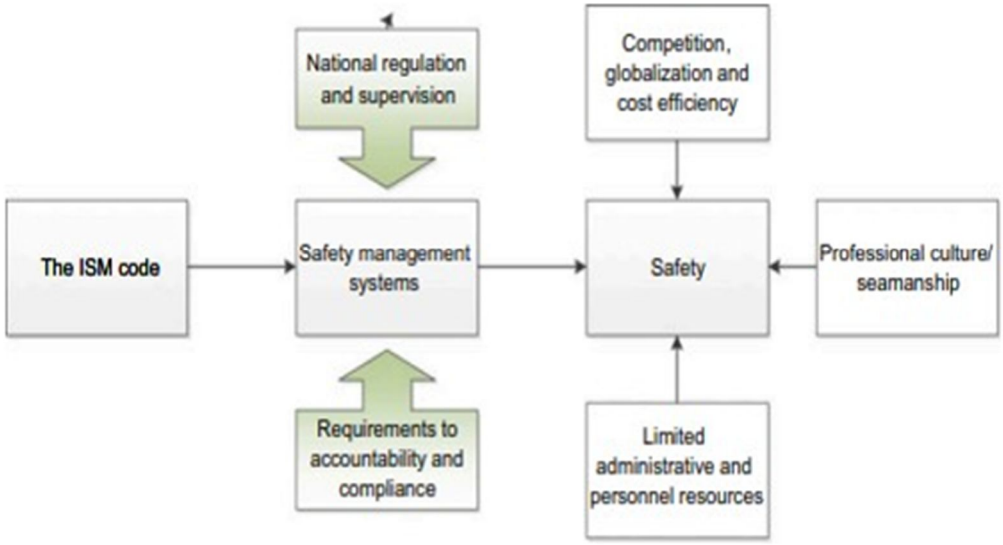

Fig 7. ISM Code

The ship's construction is determined by nine elements, the most significant of which are severe weather, load specifications, crew proficiency in cargo handling operations, or comply with various safety and cargo operating requirements. However, its most highly significant impact group elements included freight stow & functional strategy, ship seniority, hull and structural integrity, and conformance to the Ship's maintenance schedule system.Ali Cem Kuzu, et.al (2021)

Human factors appear as irregular management, misoperation, unfamiliar equipment, disorganized emergency management, or breakdown of emergency services, which are among the leading causes of oil leak catastrophes from vessels & storage vessels. Consequently, enhancing the evaluation of member of the crew certifications and overseas tax monitoring of technology operation naval ships and oil tankers, increasing the amount of command line emergency staff and equipment and willingness to participate in disaster actions, articulating the separation of duties between the connector and cleaning organization, and updating the meaningful standards for evaluating the terminal's capacity to respond to an offshore oil spill emergency are required. Once an oil spill occurs, the marine environment is continuously polluted for decades or even hundreds of years.

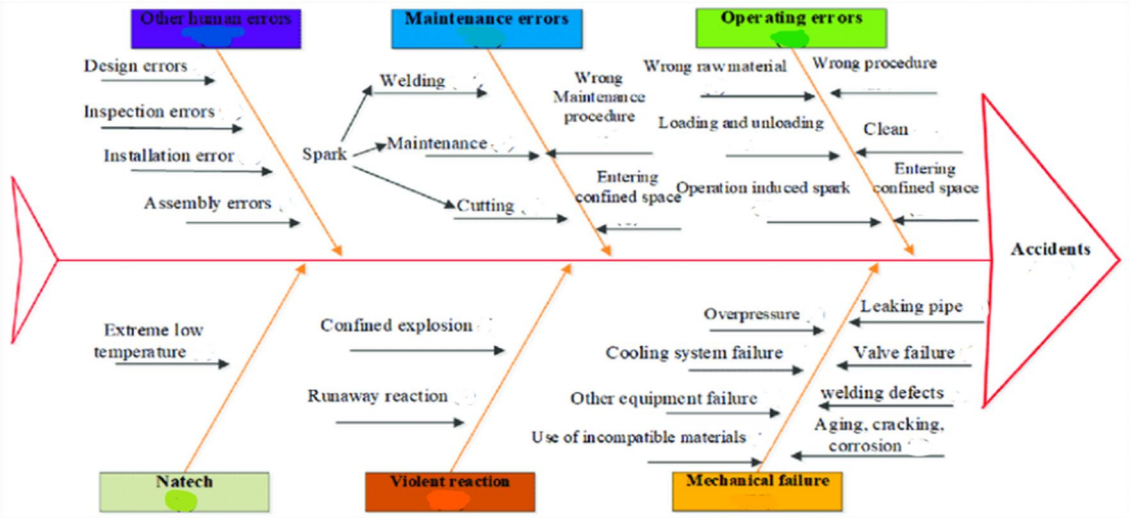

Fig 8 Accidents errors on Ship

According to study conducted by Eleftheria Eliopoulou et al. (2017) & prompted by Det Norske Testing, the contemporary statistical evaluation of marine debris and a reassessment of the degree of safety found some disturbing signals indicating a reduction in maritime security. Despite a general rise in marine debris over the previous decade, the overall severity of these occurrences has stayed nearly the same, meaning the degree of safety on diverse ship types hasn't really changed considerably.

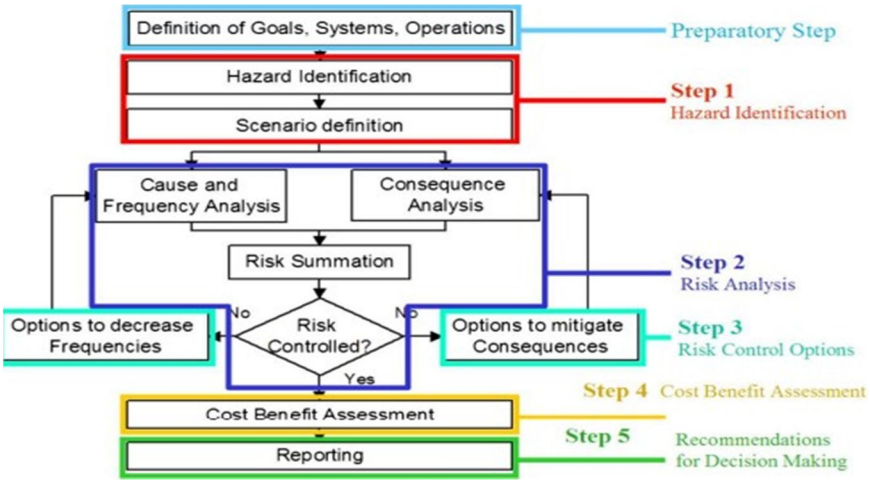

Fig 9 – Risk Analysis Steps

However, weak rules and processes, insufficient knowledge and training, & limited processes and policies all contributed to and effect marine catastrophes. External variables such as adverse weather and technological problems such as a lack of sophisticated technology such as GMDSS. The human factor and its ramifications, such as huge financial loss here to ship owner and surrounding populations, job loss, colliding with an underwater building or port that causes infrastructural damage, etc. All stakeholders in the maritime industry, particularly the major players, are increasingly concerned about naval disasters.(2019) Julius Okechukwu Anyanwu and others

B. Related to Behavioral-Based Safety

There is plenty at risk if an accident happens, both in terms of human lives and financial costs, due to the dangers of flames and explosions in oil tanker and container vessel mechanical spaces. Ince fires have caused numerous accidents with profound effects. It is determined that electrical failures and fuel leaks cause most fire mishaps, with generators, pumps, and boilers being the essential components.

Younger crew members were far more plausible to be overly optimistic; crew and passengers with less experience or training seem to be either heavily extremely confident some under; highly impulsive and socially awkward members of the crew seem to be more prone to traffic accidents; skill-based risky behaviors were indeed associated of underconfidence; guideline risky behaviors were far more almost certain to be demonstrated by highly overexcited or socially awkward crew members.

(Fig 9 Reciprocal Safety Culture Model)

Human error causes most marine accidents Ying Wang et al. (2020),

Chin-Shan LU et al. (2016), Positively affected safety behavior were economic inequality, long term orientation, togetherness, and a focus on the future. Long-term exposure improved the safety attitude of seamen, while masculinity diminished it. Due to the round-the-clock structure of career and life on a ship, the crew seldom gets to interact with the local community H.A. Octenal et al. (2009),

C. Related to Crew Injuries

According to Hansen, Nielsen, & Frydenberg (2002), the commercial shipping industry is notorious for its high incidence of fatal fatalities caused by organisational accidents & marine catastrophes. The most significant factors influencing individual maritime safety include intercultural cooperation, communication, fatigue, and a seafarer's language skills. Nora Berg et al. (2013),

According to Wayne k. Talley et al. (2005)'s Nonfatal injuries aboard cargo vessels are (1) more likely to occur while the ship is moored or docked, and (2) when there are heavy winds and low temperatures; (2) In poor visibility, nonfatal tugboat injuries are more common; (3) The number of fatalities on freight ships goes up with the age of the Ship, while the number of fatalities on tankers and tugboats goes up for fire and capsize accidents, respectively.

Tanker accidents have become less common and less severe as a result of improvements in warships and navigational. A subsequent decline in technological failures has shed light on the significance of human mistake in accident occurrence.

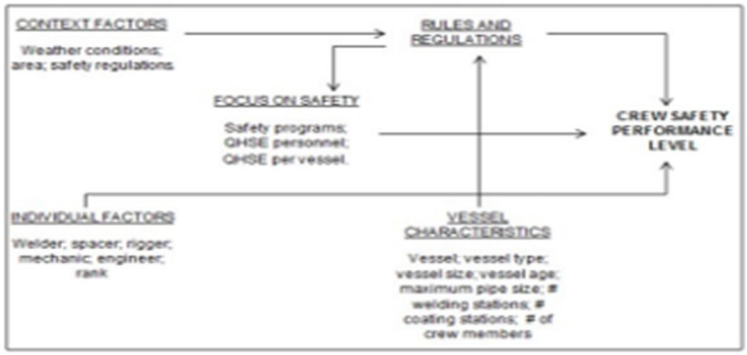

Fig 25: Conceptual Model

Source: Like (C. E.) de Korte 2014)

Moore et al. looked into the potential for human and systemic failures on crude oil tankers. Most accidents result from the complex interplay between individuals, institutions, and systems (equipment). Accidents involving just one system component are the easiest to fix; However, the treatment becomes more complicated when human interactions are involved. Jon Ivar Harold et al. (2010)

D. Safety Behaviour and Safety Intervention.

There are numerous applications for combining safety engagement behaviours-based safety culture initiatives with safety intervention strategies. The creation of an all-encompassing safety intervention model affected the crew's safety practices. Safety interventions improved safety behaviour. Safety interventions came in three varieties: individual, technical, and management, with technological intervention having the most significant impact on crew safety behaviour. In addition, five essential safety measures can be implemented to improve crew safety behaviour: safety inspections, PPE training, PPE stocking and maintenance, safe work procedures, and work licenses all contribute to a risk-free workplace. These studies demonstrate that specific interventions that enhance worker safety behaviour and appropriate safety measures can further enhance maritime safety.

IV. NONTECHNICAL AND TECHNICAL SKILLS

As defined by Nikolaos P. Ventikos et al. (2014), nontechnical skills are an additional set of competencies used in conjunction with technical shipping skills to perform tasks like manoeuvring the vessel or lowering the anchor. They include cognitive and interpersonal abilities like situation awareness, communication, teamwork, and leadership. Aside from technical know-how, soft skills like communication and fatigue management seem to play a significant role in the marine industry's effective adoption of BBS. Officers recognize that weariness is a major cause of human mistake at sea, yet they do not advise passengers to get more sleep. Behavioural-based security (BBS) is an ever-evolving process that employs positive Reinforcement to modify risky individual behavior and enhance safety performance 14 as part of a positive culture that has a substantial influence on the safety of naval operations. The combination of organizational culture (the company) and behavioral skills strengthened and improved the ultimate task or job performance (the individual). How can we make many high-risk industries safer? Utilizing CRM (Crew Resource Management)." BRM, or Bridge Resource Management, & ERM, and Engine Resource Management, originated in the aviation industry but have now spread to the maritime industry.

A. CRM's Primary Goals are as follows

1) Lessen the effects of mistakes (the error is there)
2) This is an example of the trap mistake (avoid some steps of its escalation)
3) Observe caution to avoid blunders

V. PIRACY IMPACT ON BBS

Numerous seafarers have been the targets of pirate attacks. According to the IMB, more than 3,000 pirate attacks have occurred since 2006. Seafarers can be significantly affected by piracy. Seafarers may experience anxiety and stress as they transit to the high-risk region. Seafarers risk injury or death during attacks, which can be terrifying. Abuse of seafarers is frequent and frequently severe when they are held hostage for ransom. There is ample evidence to suggest that these kinds of stress can affect mental health and well-being for a long time. The effects of hostage experiences and other maritime traumas on post-traumatic stress disorder (PTSD) symptoms can impact seafarer well-being and career decisions. 25.77 per cent of former hostages exhibit symptoms consistent with PTSD.

VI. EFFECT OF TRAINING ON BBS

According to Amir Syawal Kamis et al. (2020), training is an essential component in shaping behaviours that have the potential to influence safety either directly or indirectly. Security is crucial in any industry's growth, but strict regulations prevent proper safety procedures from being followed. Nearly twenty percent of respondents said they did not use acceptable techniques to do some tasks at work, and more than forty percent admitted they just "ticked the boxes" on the checklists with fully understanding the job at hand. In general, many human factors, including laziness, complacency, and others, are closely represented in associated with these non-compliant actions. As a result, it has been documented that human error accounts for most marine accidents and that this rate is higher than that of mechanical-related maritime accidents.

Source:(Kamis et al. 2020)

Fig 11. BBS Training Concept

The objective of the training given to the observer is that they will be able

- Learn the factors that influence safe practices
- Examine the actions of your staff
- Specific actions should be identified, monitored, and evaluated
- Effectively communicate your feedback to the speaker
- The ability to effectively use positive reinforcement in order to enhance safety performance

VII. BBS APPROACH

The observed variety in behavior is attributed to variances in the individual's qualities, the circumstance, and the interaction of both, as shown by Dompke's 2001 study. A person's deliberate response to a unique and significant circumstance (S) is human behaviour (B). The formula for B is "B= f (P, S)."Anything that you observe a person doing is behaviour, according to the simplest definition. Therefore, you are observing BEHAVIOR if you can see it.

The BBS method differs from the conventional method. The BBS approach includes safety activities and aims to reduce the number of at-risk behaviours (conscious, chronic, and unintentional behaviours) to reduce accidents and increase marine safety. The primary focus of BBS is on unintended and routine behaviour (OOW drifts off to sleep).

BBS employs a strategy to improve what people do by focusing on what they do and why they do it. In addition, the BBS researches safe and risky behaviours that can assist in loss prevention. Methods for preventing undesirable mistakes or errors on the front line are also being investigated within the framework of BBS.

Based on

- Seafarers' Reliability vs. Ship Security
- The Administration of Behavior
- Watching and giving suggestions
- The proportion of losses to management mistakes is constant
- Keep track of how your actions are influencing your outcomes.
- Positive reinforcement has the potential to produce remarkable outcomes.

Not Relying On

- Predicted or motivated by subjective considerations;
- Observation and comments only;
- Concerned only about the behaviours of seafarers but also of shore personnel;
- Substitute for conventional methods of risk assessment and management;
- Relating to dishonesty and manipulation within the crew of a ship;
- Fixation on accident rates rather than on individual actions;
- A procedure that can be carried out with little or no input from the personnel. For BBS to be successful, it takes coordinated effort from everyone involved.

A. A BBS Approach is one That

1) It's based on proven theories of how to encourage safe behaviors and keep them going strong.
2) It takes a methodical approach to promoting safe behavior by delving into the factors that influence it..
3) It's not a one-and-done deal; rather, it's a new way of working that the safety leader must consistently advocate for in order to see lasting success.
4) Because of the nature of the measurement used, the findings are visible very instantly, although the process itself might take some time..
5) Emphasizes the promotion of safe practices rather than the duration of injury-free work.
6) BBS developers are not only looking at "lagging indications" (data collected after the fact), but also at "leading indicators" (preventative).
7) If a complete health and safety program already exists, this won't replace it; rather, it will compliment it by increasing the efficacy of current procedures and facilitating objective evaluation.

Attempts to identify the root causes of accidents and near misses and devise solutions that will influence the behavior of those who matter. Changes in behavior on the part of managers and frontline employees are frequently necessary to decrease dangers, while changes in behavior on the part of engineers are also necessary to improve equipment.

"BBS is about everyone's behaviour, not just the frontline."
(Agnew & Ashworth, 2012)

VIII. SAFETY CULTURE / SAFETY CLIMATE

A company's safety atmosphere is a reflection of its workers' attitudes toward and understanding of the importance placed on safety measures in the workplace by management (Barling et al.,2002)

The phrase "safety environment" is used to describe an organization's or workplace's safety ethic, as expressed in the attitudes and beliefs of its employees, which in turn is assumed to be a predictor of those employees' actions in regards to safety. Improving safety behavior and decreasing the occurrence of accidents in the workplace are two goals that have been linked to an organization's safety atmosphere. Although shipping corporations make considerable efforts to maintain ship safety, incidents involving ships are nonetheless very common. There is a favorable correlation between safety behavior and both safety regulations and supervisory support safety behavior.

A BBS intervention should be based on improving a future assessment of the safety culture/climate. Before and after implementing a BBS intervention, a safety culture evaluation might be conducted. The comments will help the BBS programs become even more effective and provide the sailors a feeling of "validity" in their efforts to maintain safety at sea. The term "safety culture" is used to describe an organization's current set of safety-related attitudes and beliefs, as well as how they have changed through time

(climate). Different methods exist for gauging a company's commitment to a risk-free workplace,

1) *By using a Survey Methodology:* This method, which has become increasingly popular in recent years, examines the entire group of seafarers and collects individual responses to questions to produce a summary-type profile of the typical employee...
2) *With the Individual Approach*: While a survey would provide an overview, a focus group would focus on a specific group, such as deck or engine side staff: a private gathering of a particular group of seafarers with a clear goal for which their perspectives will be prioritized and become the focus of subsequent actions. The objective is to ascertain which subgroup-specific or safety-related behaviours are regarded as "normal" and which are regarded as unacceptable. Even though the segmental technique saves time and effort, the individual approach is preferable when possible. Ten percent of the workforce might participate in a focus group to share their thoughts and feelings on a certain topic linked to workplace safety. These are commonplace in many organizations and work well with a BBS software.

Finally, accidents and incidents are significantly influenced by management and organizational factors, either directly or indirectly, through their environmental effects. A behaviour-based safety approach and genuine concern for the well-being and safety of seafarers should be promoted by management at all organizational levels.

➢ *Culture of Total saFety is one in Which*

- People place a high value on safety; it's more than just an important consideration
- Employees look out for the safety of their coworkers as well as themselves; and
- Every member of staff is ready to take initiative and fulfill their moral obligations.

Beyond what is expected of them, they are able to (Perdue, 2000).

Observable, long-lasting outcomes and significant contributions to a comprehensive safety culture at work may be achieved via the following measures.

➢ *Cultural Norms of Safety*

- Management's consistent actions show a firm commitment to behavioral safety.
- Cooperation between management and employee groups on all matters of workplace safety characterized by mutual respect, trust, and openness.
- Consistent learning and improvement among mariners is made possible through an open, feedback-rich culture.
- Intensified participation from all staff members in safety-related activities and a renewed emphasis on health and safety in the workplace.
- A focal point on safe and risky actions rather than relying only on statistical after-the-fact measures of risk.
- Whether or whether an injury results from the finding of risky activities, a strong, consistent, and prompt response is required. Incidents involving safety are seen as teaching moments.
- Management, supervision, and ownership that is open and equitable in most respects.
- A company-wide culture that encourages critical thinking and encourages employees to question the "how" and "why" of their work.

The discipline of organizational behaviour analysis is the source of BBS. Behaviour is the primary focus of both BBS and organizational behaviour analysis. According to behavioural science and BBS, behaviour is sustained by what occurs after it.

Many workplace safety interventions center on the factors that come before a potential act of unsafe behavior. Many workplaces make extensive use of learning, signages, pep speeches, toolbox presentations, and pre-briefings, among other forms of communication. These may initially be able to activate behaviours, but what happens after our behaviour ensures that it will continue time and time again.

A. Company Safety Management System (SMS)

When an organization wants seafarers to follow company procedures, procedures for those who must follow them must be developed. They will not follow the guidelines if they are not designed for them, regardless of how many good seafarers an organization has or how much money they pay them. Procedures must be simple, easy to understand, and simple to follow. The designs must be as close to how seafarers work as possible. It is preferable to have simplified procedures that everyone adheres to, the perfect procedures that no one adheres to.

Seafarers must be able to connect with the procedures and have faith in them. The safety culture and management system function work together. A sound safety management system is one that seafarers believe is good, not good for the company. The current issue with safety management systems in the maritime industry is that they are perfect. Perfect to the point where these are difficult to follow.

IX. FACTORS AFFECTING THE PSYCHOLOGY OF THE SEAFARERS

The psychology of seafarers and shore personnel is essential to the safety culture. Compliance is also influenced by factors such as seafarers' perceptions of safety. Psychological factors influence many such perceptions that influence safety behaviour. These perceptions include seafarer's opinions about

1) The dedication to safety shown by management
2) Training provided to them, and
3) the work environment

a) *Managerial Emphasis on Safety*: If seafarers believe the company isn't serious about security, they won't be either. However, it is the perception of the seafarers that is important, not whether the company is serious or not.
b) *Perception of the Effectiveness of the Training*: Safety training provided to the seafarers: If seafarers believe that the training they are receiving will not help them to be safe, the movement will not contribute to the safety culture and overall safety onboard ships. Again, the perception of seafarers toward training is more important than the training itself.
c) *Perception of work Environment*: The workplace environment also impacts safety culture. These factors affect safety culture because tired seafarers cannot be agents of safety culture.

X. RESEARCH GAPS

Even though employee engagement has been in the spotlight for more than two decades, little research has been done on its applications or measurements in the marine sector One of them is the marine industry a kind because it is both a labour- and capital-intensive process with various technologies available. According to the literature review findings, there is insufficient evidence to support a comprehensive investigation of Behavioral Based Safety in the shipping sector. Unsafe working conditions bring on numerous workplace accidents. Seafarers must know that identifying, analyzing, and concentrating on such dangerous behaviour is the only way to reduce accidents further. This article examines the behavioural science approach to reducing workplace accidents that are being successfully implemented by numerous businesses worldwide in this "Decade of Behavior."

The fact that seafarers must spend months together at their workplace, which also serves as their home, is one of the unique characteristics that set shipping apart from land-based industries. Aside from that, the isolation from friends and family, the extreme and frequently harsh weather, and the work's inherent danger are disadvantages. There appears to be a lack of research on employee engagement in the maritime sector, with little available literature on its drivers and effects on shipping operations. This void is the focus of the current study, which seeks to fill it by determining whether the motivations and impediments to engagement in the maritime sector are comparable to those found in previous research. The review will quantify officials' commitment, determine what drives commitment, and decide whether this can be utilized to foresee the presentation and security maintenance.

XI. CONCLUSION

Management has implemented numerous safety measures, including a threat assessment, training, recommendation scheme, auditing, safety committee, intrinsic motivation software developers (quiz, medal, incentives), SOPs (Safety Procedures And work instructions), vessel inspection, and a work permit system, among others, in an effort to lower accident rates. Even though unsafe actions or behaviours account for between 80 and 95 per cent of accidents, most safety management systems were created to control hazardous conditions. Crew members engage in unsafe behaviour to save time and effort (using shortcuts or PPE). Because crews may remove guards and work in poor housekeeping, environmental solutions fail. Positive and negative consequences can result from punishment. Because it does not result in behaviour, attitude change is ineffective. Due to its foundation in the sensory input (S-R) concept, that postulates that BOFP (Behaviors Observation Feedback Process) provides the repeated external stimuli necessary to change unsafe behaviour and reinforce safe behaviour. The importance of taking active responsibility for one another's safety is emphasized in BBS. Focus on observable behaviour and the desired outcome, such as switching from unsafe to safe behaviour; Each individual or group's behavioural patterns should be monitored daily, weekly, and monthly to determine the proportion of safe and risky behaviours across departments over time.

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A systemic failure has occurred if up to 60% of mariners are not using PPE, which is both risky and ignored. All necessary safety system is needed and functioning for there to be a culture of safety, and implementing BBS yields outstanding results in this regard. "Punishment never works for long-term organizational safety results," as my experience in this field reveals. When thinking about how to keep your employees safe, there are a few different angles to consider: BBS is destined to become one of the finest features of safeness with in years to come; "you could have safe systems of work just at work." Although you may have advised seafarers to be safe, unsafe behaviour still results in accidents. BBS thinks that reciprocal and active care of one another can result in psychological change. Since dangerous behaviours account for between 80 and 90 per cent of accidents and injuries, BBS emphasizes that we should concentrate on unsafe and safe behaviours rather than unsafe conditions. Behaviour can be measured, defined, observed, corrected, and objective.

A. Future Study Possibilities

According to their literature study, we highlighted a number of theoretical, methodological, and conceptual areas where future study on seafarers' BBS may be enhanced. Prospective crew protection behavioral research potential are covered in this section.

1) *First, further Innovation in crew BBS Research Theories*: Realistically speaking, community well-being behavior is determined by identifying risky behaviors. It involves theories such as the customary accident cause and effect chain concept, the advanced accident correlational chain principle, the institutional theory, the probabilistic reasoning, the plan expectancy theory, this same affective commitment theory, the human capital principle, the neurocognitive theory, and the social media theory, among others. Among them, it should be feasible to innovate in the research of seafarers' safety behaviors and to improve the applicable theoretical systems.
2) *Second, Greater Originality in crew BBS study designs is Needed:* Research on maritime workers' safety practices, for instance, now makes use of surveys on relevant variables, structural equation modeling, game theory, or simulation modeling. As a result, other approaches to study could be looked into. Future exploration could utilize sociology registering investigations to recreate specialist security ways of behaving and natural science exploratory strategies to lead showings of labourer well-being ways of behaving.
3) *Third, Greater Development from the standpoint of business-to-business Systems*: Right now, there is an abundant exploration of sailors' security conduct from different points of view, including head specialists, new age teams, criminal brain research, and oppressive administration. Future safety management scholars may discover unique viewpoints and undertake in-depth evaluations based on these viewpoints. They may, for instance, conduct a detailed and methodical analysis of safety-related behaviors among employees, including both the theoretical foundations for these behaviors and their distribution throughout space and time. More study is needed to determine the internal and external elements that affect employees' compliance and engagement with safety procedures, as well as the degree to which their safe behaviour is actively monitored and encouraged. Organizations will benefit from safety management experts' research in their quest for improvement.

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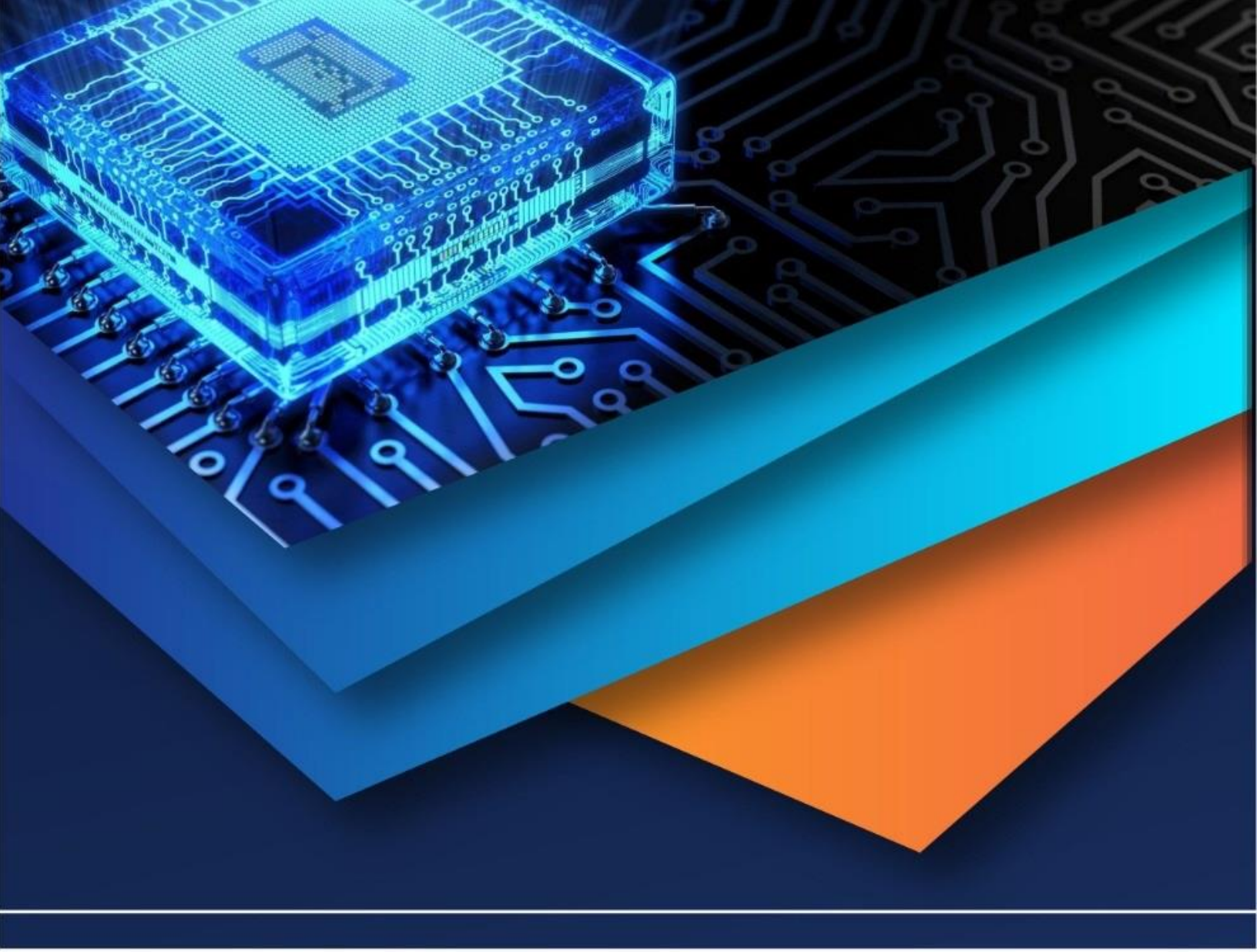

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