

Path Analysis of the Effect of Safety Climate and Job Satisfaction on Safety Behavior of Seafarers Using PLS

Ardhiana Puspitacandri*,¹, Moejiono²

¹Teknologi Rekayasa Operasi Kapal, Politeknik Pelayaran Surabaya
Gunung Anyar Boulevard No.1, Kota Surabaya, Jawa Timur, 60294, Indonesia

²Teknologi Rekayasa Permesinan Kapal, Politeknik Pelayaran Surabaya
Gunung Anyar Boulevard No.1, Kota Surabaya, Jawa Timur, 60294, Indonesia

*E-mail: ardhiana@poltekpel-sby.ac.id

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Abstract

This study aims to analyze the pathways through which safety climate and job satisfaction influence sailors' safety behavior. The population in this study comprises the deck crew (seafarers) from several domestic shipping companies, totaling 210 individuals. The sample was selected using simple random sampling with data collected from 141 seafarers. The data were processed using Partial Least Square (PLS) with SmartPLS software. The results indicate a significant direct positive relationship between safety climate and safety behavior (path coefficient = 0.421) and an indirect effect mediated by job satisfaction (path coefficient = 0.177). The analysis also reveals a significant positive relationship between safety climate and job satisfaction (path coefficient = 0.631), and a significant direct relationship between job satisfaction and sailors' safety behavior (path coefficient = 0.280). The structural model analysis using PLS demonstrates that safety climate and job satisfaction influence sailors' safety behavior, jointly predict 52.45% of sailors' safety behavior, indicating strong predictive capability. Although the safety climate and job satisfaction influence the safety behavior of ship crews, other external factors—such as intelligence (IQ), special skills, physical condition, personality, emotions, thinking style, perceptions, and work attitudes that can influence behavior as external factors in this study. As a practical recommendation, shipping companies are advised to improve the safety climate and job satisfaction. This can be done by providing safety facilities, regular training, implementing policies that prioritize crew safety, and effective communication between management and employees.

Keywords: job satisfaction level, partial least squares, safety climate perception, sailor's safety behavior, structural equation modeling.

Abstrak

Analisis Jalur Pengaruh Iklim Keselamatan dan Kepuasan Kerja terhadap Perilaku Keselamatan Pelaut Menggunakan PLS: Penelitian ini bertujuan untuk menganalisis jalur pengaruh iklim keselamatan dan kepuasan kerja terhadap perilaku keselamatan pelaut. Populasi penelitian terdiri dari 210 awak dek (seafarers) dari beberapa perusahaan pelayaran domestik, dengan 141 responden terpilih melalui simple random sampling. Data dianalisis menggunakan metode Partial Least Squares (PLS) melalui perangkat lunak SmartPLS. Hasil penelitian menunjukkan adanya hubungan langsung dan positif yang signifikan antara iklim keselamatan dan perilaku keselamatan (koefisien jalur = 0,421), serta pengaruh tidak langsung yang dimediasi oleh kepuasan kerja (koefisien jalur = 0,177). Analisis juga mengungkap adanya pengaruh positif yang signifikan antara iklim keselamatan dan kepuasan kerja (koefisien jalur = 0,631), serta hubungan langsung yang signifikan antara kepuasan kerja dan perilaku keselamatan pelaut (koefisien jalur = 0,280). Model struktural menunjukkan bahwa iklim keselamatan dan kepuasan kerja bersama-sama memengaruhi perilaku keselamatan pelaut dengan daya prediksi sebesar 52,45%, yang menunjukkan kemampuan prediksi model tergolong kuat. Meskipun kedua variabel tersebut memengaruhi perilaku keselamatan, terdapat faktor eksternal lain seperti kecerdasan (IQ), keterampilan khusus, kondisi fisik, kepribadian, emosi, gaya berpikir, persepsi, dan sikap kerja yang juga dapat memengaruhi perilaku. Sebagai rekomendasi praktis, perusahaan pelayaran disarankan untuk meningkatkan iklim keselamatan dan kepuasan kerja melalui penyediaan fasilitas keselamatan, pelatihan rutin, kebijakan yang memprioritaskan keselamatan awak, serta komunikasi yang efektif antara manajemen dan karyawan.

Kata Kunci: model persamaan structural, partial least squares, persepsi iklim keselamatan, perilaku keselamatan awak kapal, tingkat kepuasan kerja.

1. Introduction

The data from the International Labor Organization (ILO) show that an average of 99,000 workplace accidents occur in Indonesia each year. Approximately 70 percent result in fatalities and disabilities [1]. When calculated, the financial loss due to these workplace accidents amounts to 283 trillion per year. This is equivalent to four percent of Indonesia's gross domestic product [2]. Based on the data on workplace accidents released by the Social Security Administration for Employment in 2018, 114,148

workplace accidents were recorded. Workplace accidents are unwanted incidents that can endanger human lives, cause property damage, and lead to process losses [3][4].

Workplace accidents have become a crucial issue occurring in any industry, including the maritime industry. In 2020, an accident involving a crew member being struck by a broken mooring line during docking resulted in the crew member's death. In 2022, another accident involved a crew member on a cruise ship suffering a broken arm, while in 2023, two cases of tanker ship fires occurred during maintenance in January, and a fire at sea in March led to the deaths of three crew members.

Apart from the loss of lives, workplace accidents also affect the decline in company performance and productivity, including delays in passenger and cargo distribution services, and can even affect maritime safety, leading to ship damage and shipwrecks [5][6]. This view is supported by research conducted by [7] that the increasingly intense international competition in the shipping industry has led to increased demands on seafarers, often forcing them to work long hours and endure difficult conditions. This can have negative effects on their physical and mental health and pose safety risks.

The economic impact of maritime workplace accidents on a global scale is also significant, with recovery and repair costs placing a heavy burden on industry. The shipping industry also incurs high costs for the maintenance and repair of damaged vessels, along with expenses for improving safety systems and crew training to prevent similar accidents in the future. Additionally, the reputation of shipping companies may be affected, ultimately reducing customer and client trust. These impacts lead to long-term economic losses and require serious attention from various parties within the related industries.

Research by the National Safety Council (NSC) on the causes of workplace accidents shows that 88% of accidents are due to unsafe behavior, 10% due to unsafe conditions, and 2% with unknown causes. Unsafe behavior refers to those that can lead to accidents, such as not following existing rules, not using personal protective equipment, working without permission and beyond one's capabilities, and using equipment in violation of rules. The opposite of unsafe behavior is safety behavior, which reflects efforts to minimize or prevent disasters.

Safety behavior can be conceptualized similarly to other work behaviors that shape work behaviors [8]. Safety Behavior is the behavior of employees adhering to the company's rules in carrying out their work [9]. Safe behavior is behavior directly related to safety, such as using safety glasses and other protective equipment, signing risk assessment forms before work, discussing safety issues, and having good knowledge of occupational safety and health [10][11].

There are two components of job performance: task performance and contextual performance. In the context of workplace safety, task performance is referred to as safety compliance, which includes all formal activities required to maintain safety in the workplace. Safety compliance includes general compliance and compliance with Personal Protective Equipment (PPE), such as following safety standards and using protective equipment. Contextual performance is referred to as safety participation, which involves proactive behaviors not directly related to workplace safety. These behaviors include volunteering for safety activities, assisting colleagues with safety-related issues, and attending safety meetings [12].

The safety climate affects safety behavior. Safety climate is the perception that employees are safe in their workplace [7][13]. This perception depends greatly on the actual safety situations in their workplace. Organizations looking to improve employee safety climate should focus on creating a positive safety culture that emphasizes the importance of safety, encourages employee participation in safety, and values safe behavior. [14] This indicates that safety climate is a relevant predictor of workplace accidents. Organizations should use safety climate surveys to identify and address safety climate issues to reduce the risk of workplace accidents [15].

In this study, the safety climate measurement instrument refers to dimensions according to Kines et al., which have good validity and reliability. The dimensions of safety climate consist of 1). Management safety priority, commitment, and competence: employees' perception of the extent to which management prioritizes safety in the workplace; 2). Management Safety Empowerment: employees' perception of management's efforts to enhance employees' safety-related skills; 3). Management Safety Justice:

employees' perception of management's actions toward employees who have experienced workplace accidents; 4). Worker's Safety Commitment: employees' perception of how involved employees are in maintaining workplace safety and caring about safety activities; 5). Worker Safety Priority and Risk Non-Acceptance: employees' perception of how employees prioritize safety aspects before carrying out their work; 6) Safety communication, learning, and trust in co-worker safety competence: the perception of the work committee system, the intensity of communication interaction between management and employees, and the importance of safety training; 7) Worker's Trust in the Efficacy of Safety System: employees' perception of management in finding solutions to problems and providing facilities for information transfer related to safety [16].

Job satisfaction is an individual's behavior resulting from their experiences at work and their expectations for future experiences. The more positive an individual's work experience, the more positive they view their job. Job satisfaction was found to influence employee commitment to the organization and improve employee performance [17]. It is predicted that job satisfaction can lead to compliance with company rules and safety procedures, including safety work procedures, due to its crucial role in safety. Job satisfaction has been studied extensively in industries that are highly important for safety. In maritime, it is related to seafarer performance and overall maritime safety behavior [18].

Several factors affect employee job satisfaction, including individual factors such as intelligence (IQ), special skills, age, gender, physical condition, education, work experience, length of service, personality, emotions, thinking style, perceptions, and work attitudes. Job-related factors include job type, organizational structure, rank (grade), position, quality of supervision, financial security, promotion opportunities, social interaction, and work relationships [19].

An individual's job satisfaction can be measured in terms of job characteristics, salary, promotion, supervision, workgroup, and working conditions, according to Khan [20]. According to another study focusing on what seafarers considered most important, organizations in the maritime industry can help improve job satisfaction through the attractiveness of rewards, disposition, job stress, and job design [21].

Previous research in this industry has generally focused on technical safety aspects or the physical health of the crew, with limited studies linking safety behavior factors to overall organizational performance in the maritime sector. This study builds on that literature by adopting a holistic approach, considering safety climate and job satisfaction as key predictors of safety behavior in the maritime environment, and offering strategies to reduce risks and enhance safety through an integrative approach.

2. Method

This research aimed to find the relationship between variables, which is an examination of existing theories and the results of previous research studies. The study aims to explain the causal relationship between safety climate (X1) and job satisfaction (X2) with safety behavior (Y) through hypothesis testing, examining which variables are predicted to have an effect, both directly and indirectly, on safety behavior in the maritime industry. The research process started with specifying the model based on theoretical studies and formulating hypotheses based on the model specification. The model was then analyzed using Structural Equation Modeling-Partial Least Squares (SEM-PLS). It was then evaluated and modified or re-specified. Once the data had been processed and analyzed, conclusions were drawn based on the research questions.

2.1. Population and Sample

The population in this study was the deck crew (seafarers) in several domestic shipping companies undergoing safety training at a maritime school, totaling 210 individuals. The sample for this study was selected using simple random sampling, a method of sampling from the entire population conducted randomly, giving all individuals an equal chance, as the population is considered homogeneous [22]. The sample size consists of 141 individuals, meeting the minimum sample size recommended by Maximum Likelihood (ML) with a sample size ranging from 100-200.

A total of 141 respondents participated in the study, consisting of 138 male respondents (97.9%) and 3 female respondents (2.1%). The respondents included 58 individuals (41.1%) aged between 20-30

years, 38.3% aged between 31-40 years, 19.9% aged between 41-50 years, and 0.7% aged between 51-60 years. Regarding the respondents' highest level of education, 48.9% had completed high school (SMA/SMK), 46.8% had completed a diploma (D3), and 4.3% held a bachelor's degree (D4/S1). In terms of work experience, 16.3% of respondents had worked for 1-3 years, 22.7% for 4-6 years, 39.0% for 7-10 years, and 22.0% had worked for more than 10 years.

2.2. Data Collection and Analysis

In this study, data was collected by distributing three questionnaires: a safety behavior questionnaire, a safety climate questionnaire, and a job satisfaction questionnaire, all of which were designed by researchers based on the indicators of each variable. The data analysis method used in this study was Structural Equation Modeling-Partial Least Square (SEM-PLS) using SmartPLS version 3 software. The calculation process of PLS involves two models: the Measurement Model (Outer Model) and the Structural Model Testing (Inner Model).

The outer model focuses on the relationship between indicators and their constructs. The initial evaluation or measurement model testing is reflective, primarily involving convergent validity. The assessment of convergent validity begins with examining item reliability (indicator validity), as indicated by the loading factor values. A loading factor value less than 0.5 is considered weak in the model, whereas a value greater than 0.5 indicates good validity. For the initial measurement stage in this study, loading values between 0.5 and 0.60 are considered acceptable. The significance of loading factors can be tested using *t*-statistics or *p*-values, with values greater than 1.96 for *t*-statistics and *p*-values less than 0.05 indicating significant validity.

In measuring how well a variable explains the dependent variable [22], the coefficient of determination was used. The coefficient of determination ranges from zero to one. Mweshi adds that with the addition of an independent variable, R^2 does not consider whether that variable affects the endogenous variable. Once the model is estimated and meets the criteria of the outer model, the next step is the evaluation or testing of the structural model (inner model). The inner model explains the relationships between latent variables based on substantive theory. This test involves assessing the significance of each path coefficient, which indicates whether there is a significant effect between constructs. The testing of the structural model is used to test hypotheses between research variables, as observed from the *p*-value and *t*-statistic. If the *t*-statistic value > 1.96 , it is considered a significant effect, or if the *p*-value < 0.05 , it is considered significant.

3. Results and Discussions

3.1. Results

Based on the operational variables of this research, a research model was formed and then run using the Partial Least Squares (PLS) algorithm to test the model's feasibility. To test the model's feasibility, the outer model (measurement model) was used, which examines the relationships between indicators and their constructs. Reflective indicators are considered to correlate with the measured variable if they have loading factor coefficients > 0.7 [23]. This shows that an outer loading value of 0.6 is considered sufficient [24]. The higher the correlation, the higher the validity, indicating better validity. Based on the validity test results, it is shown that there are two indicators with loading factors < 0.7 , namely indicator X2.2 with an outer loading of 0.552 and indicator Y.4 with an outer loading of 0.198. Therefore, the decision was made to remove these indicators from the Structural Equation Model (SEM) because they are considered inadequate in measuring the construct variables.

Following the identification of low factor loadings, indicators X2.2 and Y.4 were excluded from the SEM model. The revised model was then re-estimated, and all subsequent analyses refer to the results obtained from this updated version. The outcomes of the path analysis utilizing the Partial Least Squares (PLS) method are depicted in Figure 1.

To evaluate construct reliability and validity, convergent validity was examined through Composite Reliability (CR), Cronbach's Alpha (CA), and Average Variance Extracted (AVE). According to the data in Table 1, all CR values exceeded 0.70, CA values were above 0.70, and AVE values were greater than

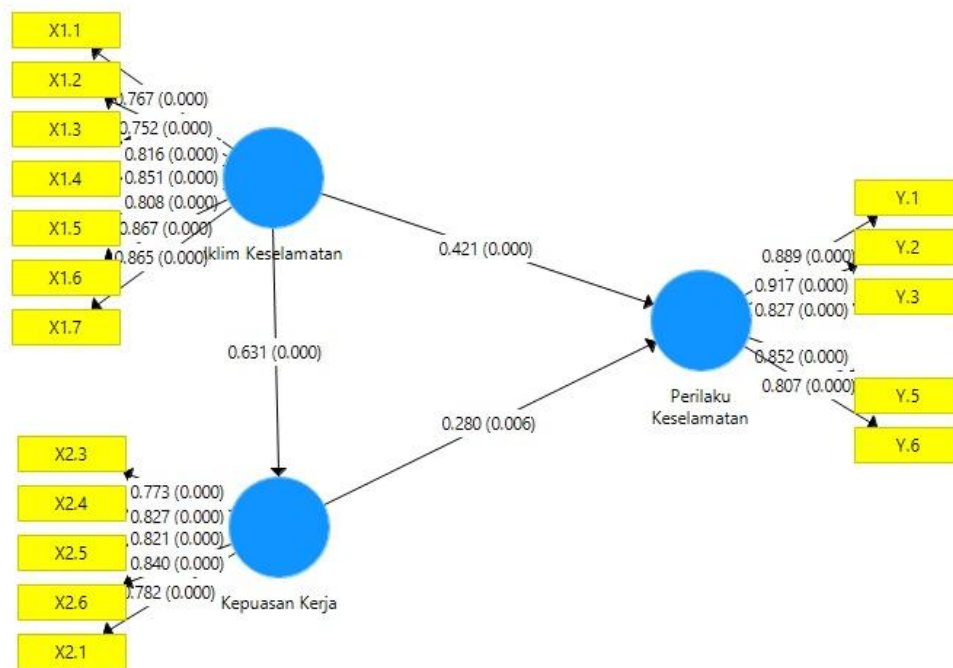


Figure 1. Path analysis model.

Table 1. Reliability and Validity Values.

Construct	Composite Reliability	Cronbach's Alpha	Average Variance Extracted (AVE)
Safety Climate	0.934	0.918	0.671
Job Satisfaction	0.905	0.868	0.655
Safety Behavior	0.934	0.911	0.738

Table 2. The value of path coefficients

Paths Description	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	t-statistics (O/STDEV)	p-values
Safety Climate -> Job Satisfaction	0.631	0.632	0.050	12.708	.000
Safety Climate -> Safety Behavior	0.421	0.412	0.104	4.029	.000
Job Satisfaction -> Safety Behavior	0.280	0.297	0.101	2.779	.006
Safety Climate -> Job Satisfaction -> Safety Behavior	0.177	0.187	0.063	2.797	.005

0.50, confirming that the constructs demonstrate strong reliability and convergent validity. Hypothesis testing was conducted using the path coefficients outlined in Table 2.

The estimation results of the inner model for the direct effect of Safety Climate on Job Satisfaction show a p -value of 0.000, which is smaller than the alpha of 0.05. Therefore, it can be concluded that there is a significant positive direct effect between Safety Climate and Job Satisfaction, with an effect size of 0.631. This means that a better Safety Climate increases Job Satisfaction. Conversely, a less favorable Safety Climate decreases Job Satisfaction.

The estimation results of the inner model for the direct effect of Safety Climate on Safety Behavior show a p -value of 0.000, which is smaller than the alpha of 0.05. Therefore, it can be concluded that there is a significant positive direct effect between Safety Climate and Safety Behavior, with an effect size of 0.421. This means that a better Safety Climate increases Safety Behavior. Conversely, a less favorable Safety Climate decreases Safety Behavior.

The estimation results of the inner model for the direct effect of Job Satisfaction on Safety Behavior show a p -value of 0.006, which is smaller than the alpha of 0.05. Therefore, it can be concluded that there

is a significant positive direct effect between Job Satisfaction and Safety Behavior, with an effect size of 0.280. This means that higher Job Satisfaction increases Safety Behavior. Conversely, lower Job Satisfaction decreases Safety Behavior.

The path coefficient value for the indirect effect of Safety Climate through Job Satisfaction on Safety Behavior is 0.177, with a p -value of 0.005, which is smaller than 0.05. Therefore, it can be concluded that the indirect effect of Safety Climate through Job Satisfaction on Safety Behavior is significant. In other words, a better Safety Climate leads to increased Job Satisfaction, which, in turn, increases Safety Behavior. Conversely, a less favorable Safety Climate leads to decreased Job Satisfaction, which, in turn, reduces Safety Behavior.

Goodness of Fit was used to assess the overall model. Based on the calculation of the GoF value, a value of 0.5245 (GoF large) is obtained, which means that the PLS model created has a high (large) ability to explain empirical data, so it can be said that the overall model predictions are good.

3.2. Discussions

Based on the research findings, it is evident that safety climate and job satisfaction have both direct and indirect effects on the safety behavior of seafarers. Safety climate has a significant direct effect of 42.1% on the safety behavior of seafarers, while job satisfaction has a significant direct effect of 28% on the safety behavior of seafarers. Furthermore, safety climate, through job satisfaction, significantly affects the safety behavior of seafarers. A better safety climate leads to increased job satisfaction, which, in turn, enhances safety behavior.

Safety climate at work refers to employees' perceptions of the safety conditions in their workplace [25]. Employees are motivated to comply with safety procedures and contribute to a safe working environment when they have a positive perception of the safety climate in their workplace and when the company shows concern for their safety.

The key components of a safety climate are safety policies and safety practices. Safety policies refer to formal rules and procedures that support safety, while safety practices encompass the informal behaviors and attitudes that support safety [26].

Social Exchange Theory suggests that an individual are more likely to act in ways that benefit their organization when they believe that it cares about their welfare [27]. Expectancy-Valency Theory posits that employees are motivated to behave safely if they believe it will result in positive outcomes or rewards [28].

The research results also indicate that the safety climate among seafarers is affected significantly by perceptions of safety priority and risk opportunities. Safety climate encompasses perceptions of safety policies, procedures, and practices in an organization. A shipping company is deemed to have a good safety climate if it has procedures and policies prioritizing employee safety and anticipating and preventing safety risks.

Safety policies and regulations within the company reflect the safety climate of an organization [29][30]. If seafarers perceive a positive safety climate in their company, they are more likely to have a positive attitude toward safety policies and regulations.

The research findings also show that the safety climate among seafarers is significantly affected by perceptions of the effectiveness of safety committees, the intensity of communication between management and seafarers, and the importance of safety training [31]. This is in line with the concept of behavior-based safety.

To reduce workplace accidents, seafarers must focus on improving both individual-level factors (such as safety training and education) and organizational-level factors (such as the implementation of safety-supportive management practices and a strong safety climate). To improve safety behavior, organizations must provide job security, career development opportunities, and a positive work environment. This, in turn, reduces job insecurity, and organizations can improve seafarers' safety behavior, reducing the risk of injuries and workplace accidents [32].

This finding is reinforced by another study. Workplace climate is crucial for safety performance, and workplaces with safe environments tend to have fewer accidents and injuries [29]. Safety climate is one of the critical factors in improving safety and other organizations [33]. Therefore, organizations should focus on creating a positive safety climate and involve safety professionals in improving safety and other organizational outcomes.

To enhance workplace safety, companies should provide safety procedure training, create a safe working environment, and address employee safety concerns [34]. Job satisfaction can be defined as an employee's overall response in terms of behavior displayed in their job, resulting from their perceptions of job-related factors.

Working conditions have a small impact on job satisfaction. However, the research results indicate that job satisfaction among seafarers is predominantly influenced by indicators related to satisfaction with working conditions [35]. Working conditions encompass physical and psychological aspects of the work environment. This suggests that physical conditions, such as facilities and infrastructure on ships and the work atmosphere concerning interactions with colleagues and management are essential factors affecting job satisfaction among seafarers.

Many studies also show that employees prefer a safe and comfortable physical environment. If the facilities and infrastructure on ships are comfortable and facilitate safety, they can lead to job satisfaction among seafarers. In another context, higher satisfaction with supervision is a significant factor shaping job satisfaction among seafarers. Supervision from both superiors and management is a form of care and concern for seafarers.

Supervision (or leadership) is another significant source of job satisfaction. Leadership styles that affect job satisfaction, such as employee-centered leadership, are measured based on the level to which leaders show personal interest and concern for employees. This is generally manifested in ways such as examining employees' work performance, providing advice and assistance to individuals, and communicating personally with colleagues and subordinates.

Positive perceptions among seafarers regarding a safe and comfortable work environment and management's care for employees create positive perceptions of the safety climate in their company, leading to job satisfaction. With these factors in place, seafarers develop positive attitudes toward safety policies and regulations. Safety climate is a preventive factor for workplace accidents. Seafarers can enhance their performance by committing to safety and providing resources for safety, involving supervisors in safety, enforcing safety regulations, communicating the importance of safety to seafarers, providing adequate safety training, and creating a safe working environment that encourages seafarers to collaborate in promoting safety. Consequently, seafarers comply with safety policies and regulations [36]. Compliance with safety regulations includes beliefs, acceptance, and actions [37]. This means that when seafarers have a positive perception of the safety climate, they will comply with safety rules by trusting, accepting, and acting following safety.

4. Conclusion

The findings of this study highlight the interrelated roles of safety climate and job satisfaction in shaping seafarers' safety behavior. A positive safety climate—characterized by supportive safety policies, effective safety committees, open and consistent communication, and prioritization of safety training—significantly enhances job satisfaction, which in turn improves safety behavior.

Both safety climate and job satisfaction exert substantial direct effects on safety behavior, with path coefficients of 0.421 and 0.280, respectively. Moreover, the indirect effect of safety climate through job satisfaction underscores the importance of fostering a work environment that promotes both safety and employee well-being.

The study reinforces the significance of organizational-level factors in enhancing workplace safety. Recommendations for reducing workplace accidents include focusing on individual-level factors like safety training and education, as well as organizational-level factors such as safety-supportive

management practices and a strong safety climate. Creating a positive safety climate involves addressing key components like safety policies, practices, and perceptions of safety priority and risk opportunities.

Furthermore, the effect of job satisfaction on safety behavior is underscored by the association between satisfaction with working conditions, supervision, and overall job satisfaction. Positive perceptions of a safe and comfortable work environment, combined with management's care for employees, contribute to seafarers' positive attitudes toward safety policies and regulations.

In line with prior research, the study emphasizes that a positive safety climate is not only a preventive factor for workplace accidents but also a catalyst for improved organizational outcomes. The proactive measures suggested, such as providing safety procedure training, creating safe working environments, and addressing employee concerns, align with the broader goal of promoting a culture of safety within organizations.

Ultimately, organizations in the maritime industry can enhance safety performance by integrating strategies that prioritize both safety climate and job satisfaction. This involves a holistic approach that encompasses leadership styles, working conditions, and effective communication, fostering a workplace environment. In this case, seafarers are not only compliant with safety regulations but actively engaged in promoting and sustaining a culture of safety.

Seafarers who perceive that their company shows concern and care for their safety will be motivated to comply with workplace safety procedures. Several things that need to be considered by shipping companies include: a) Providing facilities and infrastructure related to safety equipment, personal protective equipment, safety signs, and the like; b) Establishing safety policies and procedures that prioritize the safety of seafarers over asset safety; c) Providing opportunities and facilities for seafarers to enhance their competencies and skills regarding safety materials through training, workshops, or seminars organized by the shipping company or external parties; d) Fostering good and intense communication between management and employees to create harmonious working relationships that facilitate coordination in the field.

The structural model analysis using PLS shows that safety climate and job satisfaction together explain 52.45% of the variance in seafarers' safety behavior, indicating strong model predictability. Nevertheless, variations in results may occur in different operational contexts or due to other factors beyond the scope of this study, such as intelligence, specific skills, physical condition, personality, emotions, cognitive style, perceptions, and work attitudes.

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